INFORMAL SETTLEMENTS POVERTY ECONOMIC DEVELOPMENT WA
TER SANITATION SLUM CORRUPTION HEALTH URBAN LIVELIHOODS

Access to water and sanitation in the informal settlements of Kisumu, Kenya

HOODS OPPORTUNITY REFORMS WATER SECTOR KISUMU GROWTH

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20th of May, 2011

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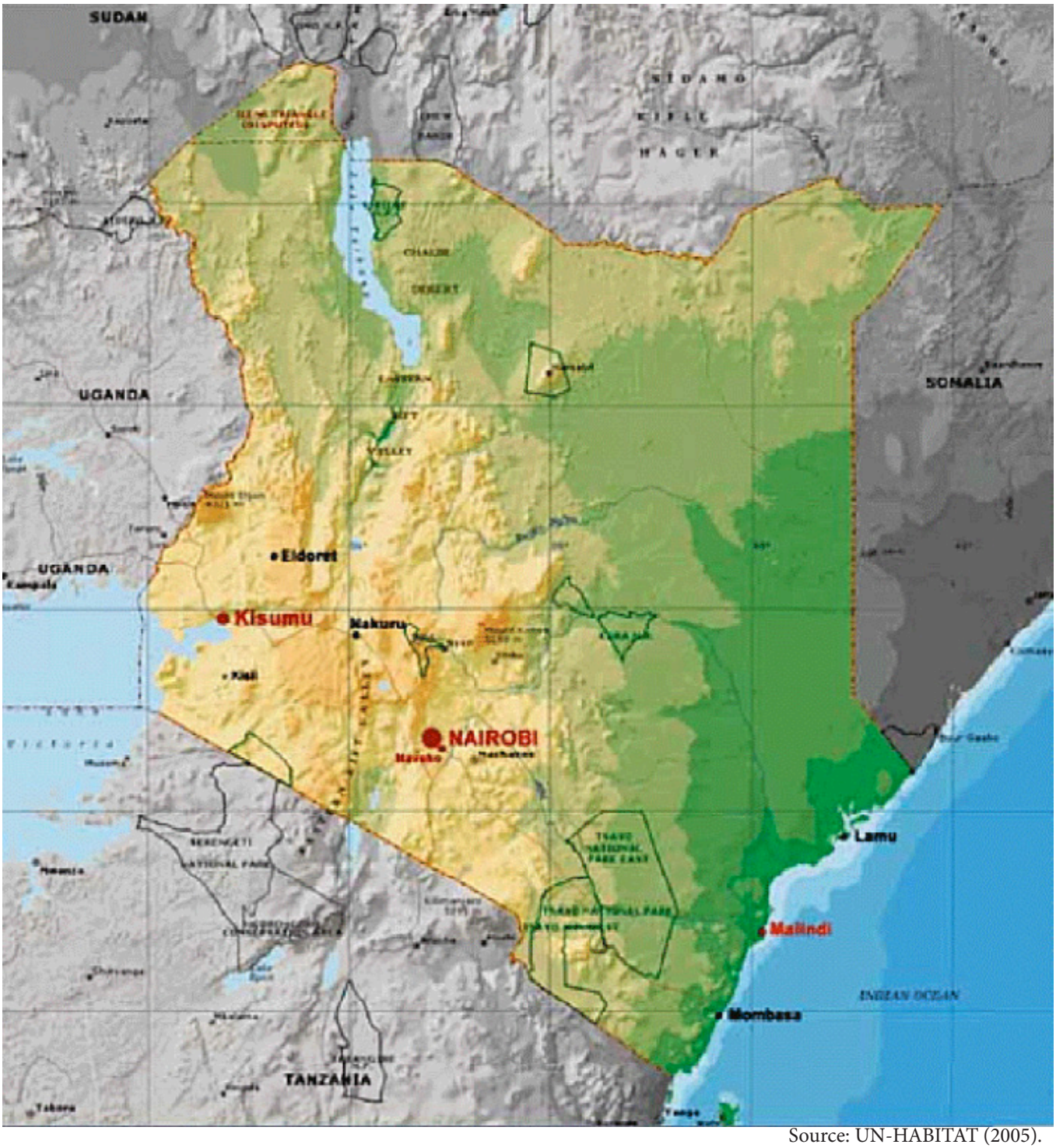

Source: UN-HABITAT (2005).

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If there is one thing I have learned during my fieldwork in Kenya, it is that a problem such as the lack of proper access to water and sanitation facilities has multiple faces, and is part of a bigger problem. The problem of the lack of water and sanitation facilities is somewhat a focused topic in itself, but is part of a larger spectrum of possibilities and widespread effects, even more if these issues were come to an end. A vicious circle, where one condition has an impact on what is next. A bad residential situation, which floods over in times of rain, with an outbreak of a disease, being unable to accumulate capital and invest in the future.

Scholars, development economists and politicians have always been trying to compete whose perspective is the best or fits the most to the situation at hand. However, it is time and I think many have come to realize, that poverty is related to so many things that we have to take into account each of those perspectives and come up with an extensive diagnostic list of how to tackle all these problems. All the various and diverse aspects of the poverty trap have to be mapped out, meaning the situation of a country must be mapped out clearly in terms of the proportion of households lacking basic needs, the spatial distribution of these households and infrastructure. Only in such case can a good working intervention take place, an intervention embodied in a comprehensive strategic plan. The key risk factors are in demographic trends such as the size of households, gender factors but also environmental trends, vulnerability to climate change and health. Then there is also a series of economic policies required: a fiscal framework to break the physical geographical factors, governance patterns and failures, cultural barriers and geopolitics. Each of these points will be explained, since they are all related to poverty.

Another thing I would like to put emphasize on is that more and more accurate information is not always helping the situation at hand. At times it will paralyze us from taking action. While overview and insights in specific details in the setup of water supply systems are important, knowing is just one part. What is being done with the information is what counts. With this in mind I approach the problem of lack of access to water and sanitation and poverty. There are enough resources on this planet. Still, many people are living without sufficient resources. It is the way these resources are managed that impacts and can change the current inequalities in this world.

With this existentialist view of the world I approach this topic of research. That we can be held responsible for our actions and make a difference. What we do matters. It makes a difference, first of all in physical and material terms. Second, it matters for the people around us, and it sets an example. I am not a human geographer or a development economist by education. I am a sociologist. I try to analyse situations from macro to micro level, from national and governmental decisions to the local interventions and individual actions. I do not have an extensive checklist and training in how to solve all these specific problems in specific places such as East-Africa. However, during my fieldwork I do have come to realize that the issues we are going to talk about are not straight forward and simply a matter of 'money' or 'bad governance'. These are complex almost organic problems, which require an extensive differential diagnosis.

The information that will be provided based on the data I collected may not be completely come as a surprise and more relevant information is available via other data sources. But without my visit to Africa I would not have been able to value the data, to fully understand what the data really means. Somehow I grew aware of the obvious, the fact that Africa is suffering and the amount of people living in extreme poverty are not decreasing, alongside with the structurally underfunding to fight poverty.
Before I introduce you the topic of my thesis I would like to take this opportunity to thank everyone who assisted me in during the preparation and execution of my fieldwork and thesis write up and who made it possible for me to have these very interesting three months in East-Africa, Kenya. Learning from books is not always motivating, but I can say clearly that I re-found back my motivation and inspiration while I was stationed in Kenya. I want to thank Dr Samuel Owuor, Dr Marcel Rutten, Dr Dick Foeken and Terry Mutune for helping me in all these matters. Thank you ASC Leiden, thank you Radboud University of Nijmegen and University of Nairobi.

Furthermore I would like to thank our research assistants, the people of SANA international who assisted us in finding the research assistants, all the households, the mothers, doctors, water kiosk owners, lab-assistants and people I have met along the road, telling me their stories.

1

Introduction. Poverty, economic development, urban livelihoods, water and sanitation.

1.1 Introduction

Grace Odera is a woman living in Bandani, a neighbourhood in Kisumu town. She is running a household of five. While it is hard to find a job, even in the informal sectors of Kisumu town, somehow she has to survive, send her children to school, stand in the line for water and pay the monthly rent to her landlord. Increased competition and higher commodity prices make it hard to continue her business of selling sukuma wiki, a local vegetable. Although Kenya experienced impressive economic growth in the past decade, this does not seem to have improved the living conditions of the ordinary Kenyans. Many people tend to seek better prospects in urban areas, leaving their rural hometown to migrate to the city. Most of these people end up in the informal settlements of these urban areas, also known as the slumbelt of the city. In Bandani, a neighbourhood in Kisumu's northern part of the slumbelt, there are no safe water sources and proper sanitation facilities, leading to increased vulnerability and chances of contamination and diseases such as typhoid and malaria. Although the treatment of malaria is free in many public, missionary and charity hospitals, visiting a doctor and buying medication often include unforeseen costs such as transport or a small compensation for the hospital. Also, primary education, although officially free, still demands a fee of at least Ksh 2,000 per year per child. For the ordinary Kenyan, it is hard to escape the poverty trap and invest in one's capacities simultaneously. Educating children or buying a house cannot be achieved at the same time, as choices in expenditures are limited. Many Kenyans are stuck in the poverty trap. Creative coping strategies make it possible to survive, but escaping the poverty trap is still a distant future for many of the poor.[1]

Both in Kenya and Kisumu (map 1.1), a major part of the households are not connected to the piped water system. According to the World Health Organization (WHO) and UNICEF (2006), 57% of the population are using improved water sources. The question that comes up is of course: how is the other 43% doing? The excluded people are relying on more expensive and potentially less safe water. Why is in Kisumu, a city lying at the enormous Lake Victoria, water still treated as a luxury good? Who has access to safe water, at what costs and why does a vast share of the population not have access to water?

This thesis elaborates on the livelihoods of the urban poor of Kisumu, and is based on two recent developments that impact or may impact the water supply system of Kisumu. The first issue concerns the possibilities of the renewed Water Act of 2002 and how this relates to the set up and improvement of water supply systems by communities and private companies. How are water supply systems set up and how are important decisions taken? What institutional and social organizational challenges do the current Water Service Providers (WSPs) have?

The second topic relates to working towards the Millennium Development Goals (MDGs). To what extent does access to clean drinking water improve the situation in, for example, the health and income generating activities of a household? The possible effects of having a stable, affordable and clean water supply on household mobility, health and level of poverty are of great importance when helping the urban poor and realizing the MDGs. This research will attempt to provide insights in these two topics.

This thesis is structured as follows: in chapter 1 the topic of research will briefly be introduced. The chapter starts off by describing the development problem in the urban setting. In chapter 2 this topic will be discussed more in depth, including theoretical approaches on subjects such as: economic development on macro level, the livelihood approach and the effects of the Water Act of 2002. Chapter 3 describes the data and methodology used. Chapter 4 will present the results and the analysis of the fieldwork conducted.

1 Name of the respondent has been changed. The character is based on interview (23/11/2009).

Map 1.1 Kisumu town and informal settlements at Lake Victoria in Western Kenya

Source: Googlemaps & Auhor (2011)

Chapter 5 will summarize this research and its most important findings. Furthermore, this introductory chapter will mainly describe the linkages between poverty and water supply, and raise questions that require more explanation.

Subsequently, section 1.4 will elaborate on the societal and scientific relevance of this thesis, as its objectives. Section 1.5 describes the research areas, the neighbourhoods that have been explored during the fieldwork in Kisumu. Some of these neighbourhoods possess an improved safe water supply, other do not. In the final paragraph 1.6 some concluding remarks, along with the thesis' research design, planning and methods will be discussed.

1.2 Urban water, human development and the poverty trap.

Human development is first and foremost about allowing people to lead a life that they value and enabling them to realize their potential as human beings. The normative framework for human development today is reflected in the broad vision set out in the Millennium Development Goals, the internationally agreed set of time- bound goals for reducing extreme poverty, extending gender equality and advancing opportunities for health and education. Progress towards these objectives provides a benchmark for assessing the international community's resolve in translating commitments into action. More than that, it is a condition for building shared prosperity and collective security in our increasingly interdependent world.

Source: Kemal Dervis, Administrator at UNDP. Human Development Report (2006).

Every living creature needs water. Human existence depends on water, direct and indirect. In order to live a healthy life, one needs access to clean water for drinking. The lack of clean water and sanitation is destroying human potential. Clean water and sanitation can make a huge difference whether or not this form of human capital is lost. The basic facilities enforce people to achieve their goals and actualise their capabilities. Access to water is a fundamental human need and therefore should be a basic human right. This resource is key for achieving the other human development goals, such as eradicating malnutrition and extreme poverty. While the supply of water may seem to be self-evident in many parts of the developed world, this is not the case in many African countries. In today's modern and globalized world more lives are taken by the lack of clean water and sanitation than by any war. According to UNICEF, 4,200 children die of water-related diseases every day, and nearly 900 million people worldwide lack access to safe drinking water (Owuor & Foeken, 2009).

Proper provision of water and sanitation is a key resource for human potential. Water is a resource for economic development, the maintenance of ecosystems, economic productivity and agriculture. Whether looking at the lack of clean water and sanitation from a human rights view, a development or economic perspective, the lack of these basic needs is deeply unethical and is essential for every party involved. It is affecting one's self-worth too, in addition to its health- and economical deprivations. Would this issue be resolved, the long-term benefits would definitely outweigh the initial costs, creating an army of human capital and be a giant leap in public health, employment, education, economic growth and human progress. For the urban poor to keep a job or realize a higher standard of living, these basic needs need to be fulfilled: poverty reduction and water management remain one of the key catalysts for development[1].

The consequences of the lack of water are most visible in the poorest regions, where there is no decent water supply system and probably no money available to put such a provisional system in place. When it comes to Africa, the water problems are severe in both rural and urban areas. Urban areas are often densely populated and the consequences of the lack of water and sanitation services lead to environmental health problems, according to Kjellen (2006) who recently published her study on water problems in Dar es Salaam, Tanzania. In rural areas, especially during the dry season it is hard to come across an affordable water provision system in operation as these places are even more difficult to cover and thus often underserved in water.

In areas where there is a piped water infrastructure available, services might be lacking. According to Owuor & Foeken (2009) many of the water utility systems in Kenya are characterized by high water losses, insufficient revenues to cover operating costs, dilapidated and poor functioning infrastructure, lack of investments, low billing and collecting efficiency, chronic water shortages and failure to meet the existing demand, low coverage and corruption. All together this puts the urban poor in a bad situation. Sub-Saharan Africa, in particular, scores below average in water services. The national government of Kenya, the municipality of Kisumu, the water suppliers, and public/private partnerships all play a role in the delivery of water to the urban citizen. It is of importance to establish in detail for each and every actor its role in the water sector. The water sector's strengths and weaknesses, opportunities and threats have to be determined, as well as, insights in how to provide a better water supply for the urban less wealthy households. When these insights are acquired, a comparable analysis of actors and their relevance can be made. These findings, insight and lessons learned from the past can be used to develop an accurate strategy for the Millennium Development Goal (MDG) on Water, Goal 7(targets C and D in particular).

Box 1.1 The Millennium Development Goals (MDG's)

- Goal 1: Eradicate extreme poverty and hunger
- Goal 2: Achieve universal primary education
- Goal 3: Promote gender equality and empower women
- Goal 4: Reduce child mortality rate
- Goal 5: Improve maternal health
- Goal 6: Combat HIV/AIDS, malaria, and other diseases
- Goal 7: Ensure environmental sustainability
- Goal 8: Develop a global partnership for development

Poverty affects people in various ways. The Millennium Development Goals (MDGs) give an overview of the most important limitations currently affecting the poor. The Millennium Goals describe implicitly well the poverty trap's multi-facet complexity, as well as the correlations between the goals. Goal 1 for example describes eradicating extreme poverty and hunger. Presuming this goal would

1 As much research implies (Thompson 2001; Munguti 2002), as well as for example the Government's National Policy on Water Resource Management and Development (Kenya, 2005).

be achieved; its consequences would have direct benefits to people's nutritional values and health. In the same way access to an improved water source would mean a decrease in water-borne diseases and be beneficial for human health.

While all the MDGs are somewhat equally important for getting a country and its population back on the ladder of development and breaking the poverty trap, it is goal 7 in particular that is focussed on access to a clean water supply and improved sanitation.

The MDGs were created to serve as an extended framework for helping the poor. MDG 7 Describes the sub goals of achieving environmental sustainability: increase the proportion of people with sustainable access to safe drinking water and basic sanitation, improving their lives, and making sure biodiversity is not reduced. In Kenya, the Water Act of 2002 was created to help achieve the MDGs, focussing, in particular, on goal 7. The MDGs are of great importance in helping the urban poor. This makes research in this area of even more relevance. However, the MDGs are extensive and idealistic, as shall be presented in chapter 2. Chapter 2 will also elaborate on other important activities that are meant to achieve the MDGs besides the new Water Act of 2002. Reasons for the lack of new investment in poor countries, underutilized and poorly maintained facilities are multidimensional, ethical as well as economical.

Recent research from the United Nations Development Programm[1] acknowledges this multidimensional context in which poverty, malnutrition, water and sanitation, economic development and health are connected and dependant on each other. This thesis will elaborate on these multidimensional aspects of water and sanitation with a focus on Kisumu's water supply system. In regard to the Millennium Development Goals (7D), emphasize is put on the slum-dwellers in the informal settlements: the urban poor.

1 Human Development Report of 2006. But also, Kjellen 2006, Owuor & Foeken 2009.

Box 1.2 MDG 7: Ensure environmental sustainability

Goal 7: Ensure environmental sustainability

Target 7A: Integrate the principles of sustainable development into country policies and programs; reverse loss of environmental resources

Target 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss

Target 7C: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation (for more information see the entry on water supply)

- The world is on track to meet the drinking water target, though much remains to be done in some regions
- Proportion of population with sustainable access to an improved water source, urban and rural
- Accelerated and targeted efforts are needed to bring drinking water to all rural households
- With half the population of developing regions without sanitation, the 2015 target appears to be out of reach
- Disparities in urban and rural sanitation coverage remain daunting
- Improvements in sanitation are bypassing the poor

Target 7D: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum-dwellers

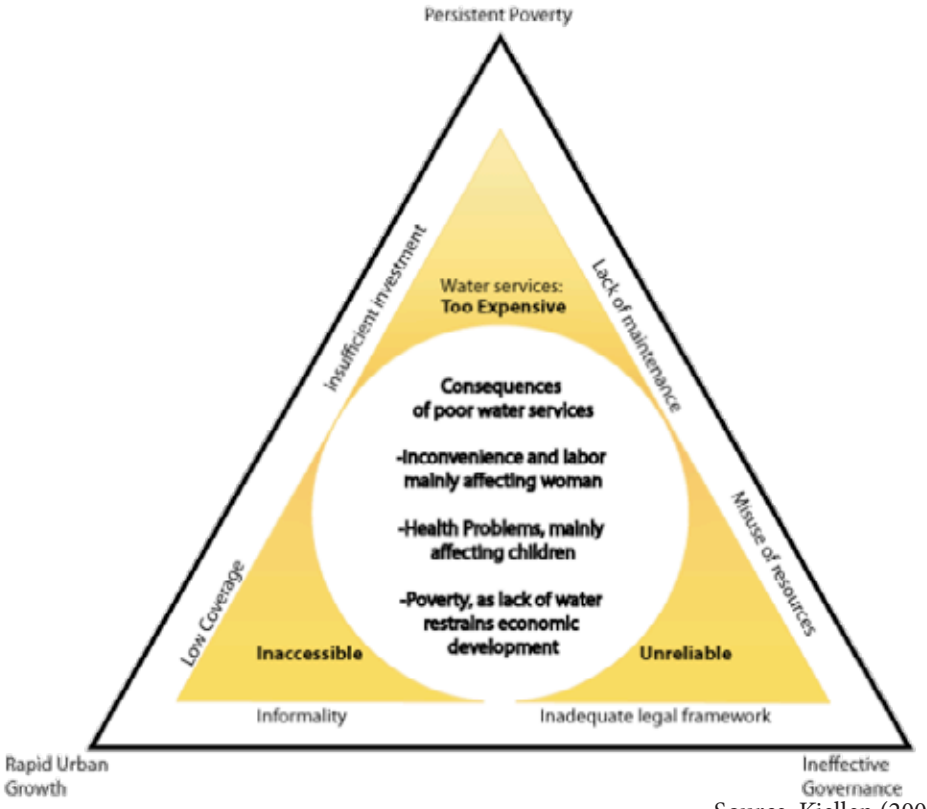
- Slum improvements, though considerable, are failing to keep pace with the growing ranks of the urban poor
- Slum prevalence remains high in sub-Saharan Africa and increases in countries affected by conflict

Source: Human Development Report (2006)

Multidimensional consequences for the urban poor

Kjellen (2006) describes the multidimensional challenges the urban dwellers in need of clean water and sanitation are facing. She produced a conceptual model that sums up the most important factors for understanding the causes and consequences of poorly performing urban water services (see Figure 1.1).

Figure 1.1 Framing the development problem of poor urban water services



Source: Kjellen (2006)

Marianne Kjellen (2006) conducted research in the water supply system of Dar es Salaam, Tanzania, Kenya's neighbouring country to the south. Her approach can be summarized with the following three points:

- Governance and ownership
- Legal framework
- Consequences for the poor

Kjellen (2006) studied how the lack of investment subsequently leads to low service standards and inadequate cost recovery. Such vicious circles are hard to break through. Moreover, corruption enforces such vicious circles. One of the greatest challenges in poverty, human development and economic development is one that lies at fighting corruption. Ineffective governance contributes to the poverty trap and its vicious circles. In Dar es Salaam, but also in Kisumu, there have been adjustments in the water supply system when it comes to ownership in 'public pipes' or 'private hands'. The type of ownership and organization affect the institutions on water and sanitation. For this research it is of importance how Kenya's new Water Act of 2002 is affecting the water supply systems in the country.

One of the major consequences of the lack of water and sanitation facilities in urban areas is the spread of diseases. When access to proper water and sanitation is lacking, households live in bad, contaminated environments. This has negative consequences on public health and economic development. The spread of water-borne diseases relates to the lack of clean water and proper sanitation. Traditional toilet arrangements that are too close to an unsafe shallow well may be the cause of faecal material circulating through people's environments. In crowded and dense areas the spread of disease is even worse. Water for domestic use and drinking may be contaminated, as kitchen utensils and plates are being washed with unsafe water.

Children are the most vulnerable for infectious disease and diarrhoea, because of their lower immunity and vulnerability to dehydration. In addition, they play near the house in an environment where contact with excreta is not unique. Reports of the 'flying toilet' in the local newspapers confirm this finding[1]. Figure 1.2 shows the relation between an improved water source and child-mortality. In general, child-mortality is lower in countries with a higher percentage of the population with an improved water source. Besides child-mortality, the vulnerability of children to diseases, some water-borne, should also be mentioned. The costs of a disease such as buying medicine, visiting a hospital and not being able to work, affect a household greatly. Women are the primary caretakers if someone falls ill, so when they are being pressured it does not help the stability and mobility of the family. Women and children seem to suffer the most in these situations.

In most cases, women are responsible for running the household, i.e., cooking, cleaning, doing the laundry, and

1 By Joyce Mulama (2006) http://ipsnews.net/news.asp?idnews=35222 visited 20th march 2010

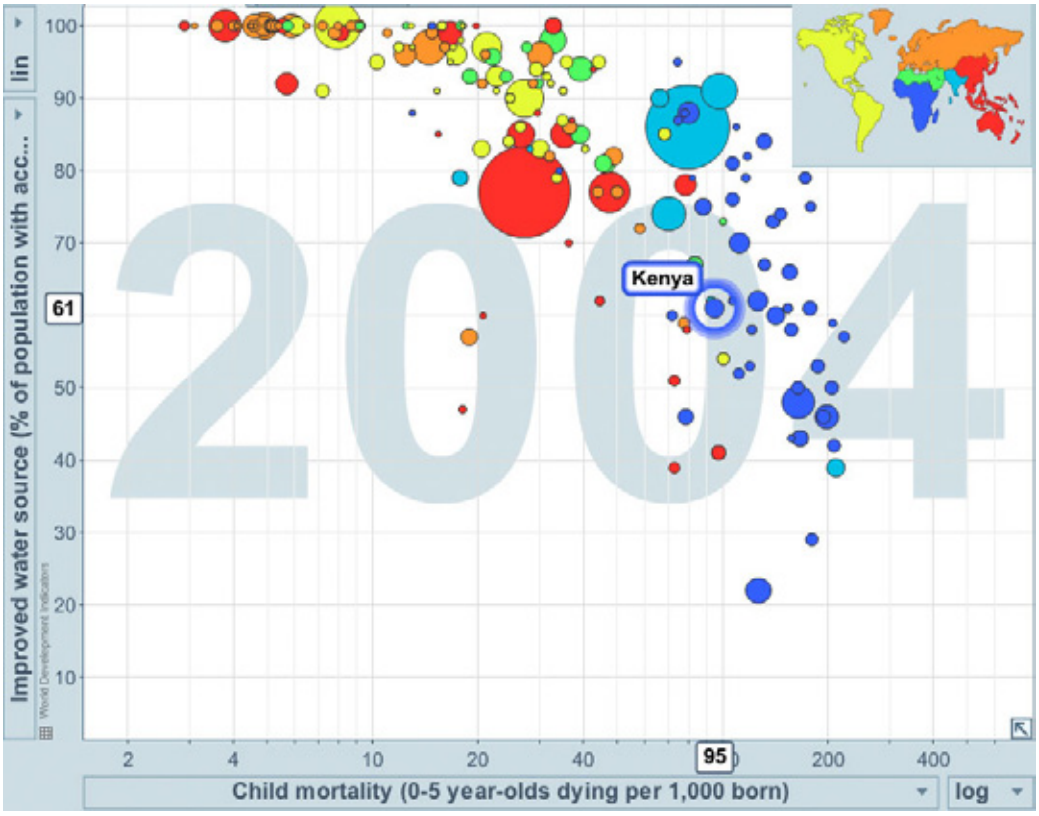
taking care of the children and elderly. Most of the households do not have their water source on plot, or close nearby the house. In the majority of the cases, the women have to go and fetch it, stand in long queues, wait for it, carry the water on their heads, making it a troublesome task. Thompson & Porras et al., (2001) showed that women who commonly carry water on the head, have increased chances of headaches, general fatigue, and pains in the chest, neck, back and waist. Also, daughters are frequently kept out of school to ensure that water can be obtained when available (UNDP, 2006).

Besides for human wellbeing, water is also an important resource for making a livelihood. Income-generating activities for which water is important are for example cooking and urban farming. These activities help improve the financial position and nutritional status of the household, where water is a key asset for productive or commercial purposes.

The communities living without access to water and sanitation are strongly disadvantaged in terms of health and economic development. Access to proper water and sanitation means an improved living condition with better nutrition, health, housing and education. Households without these basic resources are unable to escape the poverty trap. When a lot of households and communities are affected, economic development on a larger scale will also be reduced. The vicious circle of poverty does not affect households positively, but rather keeps them in deprivation.

Also, the problem of urban water goes hand in hand with the rapid urban growth. Several studies, including research done by Kjellen (2006) shows that economic growth, urbanization, persistent poverty and ineffective governance are the key determinants for the problematic situations of the lack of water services in low-income areas.

Figure 1.2 Proportion of the population with improved water source and child mortality



Sources: World Development Indicators (2004) & Gapminder (2011)

1.3 Lessons on history and urban water supply in Kenya & Kisumu

Throughout history, access to clean drinking water and societies ability to manage their water have been two key factors in human development. Water for livelihoods is an absolute necessity when it comes to production and survival, two elements forming the foundations of human development. In many parts of the world, in Africa, Kenya and Kisumu, these foundations are not yet in place. A few centuries ago, safe water and sanitation were also missing in today's modern and globalised cities such as New York, London and Paris. Water was polluted, children died and the lack of access to clean water and sanitation created a health crisis. Growth was undermined and people were kept in poverty. This was at the turn of the 19th century.

Social reformers, physicians and industrialists formed powerful coalitions that elevated water and sanitation to the top of the political agenda (UNDP, 2006). In the 19th century they knew that prevention was better than cure. The combination of technology, investment and political leadership made access to clean water possible. Today more knowledge, experience and technology is availiable to provide the world with access to clean water and sanitation. It should be possible to facilitate everyone with access to clean drinking

water and sanitation. It should be within today's reach to achieve the MDGs by the use of powerful political leadership and the forming of strong coalitions. Solving a very similar problem was possible in the 19th century, so it should be possible with today's resources.

Kenya and Kisumu's colonial past and underdevelopment

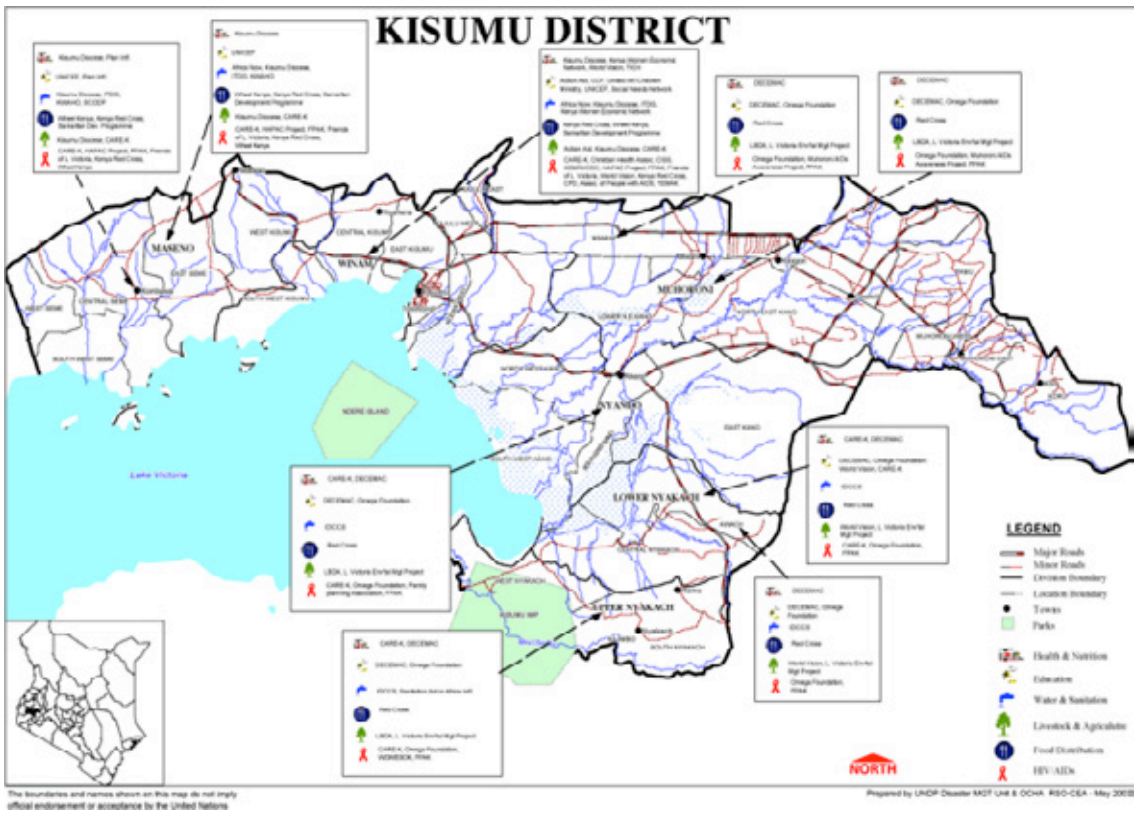
Up until the 19th century East-Africa remained one of the most isolated and least developed places in the world, despite the fact that multiple cultures had been settling the coast of East-Africa for several centuries. In the 13th century the Arabian people settled on the coast of Kenya and helped to build the towns of Malindi and Lamu. In the 13th century the Arabian people settled on the coast of Kenya and helped to build the towns of Malindi and Lamu. They did not really settle down here, but only visited through this part of the region with their trade trips. At the end of the 19th century, around 1880, Europeans started to explore East-Africa. In this subsequent period, railroads were build and the establishment of the European colonies became a fact. This had consequences for the management of land and administrative organization of townships. New organizational systems were introduced concerning tax collection, governance, labour organization and production. Kisumu was founded in 1898 as Port Florence[1] and became the terminus for the Uganda railway. Kisumu harbour overtook Port Victoria at the mouth of the River Nzoia. At the time, the town was ideally located on the shores of Lake Victoria, with a lot of potential. Around 1930, when the economic crisis emerged, the position of the white colonists in Kenya was weakened and there were protests by a new generation of educated young Africans, supported by the Indians. The latter had helped Kenya build railways. As a result the agricultural industry commercialized and many small-scale entrepreneurs entered the market (Poyck, 1985).

1 UN-HABITAT (2005). Situation Analysis of Informal Settlements in Kisumu. United Nations Human Settlements Programme, Nairobi, 2005.

This led to a relatively quick recovery after the 1930s crisis. Agriculture, manufacturing, commercial and industrial sectors grew. As a result cities such as Kisumu and Nairobi experienced a fast growth of the population. According to Poyck (1985), these developments on their part again speeded up the process of ending the colonial period. This development did not reduce the inequalities in the country. There still is much variety in levels of income, opportunities and ownership over resources. Even though Kenya is no longer part of the British Empire, its colonial past has been impacting the country's development in many ways. Its traces are still visible today, especially in Kenya's institutions and level of administrative bureaucracy. These developments affect Kenya's water supply system and the way the country and its financial resources are managed. The government has trouble managing itself, contributing to Kenya's lack of development, corruption and internal affairs. The country is trying to improve and make its institutions stronger, partially by improving the rule of law.

The renewed Water Act of 2002 and the new constitution are examples of this. Changes in the way the country operates are required in order to achieve the MDGs and increase the number of people having access to clean drinking water and sanitation. The population of Kenya however, is increasing steadily, especially in the informal settlements. This is another very important development that affects whether Kenya will be achieving the MDGs of 2015. Population growth makes it harder to ensure every individual has access to clean drinking water and sanitation.

Map 1.2 Map of Kisumu, western Kenya



Box 1.3 A Definition of a slum

According to the the Princeton university dictionairy, Wordnet, a slum is a district of a city marked by poverty and inferior living conditions. A slum is often described as a place where household lack any of the following services: access to sufficient amounts of water for family use at an affordable price, without being subject to extreme effort; access to improved sanitation, either in the form of a private toilet or a public toiliet shared with a reasonable number of people; security of tenure (the rights of a tenant to hold property); housing in a permanent and adequate structure in a non-hazardous location; and, in most areas, a household requiring more than two people to share the same room. However, as housing in some cities lacks sufficient living space for middle-class household to fit this final requirement, the definition of a slum would be modified to rquire a lack of two of these conditions. (From UNICEF & PBS 2011, RX for survival, A global health challenge)

Rapid urban growth & informal settlements

Kenya is a good example of an urbanizing country, although not as much as Nigeria or Brazil (see Figure 1.3). In 2000, around 10 million people, of the total population of 30 million was classified as urban. Projections for 2015 show an increase of the urban population to 17 million, i.e., the Kenyan population will have grown by 25% and the urban population by 68% (UN-Habitat 2005, Owuor & Foeken 2006). This means a faster growth of the cities and their informal settlements. The latest census of the Kenya National Bureau of Statistics (KNBS) state for 2009 an urban population of 12,487,375 (32.3%), a rural population of 26,122,722 (67.7%), with a total number of Kenyans estimated at 38,610,097.

In Table 1.1 the proportion of the slum population as percentage of the urban population in Kenya can be observed. This number has been increasing and probably will keep on increasing. A large proportion, about 55% of the urban population lives in a slum. Many people are migrating from rural areas to the city, hoping on a better life and looking for work in town. Chances are that they will end up in a slum and a job in the informal sector. Jobs in the formal economy are scarce, and it is no surprise that urban poverty has also been increasing.

Rapid urbanization and urban growth have consequences for the water services a city can provide. Proper infrastructure and services are mostly lacking in the slums of the city and include: roads, water and sanitation, electricity, waste management, schools and hospitals. The lack of services also has an impact on the well-being and opportunities a person may get in life. For instance, a person in good health and with a good education is likely to perform better than a person lacking these qualities (Owuor & Foeken 2006). By offering good services to people in slums they might be able to escape the poverty trap. Offering clean water, sanitation and health services are the basic needs for households to develop themselves. UN-HABITAT's Report on Water and Sanitation in the World's Cities notes that the inadequate water supply is not because of lack in government funds. It is argued that it is possible to improve the provision of water in low-income settlements while charging their inhabitants less than they currently pay for inadequate provision. Figure 1.4 illustrates that Kenya is a country with economic scarcity of water. Although water is scarce, especially in dry seasons, according to UNDP (Human development report, 2006) and Earthscan and the International Water Management Institute, the bottleneck is mainly the way the water is managed. The economic water scarcity in Kenya is described as follows: *Human, institutional and financial capital limit access to water even though water in nature is locally available to meet human demands. Water resources are abundant relative to water use, with less than 25% of water from rivers withdrawn for human purposes, but malnutrition exists.*

Figure 1.3 Urban population as % of total in Tanzania, Nigera, Kenya and Brazil

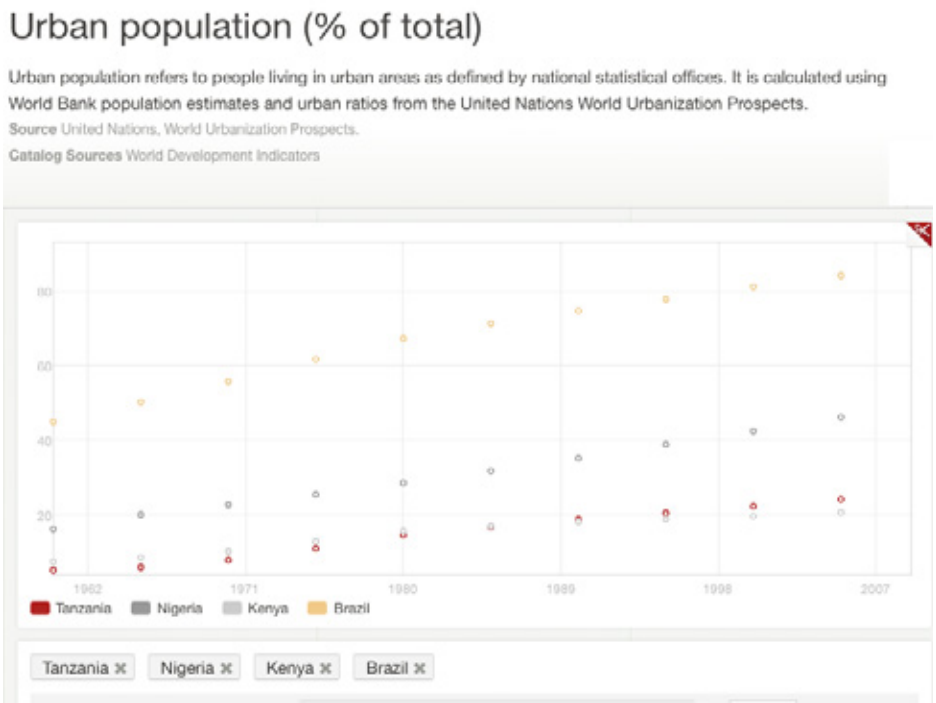
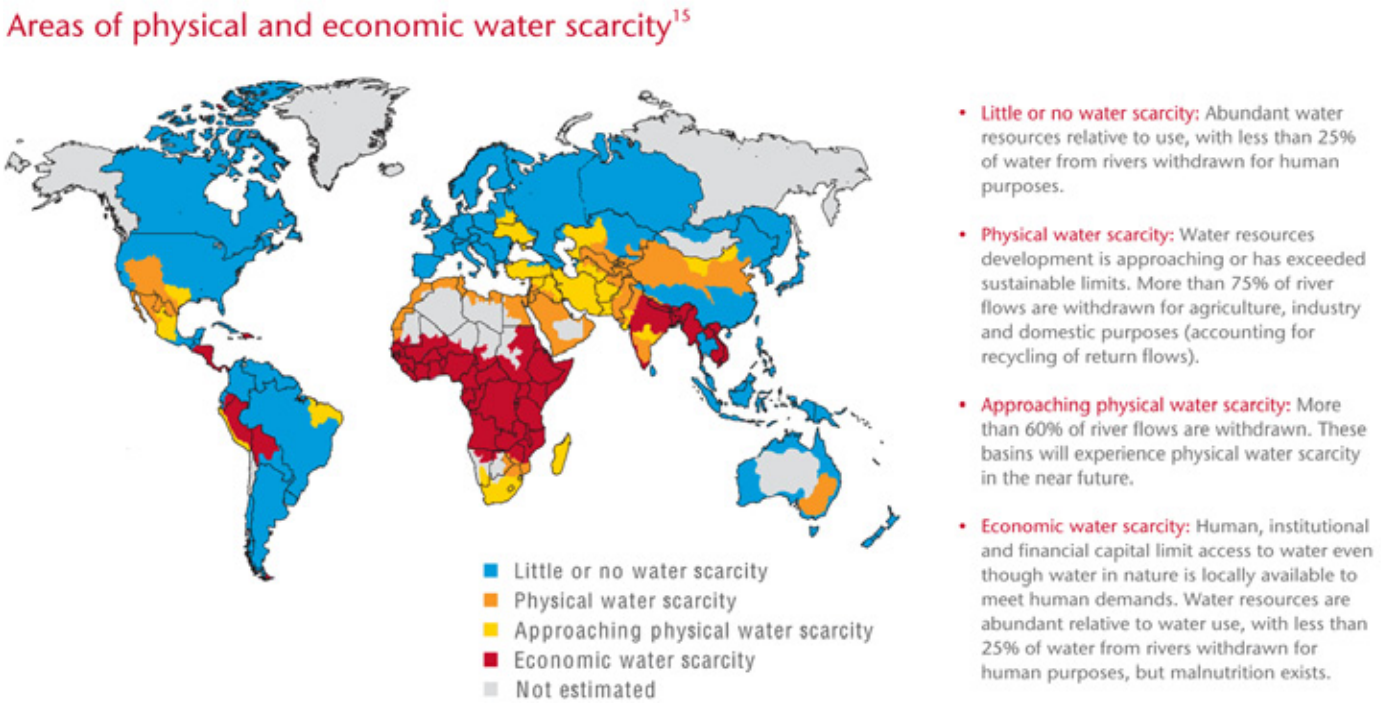


Table 1.1 Slum population as a percentage of the urban population in Kenya

	1990	1995	2000	2005	2007
% of urban population	54,9 %	54,8 %	54,8 %	54,8 %	54,8 %
absolute population	2 344 776	2 847 731	3 379 459	4 044 152	4 370 412

Source: MDG indicators (2009)

Figure 1.4 Areas of physical and economic scarcity



Source: Earthscan and International Water Management Institute, "Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture", 2007, London: Earthscan, and Colombo: International Water Management Institute.

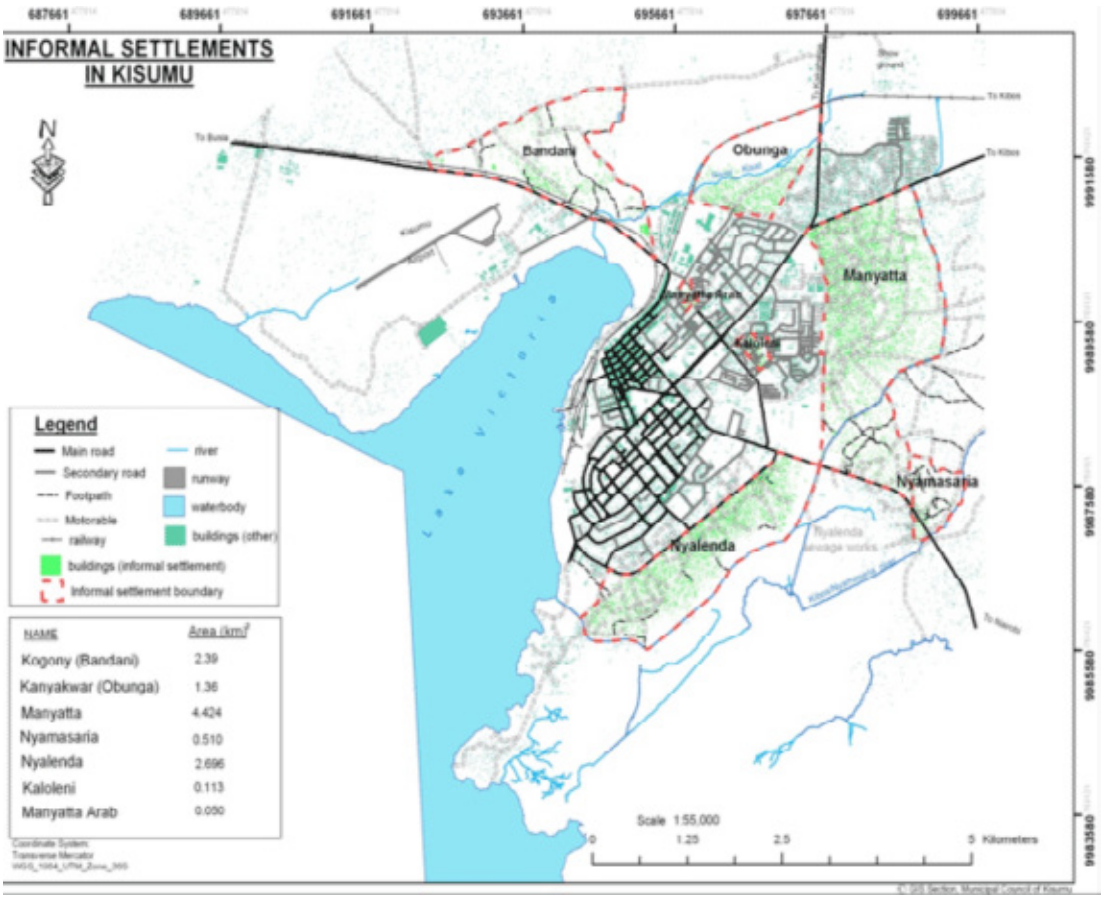
1.4 Purpose of this study & research questions

When a household does not have access to safe water, issues such as health, water related diseases, nutritional condition and even morbidity are at stake as these factors affect the household in many ways. According to UNDP (2006:28-29), a safer water supply has a positive impact on the health and nutritional condition, which increases time and energy to invest in productive activities. Time to fetch water from unhealthy resources is inefficient and cost time and energy. Also, traditionally, women are assigned to perform these household tasks such as fetching water and looking after (sick) family members. Improvements in the water supply system will positively affect the efficiency of women's efforts in these areas. Preferably also young girls will benefit and improvements in water will hopefully impact positively on the school attendance of girls. A small comparative study in Uganda and Nakuru town showed an increase and a positive contribution to small businesses and urban farming as a result of water provision (Owuor, 2006).

Map 1.3 on the next page displays the informal settlements in Kisumu. An informal settlement is a shanty town, also called a squatter settlement, sometimes illegal or unauthorized, of impoverished people who live in improvised dwellings made from scrap materials. It often lacks the services described in Box 1.4. Although the majority of the people in the informal settlements are poor, there are also households that have found a way to cope and make the best of the situation in these areas. These households often stay in the informal settlements in spite of having enough resources to move to a more wealthy area. The straight black roads on map 1.3 emphasize the old town and the centre of the city. The slums surround the city centre. In this research the focus lies on the households in the informal settlements.

There are many types of interventions ongoing in Kisumu. The Water Act of 2002 impacted the way the informal settlements have access to water. Second, the Cities Without Slums (CWS) programme for Eastern and Southern Africa was launched in response to the degrading situation in the region. This programme has several goals, including strengthening institutional arrangements, building partnerships and improving the conditions of people living and working in the slums. Furthermore, this programme falls directly under Millennium Development Goal 7 target 11 'Cities Without Slums' in agreement with the Kenyan government. The Kenyan version of the Cities Without Slums, the Kenyan Slum Upgrading Programme (KENSUP) fits the strategic framework laid out in the Poverty Reduction Strategy Papers (PRSP), the National Housing Policy, National Housing Development Programme and the Economic Strategy for Wealth and Employment Creation. The Kenyan Slum Upgrade Programme was supposed to improve access to water and sanitation, and improve housing and living conditions. The question what exactly has been improved is hard to measure. Also, the implementation of the KENSUP was not completely finished due to lack of funds. The differences between areas are visible today in, for example, the type of housing. The initial goal of the KENSUP was to form partnerships, strengthen institutional arrangements and improve the living conditions of the urban poor. Recent literature and reports on the KENSUP is missing. It is rumoured, that parts of some areas in Kisumu have been upgraded, while others have not (UN-Habitat, 2005). The informal settlements are still lacking facilities. In Box 1.4, the indicators of an (upgraded) slum area vcan be observed. In spite of attempts to upgrade the slums, the urban poor are still lacking upgraded facilities.

Map 1.3 Overview of Informal Settlements in Kisumu



source: UN-HABITAT (2005). Situation Analysis of Informal Settlements in Kisumu. United Nations Human Settlements Programme, Nairobi, 2005.

Box 1.4 Indicators of an (upgraded) slum area

Access to water

A household is considered to have access to improved water supply, if it has sufficient amount of water for family use, at an affordable price, available to household members without being subject to extreme effort, especially to women and children.

Sanitation

A household is considered to have adequate access to sanitation, if an excreta disposal system, either in the form of a private toilet or a public toilet shared with a reasonable number of people, is available to household members.

Secure Tenure

Secure Tenure is the right of all individuals and groups to effective protection by the State against forced evictions. People have secure tenure when:

- There is evidence of documentation that can be used as proof of secure tenure status;
- There is either de facto or perceived protection from forced evictions.

Durability of housing

A house is considered as 'durable' if it is built on a non-hazardous location and has a structure permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions such as rain, heat, cold and humidity.

Sufficient living area

A house is considered to provide a sufficient living area for the household members if no more than two people.

Source: UN-HABITAT (2005). Situation Analysis of Informal Settlements in Kisumu.

Figure 1.5 displays the forming of city belts around the high-income centre of Kisumu. Block A represents the high-class residential area, Millimani. This is the former European area. Block B is the low and middle-income section, with a lot of public housing. This area has been build for employees and office development of the Municipal, the railways and services such as the Kenyan Post. Block C is the peri-urban unplanned section with slum settlements. These slums extent to a more rural part of the city, and its land is utilized for residential and agricultural purposes. The physical infrastructure of the slums has been neglected, and investment in Kisumu's development went to the high-income residential areas. Water and electricity are only available to those who can afford these goods. This can be observed in the high-income areas. A vast majority of the population in the slums do not have access to a piped water supply from the Kisumu Water and Sewerage Company (KIWASCO).

The purpose of this study is to provide insights in how a water supply can help the livelihoods of the urban poor. According to a situational analysis of the informal settlements of Kisumu (UN-Habitat, 2005), the bulk of the population in the slum areas works in the informal sector with monthly income ranging from KSh 3,000 to 4,000, which is about €25 to €35 at €1 = 115 Ksh[1]. This research builds on an African Studies Centre working paper of Dr. Samuel Owuor and Dr. Dick Foeken called: "Water sector reforms and interventions in urban Kenya: The impact on the livelihood of the urban poor". Within the research group Economy, Environment and Exploitation (EEE) of the ASC goals are set to acquire insights in the development of African societies, how institutions provide resources and how this affects the constraints and opportunities for wealth accumulation.

The water supply of a household may be a key aspect in improving the financial position, especially of the slum dwellers. Exploratory research undertaken by Owuor & Foeken (2009) evaluated in five urban centres different water supplies in Kenya and the possible effects of the availability of water for the inhabitants. Throughout this chapter the link between development problems and access to water has been emphasized. Insights are now needed in how the water companies and vendors operate and what effects the water sector reforms have on the urban poor. What are the current challenges and bottlenecks in the set up of water supply projects? To what extent does the new Water Act of 2002 make it easier to set up such a project and in which way does this benefit the household? There are still many questions left unanswered, which need to be dealt with, especially if Kenya and the world are to achieve the Millennium Development Goals of 2015.

This research will provide a detailed description and analysis of the nature and extent of water sector reforms and interventions in urban Kenya. Also, emphasize will be on its impact on the livelihood of the urban poor. To do this, the research aims to answer the following questions.

Research questions

1. To what extent are global developments affecting economic development, urban livelihoods and water and sanitation issues in the informal settlements of Kisumu?

Figure 1.5 The forming of slums in the informal settlements

Source: UN-HABITAT (2005)

2. To what extent is (in) effective governance affecting the actualisations of the new water act of 2002 in regard with water and sanitation issues in the informal settlements of Kisumu?

3a. To what extent is in areas with an intervention the household health improved by a reduction in water-borne diseases?

3b. To what extent does improvement in the water supply system contribute to household resources such as time, money and energy and to what extent do these resources contribute to productive economic activities such as urban farming?

3c. To what extent does improvement in the water-supply system increase the girl's s school participation and the status of the women in general?

In order to answer the research questions multiple types of data have been collected. This includes data on households, data on country level, on economic development, data on the operating of the government, institutions and water service providers. The research questions of this thesis require various data and methods including: direct field observations, general household surveys using structured questionnaires, formal and informal interviews with selected key actors, hospital data and bacteriological data on the safety of water. Furthermore, data from secondary sources include scientific literature, development reports, governance indicators, and Millennium Development Goals statistics have been used. Also, water quality assessments of various water sources have been carried out to determine to what extent the water sector reforms and interventions have improved the water quality in the low-income settlements. The fieldwork that was carried out consists mainly of household surveys and interviews with key persons of the water service providers and kiosks. The household surveys are focussed on three neighbourhoods in Kisumu, Kenya; (a) Wandiege in Manyatta B (b) Nyalenda, and (c) Bandani.

1 Exchangerates (dot) org. Exchange rate for 11/11/2009

1.5 Research areas

These research areas can be characterised as follows:

(a) An informal settlement that has experienced a community-based intervention in collaboration with an NGO: The Wandiege community water supply project (Wandiege) in Manyatta B

(b) An informal settlement that has experienced a private-based intervention: the Kisumu Water and Sewerage Company's (KIWASCO) intervention in Nyalenda B, also known as the Delegated Management Model (DMM) line of "Katuoro"

(c) An informal settlement that has not experienced any intervention: Bandani without any formalized water supply system.

According to a situational analysis of the informal settlements of Kisumu (UN-Habitat, 2005), the bulk of the population in the slum areas work in the informal sector with monthly income ranging from KShs 3 000 to 4 000.

1.5.1 Wandiege Area, Manyatta B

The informal settlement Manyatta can be subdivided into two areas, A and B. Manyatta A is older, more urban, more densely populated, with a bigger informal sector. It is said that Manyatta A has a more improved infrastructure and has higher property values. There have been some slum-upgrade- and development projects in Manyatta A. This has attracted a population with slightly higher incomes The Wandiege area lies in the slum Manyatta B. Manyatta B lies east of Kisumu town (see Map 1.4). The map displays the location of the Wandiege Primary School, the only borehole in the area at the time, and the area of coverage of the Wandiege Community Water Supply Project (WCWSP). The population of the Wandiege Area has been estimated at 25,000. The difference between Manyatta A and B lies in the quality of housing due to an urban upgrading scheme. Manyatta A has been upgraded. Slum upgrades in Manyatta B and Nyalenda B were not fully completed, according to UN-Habitat (2005). Many people in Manyatta A moved to Manyatta B due to higher housing prices, that resulted in the forming of Manyatta B. The government has never owned land in the Manyatta area. This is causing problems as there is land needed for public purposes. Nyalenda A and B follow a similar historical development, where parts of Nyalenda B were not upgraded.

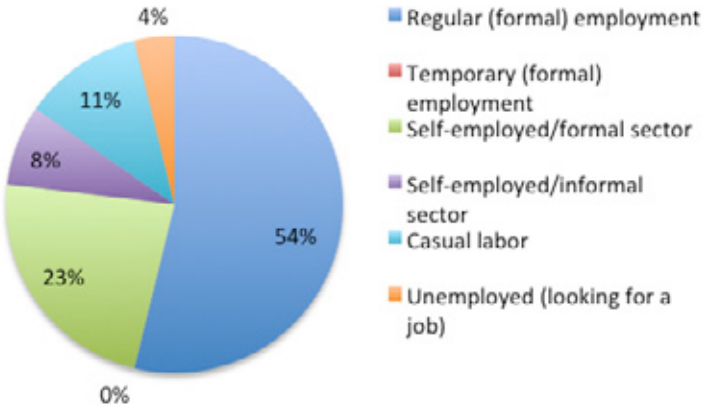
Figure 1.6 shows the type of employment of the residents interviewed in Wandiege. In the household questionnaires the occupation of the head of household was asked. Examples of employment are, selling of vegetables, owning a kiosk, handcart and boda-boda services, carpentry, tailoring, barbers and restaurants. Also, many household heads have a job in town, working in a school teaching, or as an employee of the municipality of Kisumu. Manyatta B is a low-income residential and agricultural area. The average income is

Map 1.4 Wandiege in Manyatta B

Source: Google map creator & Author (2010).

estimated at slum level, thus around KSh 3,000-4,000. There are no official drainage systems and the slum upgrades were mainly in Manyatta A. Manyatta B has a poor infrastructure, while Manyatta A has an improved well-connected road, where matatus (small communal taxi busses) provide transport. There are basic primary schools and small hospitals in Manyatta B, and there is less social disparity and social resentment. Related to this may be the combining of forces and the set up of the Wandiege community water supply project.

Figure 1.6 Occupational types in Wandiege



Source: Fieldwork (2009).

The Wandiege community water supply project

The Wandiege Community Water Supply Project started in late 2001 and was operational by 2003. The borehole is located in the Wandiege Primary School. For exact reasons unknown, there are times that there is no electricity available. At those times the borehole and pump are also not functioning, meaning water is not available then. The community initiative focussed their first project on water. The community handled correctly in thinking water is more important than roads and electricity. As many interviews with hospital assistants and doctors point out, water was the most scarce and important missing resource in the area. Another possibility of getting a stable water supply was buying a pipeline, where its access point was about 2 kilometres away, at the local Nakumatt Mega (supermarket). It would have been much more expensive and the community would be dependent on the official water company of the municipality, KIWASCO. Also, the water would be more subject to the burst of the pipes and contamination. Although some of the current challenges of the project remain daunting, the community having their own borehole has been the better option for Wandiege.

The soils of Wandiege are problematic for the construction of proper sanitation facilities. Some of the sanitation facilities collapsed, as the ground beneath them was seriously affected in times of heavy rain. Without a proper drainage system, this will lead to water borne diseases. Some improved ECOSAN toilets have been set up, reducing the occurrence of waterborne diseases drastically.

While the benefits of this water project have been significant, the question remains whether it is also economically viable. For the consumer it is much better, as they have a more stable water supply for less money. The tariff structure is viable for the consumer and the project. On average the consumer pays less. A jerry can of 20 litres of water costs about KSh 2 only. The litre price of water at the Wandiege kiosks is higher than when owning an individual pipeline. However, it requires no initial costs and is more

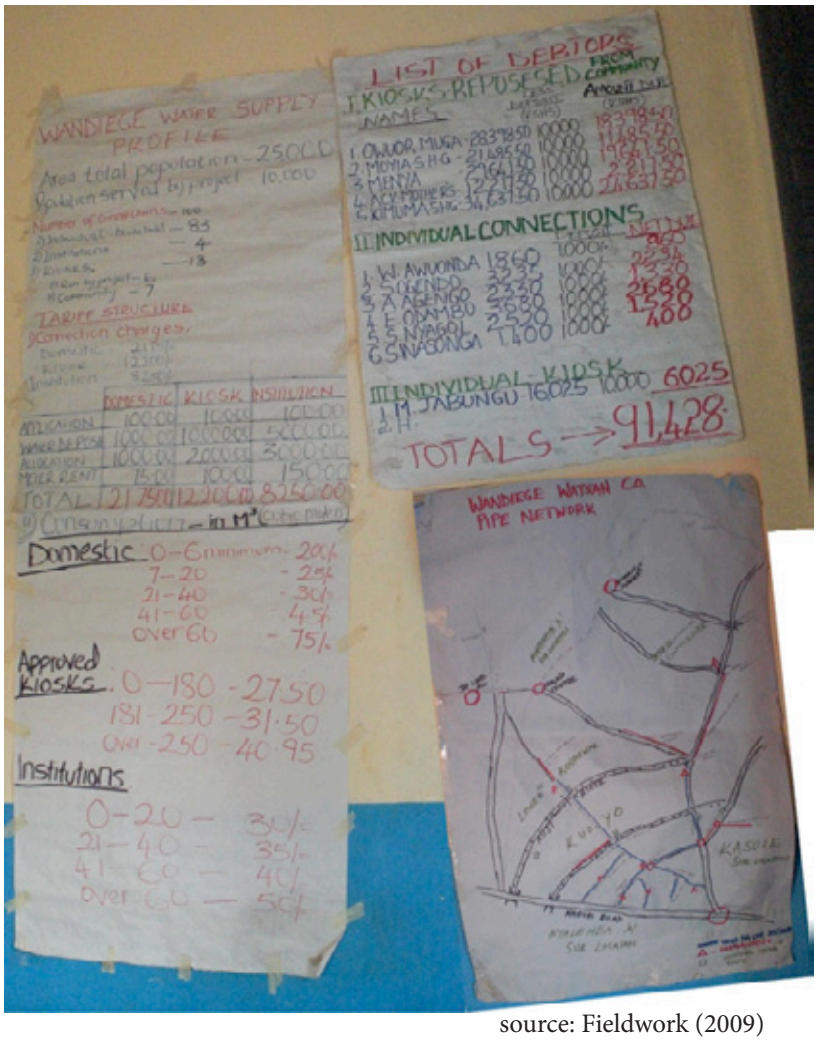
Photo 1.1 Wandiege Primary School, water kiosk and borehole

source: Fieldwork (2009)

beneficial for small consumers. The community project is making small profits. This brings up another hard topic, finance. The project could not have been set up without investments, donations and help of a few organisations. In particular SANA-international and CORDAID had an enormous role in the set up, financing and implementation of the project. Community members contributed in the form of shares and work. Examples of this work are digging trenches and laying pipes. Unfamiliar with how investment and shares work, one of the challenges of the project was how it had to cope with the expectations of investors wanting to see dividends too soon.

Corruption in Kenya is a big issue and it is also a reason for a community such as Wandiege to be independent and responsible for their own water supply. The new Water Act of 2002 and the Ministry of water and irrigation created guidelines for setting up Community Initiatives. A result of this is the transparency in the basic income and expenditures of the project, which can be observed in the Wandiege administrative office.

Photo 1.2 Inside Wandiege administrative office



source: Fieldwork (2009)

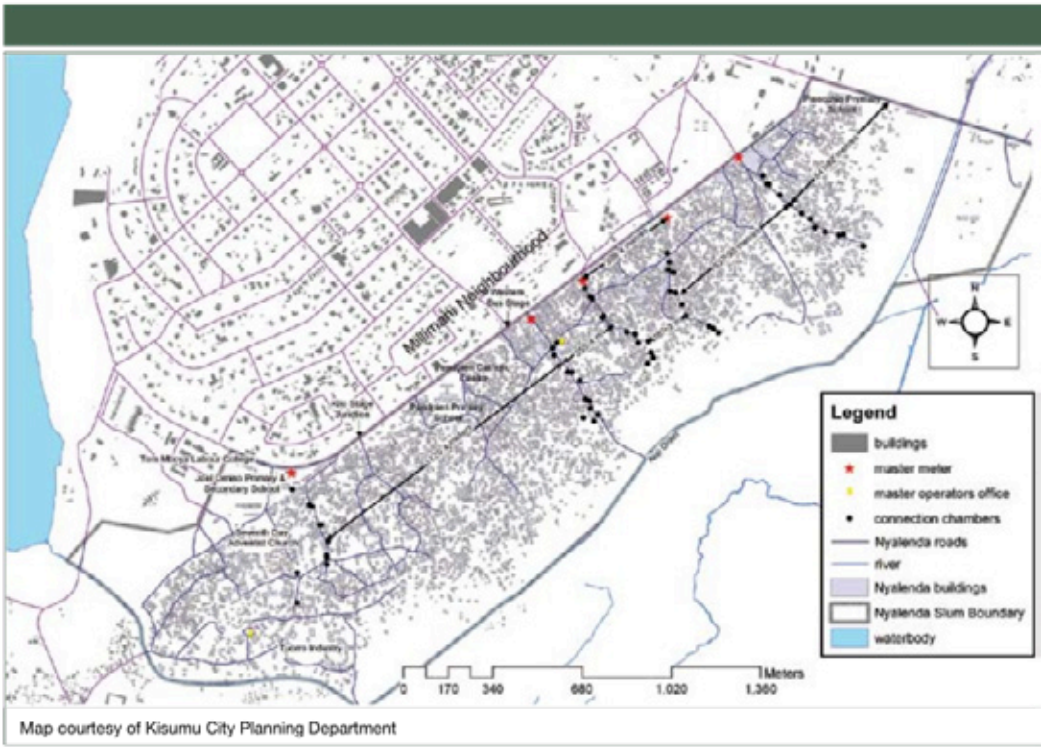
Photo 1.3 Sunken soil destroys latrine

source: Fieldwork (2009)

1.5.2 Katuoro, Nyalenda

Map 1.5 shows the informal settlements Nyalenda A and B. It is located in the south-western part of Kisumu. The most southern group of dots is located in Nyalenda B and is the first of a total of five Delegated Management Model (DMM) lines in Nyalenda. The other four lines located towards the north-east are in the area named Nyalenda A. Nyalenda B is the part of Nyalenda chosen for this research, which has experienced a private based intervention. The group of black dots in the lower left part of the map represent the DMM line that is called Katuoro. In this area 60 households have been sampled.

Map 1.5 DMM-lines in Nyalenda A and B



In rainy seasons some parts of Nyalenda get swampy and flooded. Nyalenda is located at a higher sea level than the Millimani neighbourhood and the other informal settlements Wandiege and Bandani. The place is considered a wetland. Housing is very basic, with the majority being semi-permanent rental houses with a mud wall and tin roof. Nyalenda can be reached by road. In the area however, the roads are not hardened. There are no government health facilities in Nyalenda A and B. There are a few charity and private hospitals. Although resources constrain its activities, the Pandipieri health centre provides health and child services. Infrastructure, social facilities, schools lack basic amenities and are inadequate, according to UN-Habitat (2005).

In general, Nyalenda B is considered less attractive for developers than Nyalenda A. The population of Nyalenda A and B are estimated around 25,000[1] people each, adding up to 50,000 for Nyalenda A and B combined. This number was estimated in 1999. There are no accurate recent counts of the population of Nyalenda. If the numbers of growth for Kenya in the period between 1999-2009[2] are used, the population of Nyalenda A and B for 2009 together is estimated at 83,000 people. The distance between Nyalenda B, the Millimani neighbourhood (upper-class), and other areas of economic activity is larger, making it a less attractive neighbourhood in comparison to Nyalenda A. Prices for land are lower in Nyalenda B.

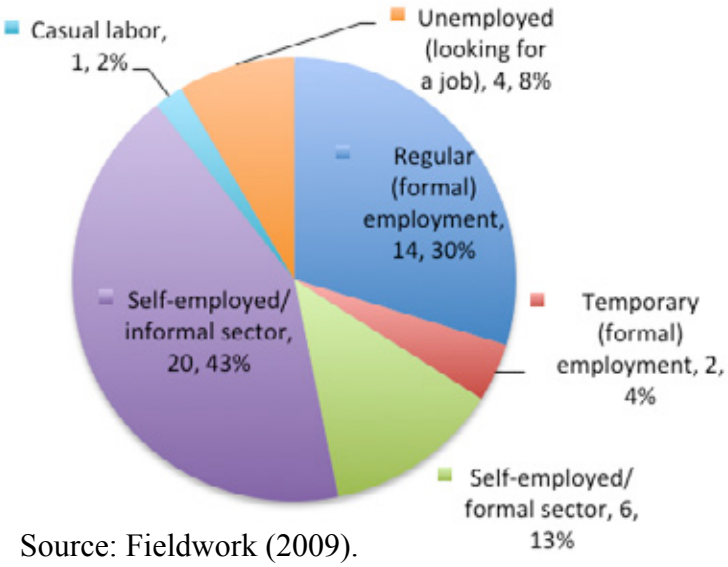
In Nyalenda B, a fair proportion of the population is working in the informal sector. Examples are: petty trade, fishing in Lake Victoria, Jua Kali (literally; loading and unloading goods out in the open, a kind of informal work, mainly artisan and

1 GOK census (1999) in UN-Habitat (2005).

2 KNBS (2009). Kenya 2009 population and housing census highlights.

Photo 1.4 An Aerial view of Nyalenda

Figure 1.7 Occupational types in Nyalenda B



Source: Fieldwork (2009).

industrial work) and urban farming. In general, farming takes place in another area called Nam Thowe, an area primed on developing productive urban agriculture. However, income levels in these slums are low and the availability of land remains an issue.

With help of a local guide, a young worker for the Katuoro water supply office, households were randomly selected around the DMM line of Katuoro. Households dispersed through the area that is covered by the Katuoro line were interviewed. Every household in the area gets their water either directly or via a kiosk, from the Katuoro line.

The Delegated Management Model (DMM)

The DMM-lines are an initiative of the Kisumu Water and Sewerage Company (KIWASCO). KIWASCO, a private company, was making financial losses in certain areas of operation, in particular the informal settlements Nyalenda A and B. In Figure 1.8, illustrates the old situation and the main reasons for making losses: unmetered connections, high levels of unaccounted for water (ufw) and spaghettization. These flaws in the water administration were causing KIWASCO losses and so a new initiative was set up to 1) provide the population with safe drinking water; 2) upgrade their water supply system, and; 3) turn their losses into profit. The DMM is a combination of providing paid services and an intervention in an informal settlement, in collaboration with the community.

The DMM provides a framework between the water company and the consumers, making use of 'Master Operators'. These Master Operators are mediating between the consumers and the water company (KIWASCO). In practice this means better cooperation, more responsibility and monitoring between the consumers, master operators and the water company. Each party now has an incentive in avoiding illegal connections, unaccounted for water and spaghettization. Unaccounted for water is water that has been produced and is 'lost' before it reaches the customer. Water is lost through leaks, theft and also metering inaccuracies. Unaccounted for water, sometimes also called non revenue water, is typicaly measured as the volume of water lost as a share of the netto water produced. Related to this, spaghettization (see Figure 1.8) occurs when many people are forced to connect to the city's water grid through informal and illegal ways, and rely on access to water of their local neighbours or water vendors, resulting in among other things unaccounted for water and low pressure in the water pipes.

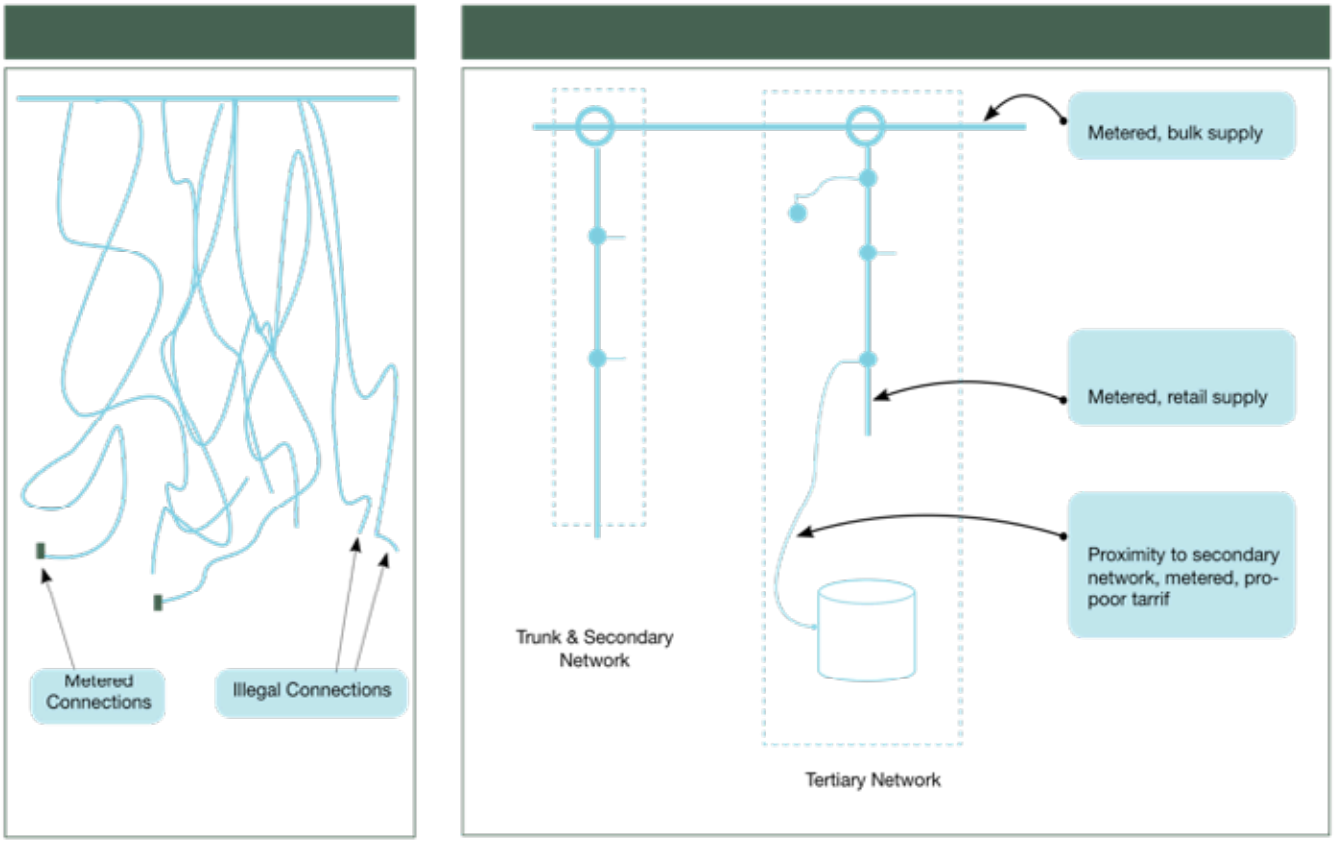
The delegated management model makes the water supply more efficient and practical, resulting in less illegal connections, spaghetti-lines and a better revenue-collection. The role of the Master Operator (MO) plays a significant role in this process. The Master Operator is a representative of the community that is hired by the water company KIWASCO.

Box 1.5 Responsibility in the new Delegated Management Model

[T]he system has now come to known as DMM for Delegated Management Module. Under this arrangement KIWASCO offers contractors, termed 'master operators' (MO's), or agents who are contracted to operate and manage part of the water network in the informal settlement. In turn, the master operators are responsible for minor maintenance, such as the repair of small leaks, and the management of customer interfaces.

Residents of Informal Settlements Enjoy water supply through delegated management, press release November 2009.

Figure 1.8 Old situation versus Delegated Management Model (DMM)



Source: WSP, (2009). Improving Water Utility Services through Delegated Management. World Bank. Water and sanitation program Africa. Field Note May 2009.

1.5.3 Bandani

> The inadequacy of physical infrastructure and basic social services in this area is comparatively worse than in other slum areas. – Situational Analysis of the Informal Settlements of Kisumu (UN-Habitat, 2005)

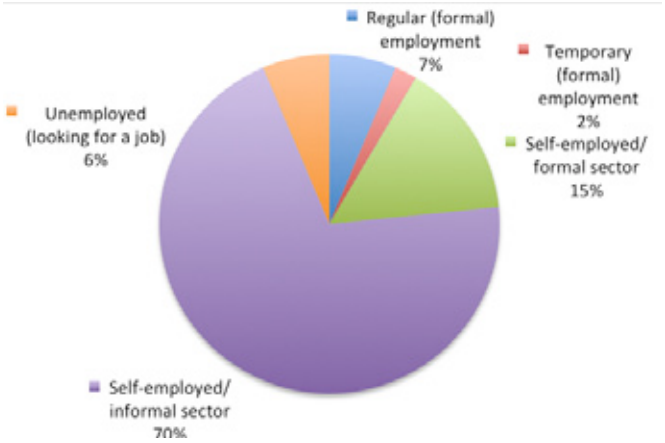
Traditionally, Bandani is a working-class residential area and is located in northern Kisumu. The informal settlement emerged next to the industrial area where most of Bandani's inhabitants found employment. Since the 1990s, land has been commercialized and nowadays, urban farming is a popular replacement for the declining jobs in the industrial sector. Around 80% of the houses have mud walls and a tin rooftop, often referred to as semi-permanent housing.

According to the GOK Census (1999), the population of Bandani is estimated around 14,000. The infrastructure in Bandani is bad. Roads are often impassible due to poor drainage. Also, the area is hard to reach, as the railway is blocking access to most parts. Lack of spacing between houses and bad urban planning make some parts of Bandani only reachable by foot. The bad infrastructure and land-locked situation, makes Bandani less attractive to invest in. Clean drinking water, latrines, hospitals and other facilities are scarce. There are a few water points in Bandani, however there are limitations to these. The kiosk only serves water at certain hours, and the lines to queue for water are long. The water from the Bandani mosque is contaminated, altough with the right treatment should be safe enough for drinking. The same goes for the Bandani spring outlet, as displayed in Photo 1.4.

Development in Bandani is at lower levels compared to the other study areas. The proportion of people working in the informal sector is larger than in Wandiege or Nyalenda (Figure 1.9). Bandani has a reputation of being unsafe and there are dubios activities such as the brewing of local liqour.

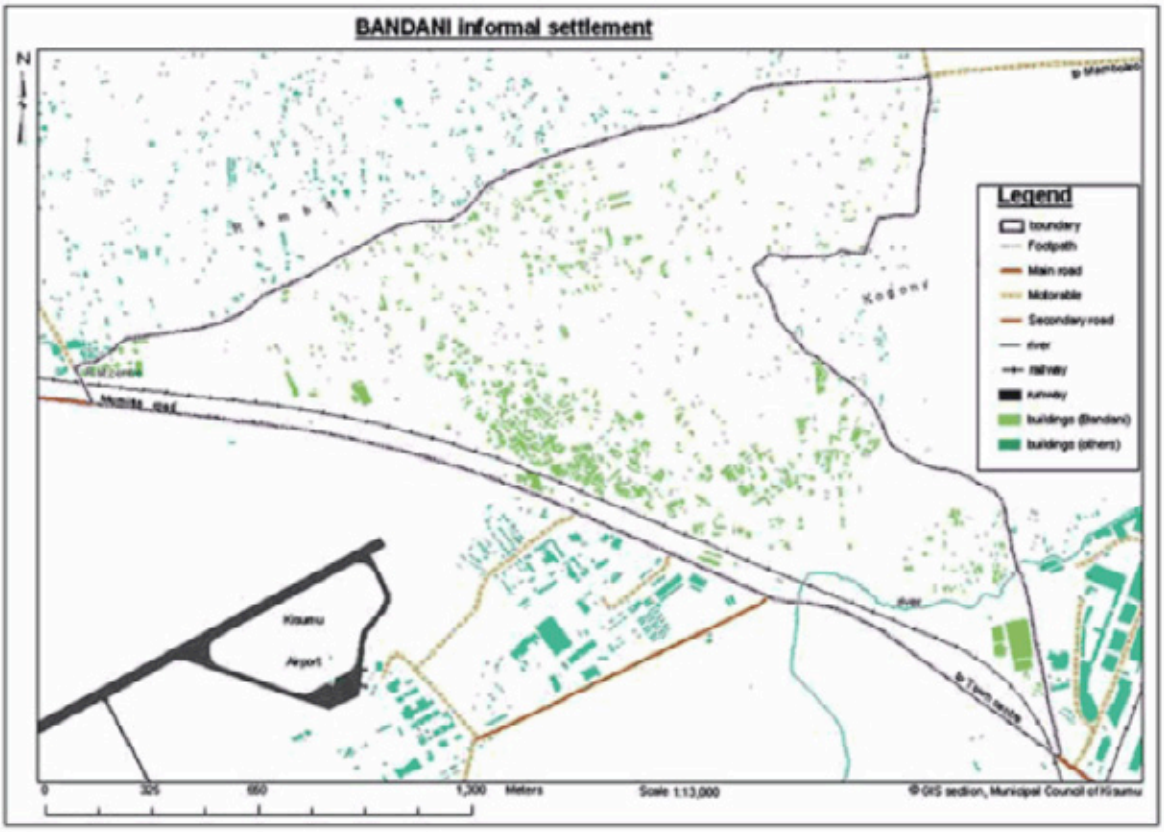
There has been no type of development intervention in Bandani, and the area lacks a proper water supply, waste management system, infrastructure and social services. Prospects for development in Bandani are poor. Perhaps access for the population to a proper water supply can raise hopes for a better future.

Figure 1.9 Occupational Types in Bandani



Source: Fieldwork (2009), 63 households

Map 1.6 Bandani, in northern Kisumu



Source: Situational Analysis of the informal Settlements in Kisumu (UN-Habitat 2005)

Photo 1.5 Bandani Mosque protected shallow well (contaminated)

Source: Author, Fieldwork (2009)

Photo 1.6 Bandani Clinic

Source: Author, Fieldwork (2009)

Photo 1.7 Girl drinking from unprotected spring outlet (contaminated)

Source: Author, Fieldwork (2009)

1.6 Conceptual model and final thoughts

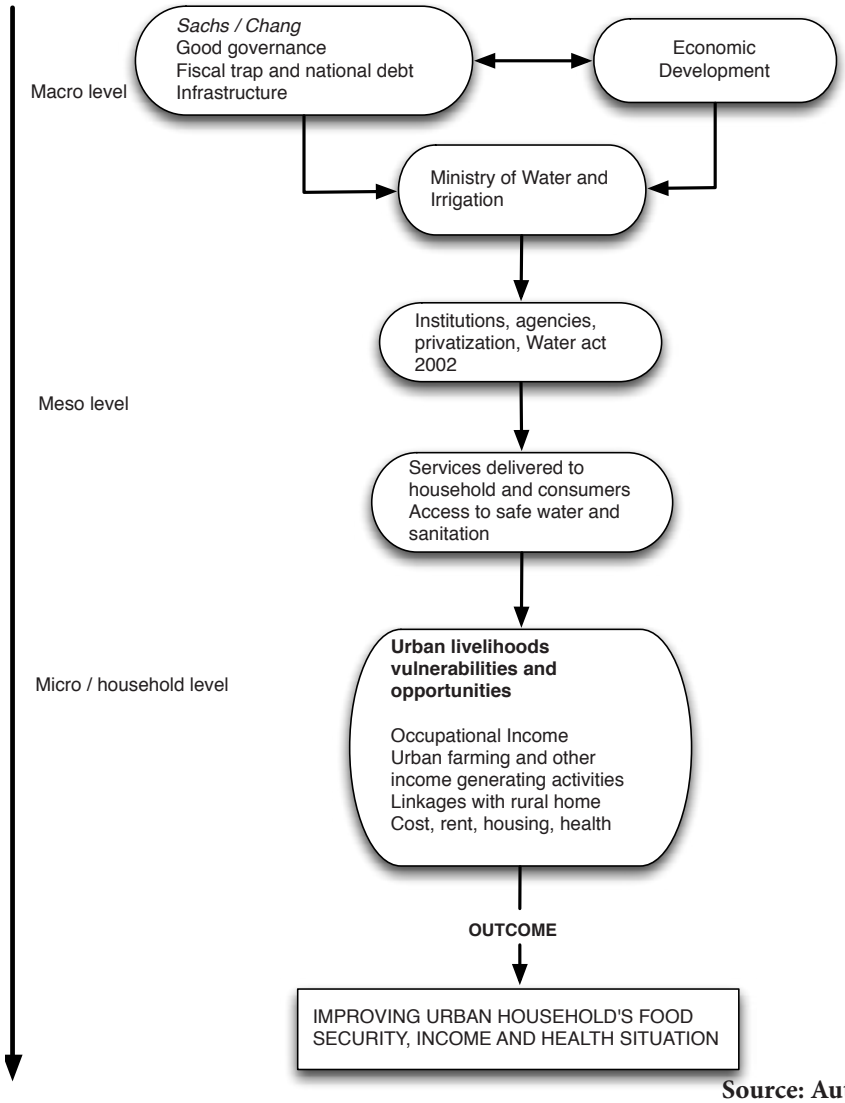
This study aims to contribute to the iterative process of ideas, theories and the implementation of development policies in Africa, where evaluation and analyses gives new insights for scientists and policymakers. To do this a model will be used that incorporates different perspectives from macro to meso and micro level. Theories and ideas on economic development are important, but the livelihood approach is equally of relevance. Also, since technology and the physical availability of water are not the bottleneck, politics, economic policy, and the law perhaps are. This thesis will apply macro theories of economic development and how they affect Kenya as a country, the government and institutions, and the different interventions in the water sector. Next, we will continue on how these interventions affect the livelihoods of people, and whether their circumstances get better. An overview of the macro-micro topics that this thesis will put emphasize on are displayed in the conceptual model in Figure 1.10.

The conceptual model describes how access to water and sanitation is affecting and is effected by:

- Macro factors: Good governance, economic development and the infrastructure of the country
- Meso factors: The strength of the new water act, institutions, the number and set up of new water supply projects
- Micro factors: Households in the poverty trap, communities that set up their own water supply project, prosperity of the household due to access to water.

This approach emphasizes the importance of practical and This approach emphasizes the importance of practical laws and good governance, and the opportunities that the rule of law can have for the livelihoods of the urban poor. Urban growth is increasing the demands for clean water. The question now remains to what extent good governance, practical laws and the set up of small local self-sustaining water supply projects can bypass the problem of the physical scarcity of water. Although various sources categorize Kenya as a country with economical scarcity of water, this remains debatable. Especially when observing dried up rivers from close range, or taking in account the industrial and agricultural demands that are competing with local water provision.

Figure 1.10 Conceptual Framework: an overview of this thesis' most important topics



Source: Author (2011)

2

Theory
The development nexus; from macro to micro

2.1 Introduction

Chapter 1 introduced the research topic of this thesis, the research questions and briefly described the themes and approaches this research will elaborate on. Chapter 2 discusses poverty and attempts to fight it, in particular through the Millennium Development Goals (MDGs) initiated by the United Nations in the year 2000. Jeffrey Sachs, a development economist and author of the book The End of Poverty (2005), gives clear guidelines how to achieve the MDGs. His theory on the linkages between economic development, ODA and the poverty trap and its relevance for this research are described in this section. The work of Ha-Joon Chang is also discussed. Ha-Joon has written several influential books on development economics including Kicking away the Ladder (2002). Following the discussion of these macro economic development theories, attention will be shifted to the livelihoods framework used to describe the possibilities and restraints of households. Finally, the state institutions and organizations relevant for the provision of water and sanitation in Kisumu will be presented, along with the livelihood framework, urban farming, and the hypotheses of this thesis.

2.2 Poverty, aid & the Millennium Development Goals

Urban livelihoods and the access to water and sanitation facilities are increasingly on the agenda of both researchers and policymakers. A critical stumbling block in providing access to water is poverty among many of the urban residents. Yet, what exactly is poverty? Defining poverty has been an intense scholarly debate for decades, and there are many definitions and approaches to this. The aim of this thesis is not to dwell on the subject of poverty as such but to examine what poverty means for access to water, sanitation and urban livelihoods in general. In this sense it is of importance to understand the underlying processes and multi-faceted context of poverty since its meaning consists of multiple ideas. In general, degrees of poverty are distinguished, i.e., extreme (or absolute) poverty, moderate poverty and relative poverty.

- Extreme poverty means that households cannot meet their basic needs such as food, access to health, access to safe and clean water, sanitation, education and in some cases also shelter and clothing.

- Moderate poverty refers to the fact these basic needs are just barely met.

- Relative poverty refers to mostly developed countries where certain social groups are below the average of these countries income which neglects them from certain cultural goods, recreation, quality education and other perquisites for upward social mobility (Sachs, 2005).

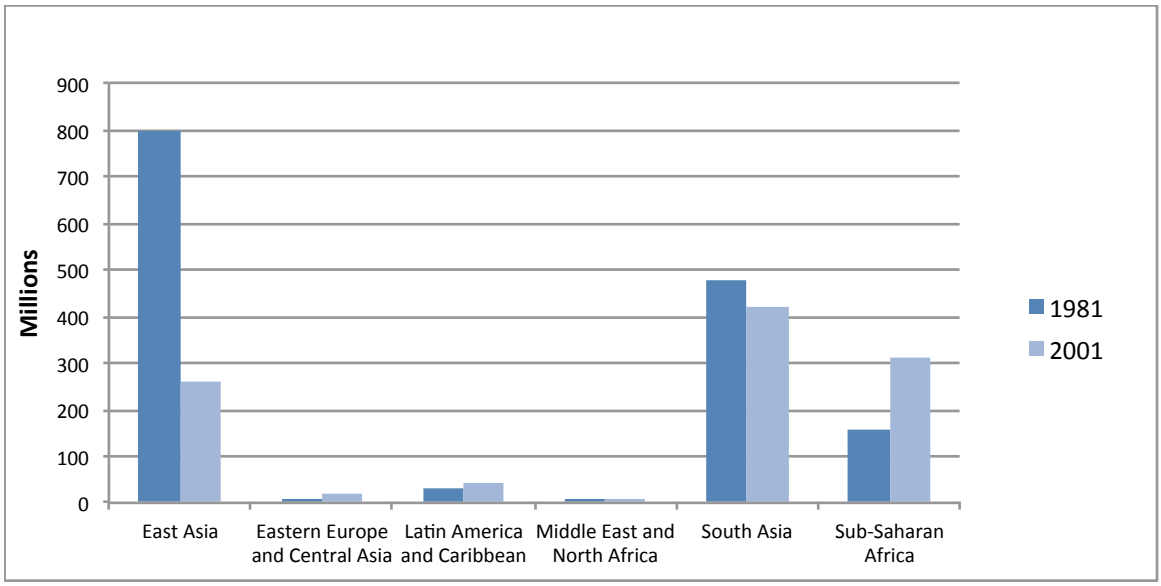
The World Bank has introduced the statistical standard of $1.25 (PPP) a day per person to measure extreme poverty[1]. Whenever individuals cannot spend more than $1.25 a day, meaning they are living under $1.25 a day, they are labelled as 'extreme poor'. When a person lives on an amount between $1.25 and $2 a day, he or she is labelled 'moderate poor', a condition where basic needs are just barely met.

Relative poverty basically concerns people in high-income countries, who are living below a given proportion of the national income, lacking access to certain (cultural) goods, quality education and health care and other prerequisites to upward social mobility. In Figure 2.1 and 2.2 the numbers and proportion of people in extreme poverty in 1981 and 2001 are presented.

1 Note that these amounts are standardized using purchasing power parity (PPP). Measuring poverty using PPP helps creating a comparable international standard, meaning people in Asia should get the same basic goods for $2 (PPP) as someone in Africa.

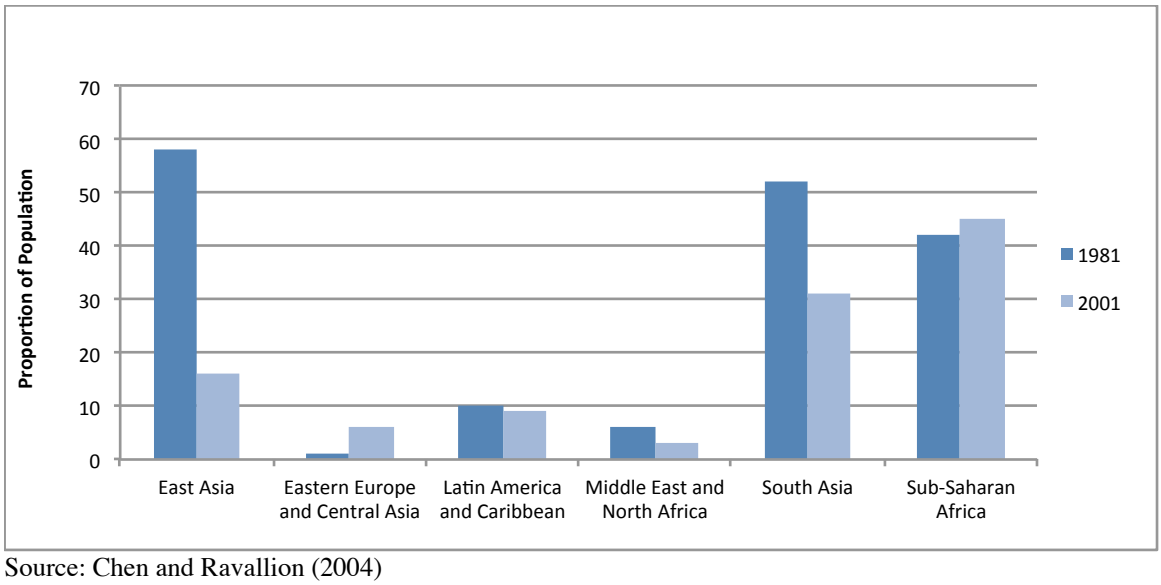
According to these standards of $1.25/day (PPP) to measure extreme poverty, and a $1.25 to $2 income per day defining moderate poverty, various scholars have been working on the distribution of extreme and moderate poverty over the world. The numbers and proportion of people living in extreme poverty can be observed in Figures 2.1, and 2.2. Most of the world's extreme and moderate poverty is located in South Asia, East Asia and Sub-Saharan Africa. At this moment, almost half of Africa's population is living in extreme poverty, and about 30% is living on $1.25 - $2 (PPP) a day. An important observation from Figures 2.1 and 2.2 is that the absolute and relative extreme poverty in Sub-Saharan Africa have increased between 1981 and 2001. Although extreme poverty still exists in East and South Asia, the absolute numbers have decreased between 1981 and 2001. Sub-Saharan Africa does not seem to have profited from any economic development. Instead, their situation has become worse.

Figure 2.1 Numbers of Extreme Poor



Source: Chen and Ravallion (2004)

Figure 2.2 Proportion of the population living in extreme poverty



Source: Chen and Ravallion (2004)

2.3 The ladder of development

Understanding economic development provides insights in why a country is unable to provide infrastructure, education and access to safe water for their citizens, and why a country is unable to get their foot on the ladder of development. Authors such as Stiglitz (2007) Making Globalization Work and Sachs (2005) The End of Poverty, provide a clear overview of the poverty trap. According to Sachs (2005), the reason why poverty exists in Africa and Asia is because these countries failed to get stable economic growth. Some parts of Asia successfully achieved stable economic development as well as reduction in numbers of poverty. A great part of reducing poverty and getting the foot on the ladder of development is the opportunity of some countries to:

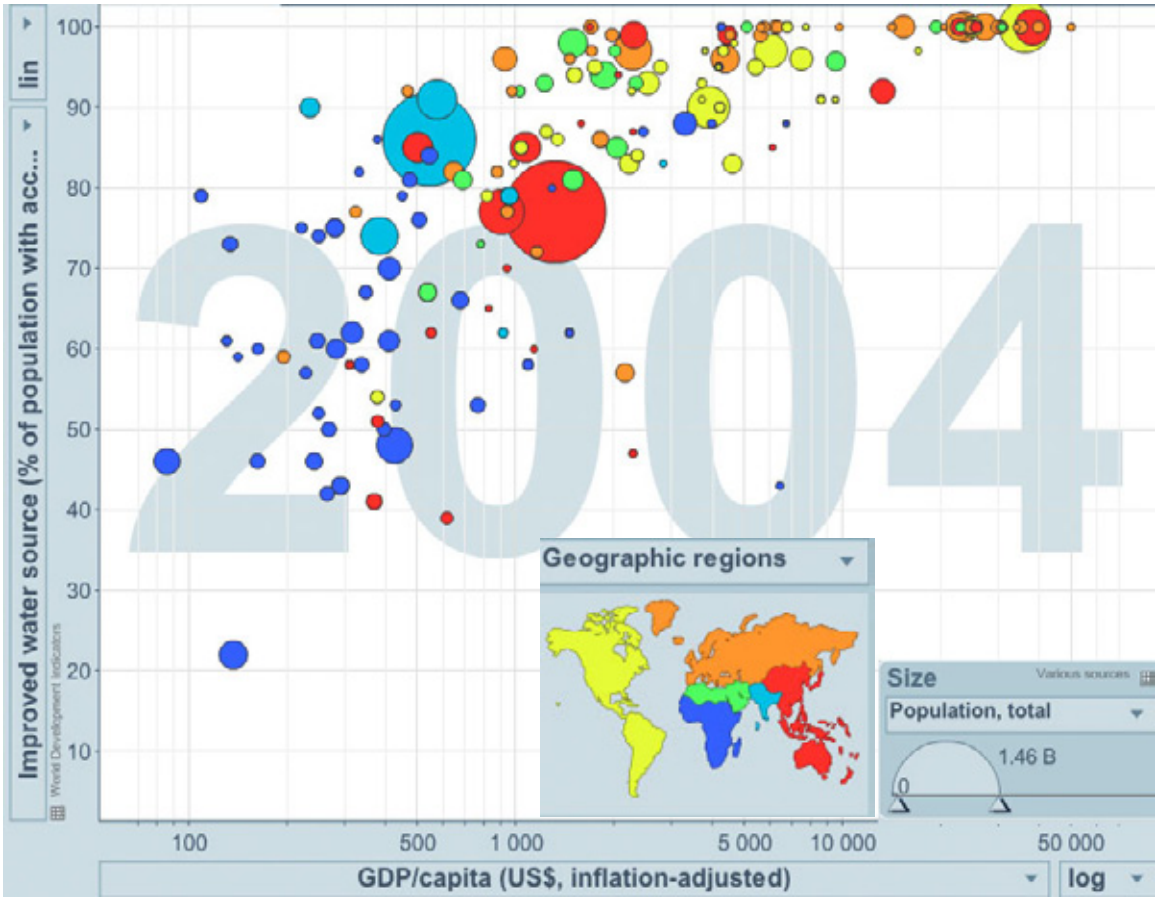
- deal with their national debt,
- get their economy going (stable economic growth) and,
- invest in the country.

Sachs' strategy consists of a whole list of important factors tSachs' strategy contains more important factors than just these three. Another key factor Sachs elaborates on is the stability of the currency, where he suggests governments of developing countries to set up a stabilisation fund. Poverty is also the process in which people's choices and level of wellbeing are narrowed (Owuor, 2006). This idea describes the topic of this thesis in a nutshell: development on the global and national level affecting the development and limitations of people's choices at the local level.

So the World Bank and IMF came up with a plan to increase the GDP growth of countries. Since the 1980s and 1990s, the World Bank's and IMF's Structural Adjustment Programmes (SAPs), many countries have come to even worse levels of economic decline, partially due to the effects these SAPs had on the country. These effects ranged from increase of their national debt and the inability to invest in their own country.

Whenever a country is in deep debt with other countries or donors, it is structurally unable to invest in health care, agriculture, education and infrastructure. Historical examples include Bolivia, Taiwan, Poland, and various African countries (Sachs, 2005). What this means is that countries with a national debt had no choice other than cooperating with the Structural Adjustment Programmes, eventually leading to bigger and more loans, some even exceeding a country's annual GNP. Opening up borders were part of the requirements in order to get loans, or lower the interest rates on existing loans. A lower interest on national debt sounds very appealing, especially to countries in debt. However, there is a dark side to the proposed agreement. In return for this reduction in interest on the national debt, the trade barriers of that country had to be removed, opening up to multinationals in the spirit of free-trade. Direct investment in developing

Figure 2.3 Proportion of population with access to an improved water source and GDP per Capita



Source: World Development Indicators (2004), Gapminder (2011)

countries led to very little flows of capital to the urban poor, but its profit rather went to a selective group of individuals. So, partially due to bad governance and the inability of small-scale entrepreneurs to compete with powerful multinational corporations, these programmes did not lead to a reduction in poverty levels. Box 2.1 describes a good example of negative consequence for developing markets. There are many other examples such as China's textile industry taking over the clothing industry in Kenya .

Both Stiglitz (2007) and Sachs (2005) are critical on this topic and past interventions of the World Bank and IMF. Their criticism does not go ungrounded or without alternative strategies. Sachs (2005) presents an overview of all the internal, external and intermediating factors of the inability of countries to get their foot on the ladder of development. His framework is presented in Table 2.1 on the next page.

Chang (2002) argues that the Western countries forced the developing world to accept the free market programmes, whereas the poor countries should have protected their own economies. He illustrates how Western countries themselves use protectionist trade measures to strengthen their economies throughout history. This contradicts the nature of the Structural Adjustment Programmes (SAPs). Chang points out that opening up borders weakens infant economies and calls upon the international community to acknowledge this myth of free trade. Although Sachs' approach on getting countries back on the ladder of development differs from Chang, both development economists agree on the consequences of free-market policy on developing economies.

There are also many internal factors such as the unique geographical conditions of a country that add to the burden. The poverty trap in Africa is a special case, where many factors such as health, bad governance, bad climate, and bad geographical conditions are all coming together. These factors are making it harder to achieve stable economic growth, invest in education and infrastructure, and get the economy going. It is no wonder that the portion of people living in extreme and moderate poverty is so vast in these countries. Throughout the analysis of Africa's development, unfavourable geographic conditions have been emphasized. For example, Bloom and Sachs conclude, "At the root of Africa's poverty lies its extraordinarily disadvantageous geography. . . " In their major statistical analysis of Africa, Bloom and Sachs use as a dependent variable the growth in output per capita, and their geographic variables are percentage of land in tropics and factors such as coastal population density. Recent work by Nordhaus (2006) examines structural estimates of the relationship between disease and climate. Nordhaus (2006) shows an important finding linking economic development with geographical factors such as distance to coastal regions and climate change. His most important findings are that these geographical factors are often neglected when it comes to researching the poverty trap of landlocked Africa and economic development. Nordhaus acknowledges the need for a combination of the geographical conditions with the effectiveness of institutions in development analysis. Africa has rivers and water sources, but they are spread unequally throughout the continent. Although Sachs confirms the importance of geographical dispersion of water as a resource, he also believes that good governance and proper infrastructure can overcome the physical scarcity of water, as well as the lack of access to clean drinking water. Sachs proposes a massive increase in Official Development Assistance (ODA). Easterly (2001) also stresses the iterative process of policy formulation and implementation, but disagrees with Sachs on ODA as a realistic solution. Sachs' list of differential diagnosis includes many factors, used in many of today's national Poverty Reduction Strategy Papers (PRSPs). These PRSPs have received some criticism on being similar to the older Structural Adjustment Programmes (SAPs). Also, evidence for reductions in inflation and encouragement in growth have been found, but are hard to measure and stay rather questionable.[1]

Box 2.1 Globalization: Multinationals versus local manufacturing. Free trade versus Fair-trade

African farmers competing in world markets.

…[m]ore than two-thirds of farm income in Norway and Switzerland came from subsidies, more than half in Japan, and one-third in the EU. For some crops, like sugar and rice, the subsidies amounted to as much as 80 percent of farm income. The aggregate agricultural subsidies of the United States, EU, and Japan (including hidden subsidies, such as on water), if they do not actually exceed the total income of sub-Saharan Africa, amount to at least 75 percent of that region's income, making it almost impossible for African farmers to compete in world markets. The average European cow gets a subsidy of $2 a day (the World Bank measure of poverty); more than half of the people in the developing world live on less than that. It appears that it is better to be a cow in Europe than to be a poor person in a developing country.
..[T]he Burkina Faso cotton farmer lives in a country with an average annual income of just over $250. He ekes out a living on small plots of semi-arid land; there is no irrigation, and he is too poor to afford fertilizer, a tractor, or high-quality seeds. Meanwhile, a cotton farmer in California farms a huge tract of hundreds of acres, using al the technology of modern farming: tractors, high-grade seeds, fertilizers, herbicides, insecticides. The most striking difference is irrigation – and the water he uses to irrigate the land is in effect highly subsidized. He pays far less for it than he would in a competitive market. But even with the water subsidy, even with all of his other advantages, the California farmer simply couldn't compete in a fair global marketplace were it not for further direct government subsidies that provide half or more of his income. Without these subsidies, it would not pay for the United States to produce cotton; with them, the United States is, as we have noted, the world's largest cotton exporter. Some 25,000 very rich American cotton farmers get to divide $3 billion to 4$ billion in subsidies among themselves, which encourages them to produce even more. The increased supply naturally depresses global prices, hurting some 10 million farmers in Burkina Faso and elsewhere in Africa.

Source: Making globalization work, Stiglitz (2007), p 85

1 Bird, G. "IMF Programs: Do they Work? Can they be made to work better?" *World Development*, Vol 29, no.11 (2001)

Table 2.1 Checklist for making a Differential Diagnosis

- **Poverty Trap**

Poverty mapping

Proportion of households lacking basic needs

Spatial distribution of household poverty

Spatial distribution of basis infrastructure (power, roads, telecoms, water and sanitation)

Ethnic, gender, generational distribution of poverty.

Key risk factors

Demographic trends

Environmental trends

Climate shocks

Disease

Commodity price fluctuations

Others

- **Economic Policy Framework**

Business environment

Trade policy

Investment policy

Infrastructure

Human capital

- **Fiscal Framework and Fiscal Trap**

Public sector revenues and expenditures by category

- Percentage of GNP

Absolute levels in comparison with international norms

Tax administration and expenditure management

Public investments needs to meet poverty reduction targets

Macroeconomic instability

Overhang of public sector debt

Quasi-fiscal debt and hidden debt

Medium-term public sector expenditure framework

IV. Physical Geography

Transport conditions

Proximity of population to ports, international trade routes, navigable waterways

Access of population to paved roads

Access of population to motorized transport

Population density

Costs of connectivity to power, telecoms, roads

Arable land per capita

Environmental impacts of population land ratios

Agronomic conditions

Temperatures, precipitation, solar insolation

Length and reliability of growing season

Soils topography, suitability for irrigation

Interannual climate variability (e.g. El Nino)

Long-term trends in climate patterns

Disease ecology

Human diseases

Plant diseases and pests

Animal diseases

V. Governance Patterns and Failures

Civil and political rights

Public management systems

Decentralization and fiscal federalism

Corruption patterns and intensity

Political succession and longevity

Internal violence and security

Cross-border violence and security

Ethic, religious, and other cultural divisions

VI. Cultural Barriers

Gender Relations

Ethnic and religious divisions

Diaspora

VII. Geopolitics

International security relations

Cross-border security threats

War

Terrorism

Refugees

International sanctions

Trade barriers

Participation in regional and international groups

Source: Sachs (2005)

Official development assistance

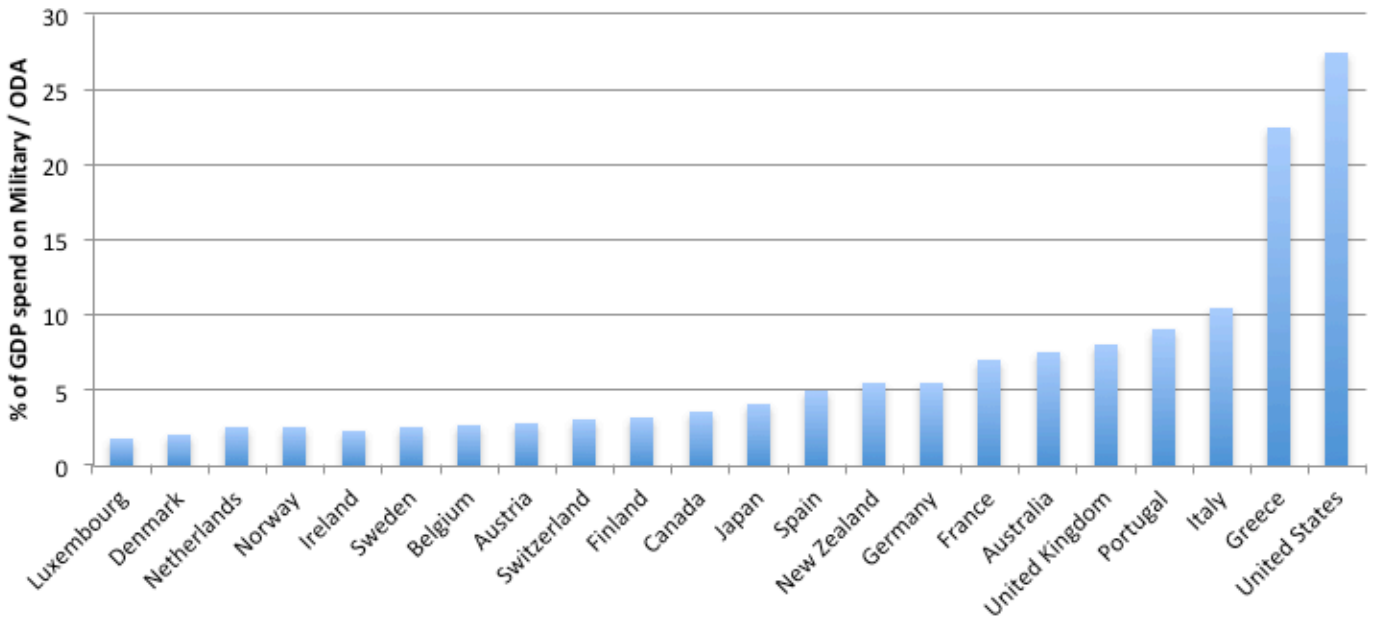
A widely discussed issue is the effectiveness of aid, also often referred to as Official Development Assistance (ODA). Sachs (2005) points to ODA as the key solution for countries to get their foot on the ladder of development and breaking the poverty trap.

Figure 2.4 shows how out of proportion the money spend on development aid is, compared to military expenditures. The figure shows the percentage of the countries' GDP spend on military expenditures in relation to the percentage of their GDP spend on ODA. Most of the developed countries fail to reach even the 0.7 % level being the internationally agreed amount of a country's GNI to be allocated to ODA. According to Jeffrey Sachs' calculation, in order to achieve the Millennium Development Goals by 2015 all countries have to invest a mere 2% of their yearly GDP. This includes the financing for poverty reduction strategies in many countries, as well as investing in education, infrastructure, health and the economy in a sustainable way. In order to make such a strategy work it is important these projects are not underfunded and all problems are tackled. Easterly (2001) however, does not agree on Sachs' vision on ODA as solving the development problem. ODA has been and in some cases still is badly managed. Easterly (2001) and many other scholars are criticising ODA for good reasons. Resources of ODA have high odds for being mismanaged. One of the reasons for this misuse of resources is corruption. A popular example is the case of Zimbabwe, where the influence of financial aid on weak and fragile states had negative consequences on economic growth and democracy. Simeon Djankov, a development economist at the World Bank, concluded that although states are democratic, financial aid did not reduce poverty nor did it lead to economic development.

Research showed that financial aid has stimulated corruption in governmental networks and affected the democracy and economic growth[1]. Numerous countries in Africa that received development aid, have troubles managing their resources, including ODA. This results in failure to invest in the countries economy, infrastructure and people, in spite of available resources.

Economic development matters, for a country's infrastructure, but also for access to water. Figure 2.3 (on page 23) confirms the correlation between: (X) GDP per capita and (Y) the proportion of the population with access to an improved water source can be observed. The dots and circles are countries of the different continents. The graph confirms the relationship: the higher the GDP per capita, the higher the proportion of the population with access to an improved water source. Although the relation between these two factors is clear and straightforward, its causality is not. What increases GDP per capita, and under what circumstances does the population of a country have access to an improved water source? Is the availability of water leading to a higher GDP per capita, or leads a higher GDP per capita to more money that can be invested in the infrastructure? Both questions hold truth. Water is a basic human need that enables people to live and actualize their goals. And of course, water and sanitation systems have to be set up and require investment.

Figure 2.4 Ratio of Military Expenditure and Official Development Assistance (2002)



Source: World Bank (2004) & Sachs (2005)

Everyone knows that water is necessary for life. Yet it comes at a price. Water and sanitation requires an investment. When money is available it can be invested in proper water supplies and sanitation facilities. When there are proper facilities households have more opportunities to invest in their livelihoods. Let us now introduce the water sector in Kenya, in particular the new legal context put in place since 2002.

1 http://www.volkskrant.nl/vk/nl/2668/Buitenland/article/detail/907247/2008/05/14/lsquo-Hulpgeld-leidt-tot-corruptie-in-Afrika-rsquo.dhtml visited 23/02/2011

2.4 Water sector reforms in Kenya

The Water Act 2002 is aimed at improving access to resources and empowerment of the poor. This Water Act facilitated the start of new water supply projects in Kenya. The water sector reforms are a huge progression in itself, despite of whether its goals will be achieved. Weaknesses in policy, regulation and service provision were the main reasons for new water sector reforms. These weaknesses, which the reforms tend to address, are summarized in Table 2.2. Due to the water sector reforms, the Kenyan municipalities are now obliged to reform their water services along new guidelines. These guidelines include more business and commercial principles. As Owuor and Foeken (2009) point out, the new Water Act laid the foundation for the National Water Resources Management Strategy, which links the water sector reforms to "eradicating poverty through the provision of potable water for human consumption and water for productive use".

The Water Act 2002 was passed by the Parliament on 18 July 2002 and became effective on 18 March 2003. The Act provides guidelines and the legal framework to change the roles and responsibilities of the actors, the institutions for the provision of water supply and sewerage services. The actors and the hierarchy of the institutions are displayed in Figure 2.5. The illustration shows how the roles and responsibilities of the institutions are checked by each other, The Water Services Regulatory Board (WSREB) is responsible for a clear regulatory framework, enhancing monitoring and evaluation, and improving the performance of the Water Services Boards (WSBs) and Water Services Providers (WSPs). These responsibilities also include improving the infrastructure, attracting investments, increasing coverage and improving the service delivery[1]. This enhances coordination and provides transparency and accountability.

1 As described by Owuor & Foeken (2009).

The new institutional structure for management of water affairs in Kenya has made many changes to the legal framework. Many functions have been separated and decentralized. The most important one is the separation between resource management and the delivery of water services. Application for a permit is made to the Water Resources Management Authority, and the factors that are taken into account for a permit include:

- The existing lawful uses of the water;
- Efficient and beneficial use of the water in the public interest;
- The likely effect of the proposed water use on the water resource and on other water users;
- The strategic importance of the proposed water use;
- The probable duration of the activity for which the water use is required;
- Any applicable catchment management strategy; and
- The quality of water in the water resource which may be required for the reserve.

Mumma (2005) points out that these considerations are designed to enable the Authority to balance the demands of competing users, and take into account the need to protect the general public interest in the use of water resources. Related to this, the Authority decides on the allocation of the water resource as follows:

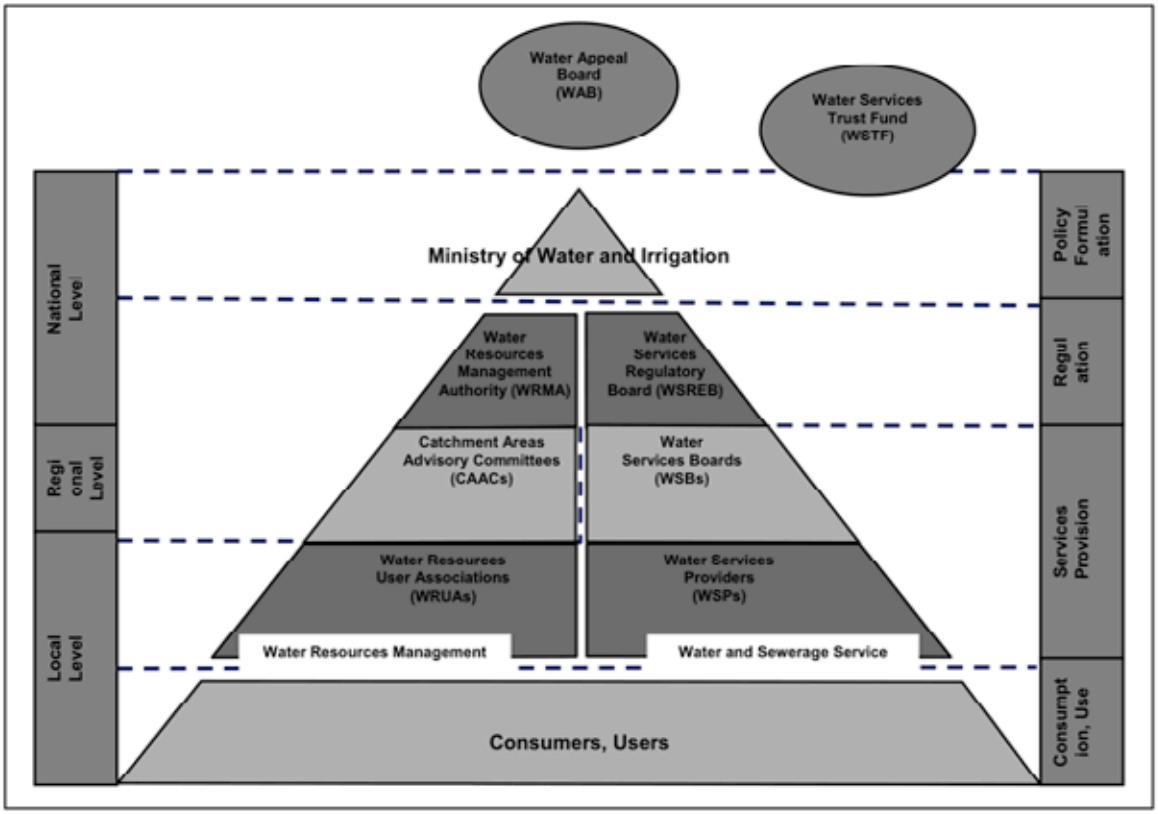
- The use of water for domestic purposes shall take precedence over the use of water for any other purpose – including agricultural purposes – and, in granting a permit, the Authority may reserve such part of the quantity of water in a water resource as is required for domestic purposes
- That the nature and degree of water use authorized by a permit shall be reasonable and beneficial in relation to others who use the same sources of supply.

Table 2.2 Bottlenecks in the water sector under Water Act Cap 372

Policy formulation	• Poor co-ordination in the sector • Poor policy accountability • Poor attention to water resources management
Regulation	• Lack of clear regulatory framework • Lack of monitoring and evaluation • Poor performance of water-undertakers
Service provision	• Poor management of water resources (quality and quantity) • Failure to attract and retain skilled manpower • Inadequate allocation of resources • Poor, inefficient and unreliable service delivery • Low coverage of water supply and sewerage services • Inability to attract investments • Dilapidated water supply and sewerage infrastructure • High levels of unaccounted-for-water • Low revenue collection, including corruption

Source: Kenya (2006) and Owuor & Foeken (2009).

Figure 2.5 The institutional set-up of water sector reforms under Water Act 2002



Source: MWI (2005); Kenya (2006b).

These changes to the Water Act 2002 will form a new basis in which conflicts between Water Service Providers and/or other demanding groups and e.g. agricultural purposes for water, can be solved by statutory law. The question now remains how these poor self-help groups are able to access and utilize these facilities in practice. When comparing the political influence and power of communities with agricultural firms, the new Water Act of 2002 is no guarantee for equal division of power.

In summary, the Water Act of 2002 corrected the weaknesses of the previous framework by decentralizing power responsibility and accountability. The Water Services Providers (WSPs) can now be set up by a group of consumers, a community for example. The actual water delivery to the consumer is done by the WSPs. Before the Water Act of 2002, the Water Services Boards (WSBs) were responsible for the water delivery. Current challenges of the Water Act 2002 lie with access to this state based system. As Mumma (2005) correctly points out, the rural poor have limited access in the acquisition and exercise of water rights. To apply for a permit certain requirements are needed, requirements that the urban and rural poor are less likely to have. These requirements include technical and financial competence. Many groups will have great difficulty demonstrating such competence, and this may result in water service agreements being granted only to well established community groups and other organizations which have access to technical and financial resources to the detriment of local community self-help initiatives (Mumma 2005: 5-8).

Another challenge lies with registration of the community water systems and legal identity of a community or self-help group. Setting up and registering as a self-help group appears to be fairly easy and inexpensive, and can be done by the District Community Officer. However, registration with the District Community Officer does not provide the group any legal personality or corporate identity under statutory law. A self-help group has to register itself as a society or association. In order to do this, one has to go to the Registrar of Societies, based in Nairobi. This makes things difficult and expensive for poor rural communities, as they would have to travel to Nairobi and engage an agent or lawyer to carry out the registration on their behalf. A possible work-around for this problem is proposed by Mumma (2005). He suggests enhancing the role of local communities in water resource management by utilizing the water resources users associations as an institutional mechanism that can give a permit to community based entities. Something also worth mentioning is the relation with land. As the permits on setting up water supply systems run with the land, the current land tenure system in Kenya will influence the implementation of the Water Act 2002. The communal ownership of a water supply system and private ownership of land can conflict when claiming the rights of such ownership.

There are still many things in the new Water Act of 2002 that can be improved, with special attention for the access to state-based systems. The way households and communities have access to state-based systems is dependant on the type of resources and capital the entity has. The livelihood framework will give more insights in the factors determining improved access to resources and state-based systems.

2.5 The Livelihood framework

The livelihood framework is an approach explaining the way people earn a living. It can be used to study how households improve and maintain their livelihoods, and identify the trade-offs in (household-level) decision making. This is done by:

- Identifying the demands and resources at household level
- Identifying the range and depth of barriers that withhold access
- Embedding these household factors in communal and national context
- Linking the micro-level linkages to macro-level policy and institutional frameworks

Many studies have shown the heterogeneity in the way households earn their living by applying the (sustainable) livelihoods framework (for example, Bebbington 1999, Ellis 1998, Scoones 1998)[1]. The model describes the outcome for peoples' livelihoods as a result of change in ecological conditions, resources, social capital, individual vulnerability to poverty and availability of coping strategies as such. People use these livelihood strategies in order to make a living, whether in times of scarcity, crisis or in times of prosperity. In times of prosperity however, people would not have to try so hard, use compensating, adaptive or coping strategies to make the ends meet (Griep 2001)[2]. However, the framework emphasizes the opportunities of households, but simultaneously limits its explanatory power by, to a large extent, bypassing the importance of institutions and political-economic approaches. Previous research of Rutten & Mwangi (2009) shows that Kenya is increasingly witnessing violence over water resources. Mechanisms to enforce regulations between the local demand of water use versus the commercial use of water cannot be maintained as resources in the state institutions are limited. Commercial farmers responsible for unsustainable groundwater abstraction are threatening the environment (Rutten & Mwangi, 2009). The in depth dynamics of the effectiveness of state institutions, commercial water exploiters and rights of local communities are bypassed by the focus on households in the livelihood approach. The livelihood framework is displayed in Figure 2.6. The figure shows how households have different kinds of assets and capital.

The livelihood framework is displayed in Figure 2.5. The figure shows how households have various kinds of assets and capital. The key question linked to sustainable livelihoods is whether in a particular ***context***, which combination of ***livelihood resources*** results in what combination of ***livelihood strategies*** and ***outcomes***. The institutional processes mediate the ability to carry out such strategies and achieve certain outcomes. This thesis has described the possibilities of the renewed Water Act. Continuing, the results of these possibilities will be compared between the livelihoods of the households.

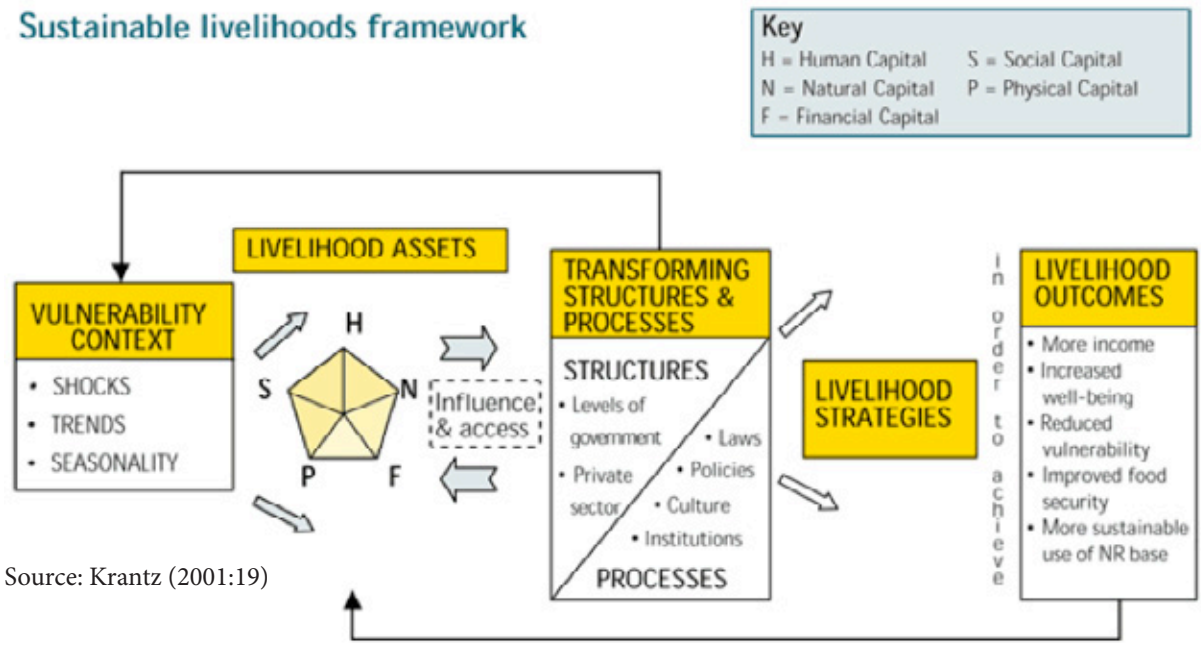
The core of the framework is an analysis on the five types of resources. These assets can vary from human capital, to natural, financial, social and physical capital. A sixth type, political capital, has been suggested (Ashley and Carney, 1999: 35). In my perspective, political capital is a major asset, as it involves more than just technical qualifications to get a permit and set up a water supply project. The other assets in the context of the water sector in Kisumu can be interpreted as follows:

- Physical capital, the physical availability of man or animal to collect water;
- Financial capital, the means to pay for water;
- Natural capital, the availability of water in the area;
- Social capital, for a community it is easier to get a permit and set-up an water supply project than for an individual;
- Human capital, knowledge and educational resources on gaining access to water or improving coping strategies and living conditions.

1 As described in Rutten & Leliveld (2008). Introduction: Inside poverty and development in Africa.

2 As described in Owuor, S. (2006), Bridging the urban-rural divide. *Multi-spatial livelihoods in Nakuru town, Kenya.*

Figure 2.6 The Sustainable Livelihoods framework



Source: Krantz (2001:19)

These various sources of capital influence the access of an individual in networks and institutions that in the end determine the kind of livelihood strategies available. For example, social capital and access to real estate networks and institutions, in combinations with financial capital, make it possible for a household to move elsewhere. In this new location the household will experience a different vulnerability context. One can live on a less vulnerable location, and find better ways to cope with the shock.

Access to secure water provision is determined by processes such as local norms and customs, local property rights, regional and national policy, political issues, and even international policy and global climate issues. It must be kept in mind that the vulnerability context also has both a geographical and seasonal dimension. Different environments present a different level of risk in securing access to water. The households' geographical location determines the physical, social and political environments that affect how vulnerable the livelihood is. Social vulnerability may relate to fragmentation within communities and households, caused by processes such as age or gender composition. Political vulnerability includes the power by authority (in all possible forms), decision-making in politics and how this may affect access to certain resources.

As said earlier, the sustainable livelihoods framework is somewhat limited when it comes to a more macro level of analyses and how, for example, globalization is affecting the individual livelihoods. The livelihood framework takes into account how individuals have access to government services, not vice versa as such. The livelihoods approach is based on a context and household level of analysis, neglecting in depth macro-factors and political power related issues.

For many of the rural and urban poor, urban farming is the only possible and effective strategy within their context that can help lift them out of poverty. In the next section we will look in more detail at the role of water in securing a livelihood through urban agriculture.

2.6 Sources of livelihood and urban farming

The urban poor are more vulnerable in periods of e.g. economic stress, food scarcity and seasonal shocks. In such periods, the households have to find a way to cope with or adapt to these situations. Livelihood strategies can help to decrease the effects of such shocks. Owuor (2006: 16) elaborates on two major coping strategies: multiple sourcing of cash incomes and urban farming. In order to increase income, more household members can go to work (in the informal sector), start their own business, growing own food, etc. Other strategies may be declining consumption and costs (2nd hand clothing and goods, buying cheaper and less food), or even migrate to another place. Households often have a combination of multiple strategies according to their own circumstances (Rakodi, 2002)

Urban farming is a way to increase household income when a part of the crops are sold. Storage for goods is often not possible, so selling is a better alternative. Urban farming is also a way to decline the costs of household consumption, especially in the late 1970s when food prices were rising and shortages increased as a consequence of the implemented Structural Adjustment Policies in the 1980s. Urban farming has been increasing and has become a widely used livelihood strategy in the households of the urban poor. Such strategies make it possible to survive and deal with the costs of living in town (Box 2.3). These costs are high for an ordinary Kenyan living in the slums, especially when income is low and work is scarce.

Box 2.3 Costs of living in town

- Transport to and from work: Transport costs, to and from work, are becoming unbearable for most urban dwellers and especially for poorer groups living far from their places of work.
- School fees: Fees for school-aged children and associated costs are often higher in towns. Even where education is free, some costs, e.g. transport, uniforms and homework books, are still present.
- Housing: A large majority of city dwellers are tenants who have to pay their monthly rent or face eviction. Even those who live in slums and squatter settlements are known to pay rent to landlords or landowners.
- Water: Those connected to piped water, usually by the local authority are charged on a monthly basis through bills. However, the poor – with no access to piped water – depend on water vendors who charge exorbitant prices.
- Food: Generally, food is expensive in town, especially for those who do not grow their own. People in town rely more on purchased food.
- Health care: Although the health facilities may be better in town, they are expensive and may be beyond the reach to many. Even in the government hospitals, cost sharing is the norm – one has to buy drugs.
- Pay-as-you-use-facilities: These vary from one neighbourhood to another and can include child care (ayah), sanitation, garbage collection, security, access to latrines, bribes, fines, etc.

Source: Satterthwaite & Tacoli (2002).

Urban farming is a source of food and income. Households that grow their own food can save money to spend or invest in other (economic) activities. Versleijen (2002: 36-37)[1] argues that revenues from farming one's own food can be a way to educate the children of the household. Prerequisites for urban farming are water, land, and time. Access to water is required to grow the crops. There has been discussion in Kenya to what extent urban farming is legal by law. In most of the cases, growing crops on land not owned by the cultivator is illegal. This topic has been under fire since it affects the poor who need it the most. Most urban-poor do not own any land nor do they have the resources to do so. Foeken (2008) discusses and compares the policies concerning urban farming and advises authorities of urban centres to acknowledge the factual situation. This means to integrate urban agriculture into urban planning and focus on the situation of the urban poor. By creating a better access to land and a better institutional set up, the urban poor can have a chance of eradicating poverty without trespassing the law.

Woodhouse (2008: 25) discusses natural resource management and poverty in Sub-Saharan Africa as follows: *African use of land, water and other natural resources needs to be understood from a perspective that recognizes the integration of many rural people within broader national and international labour markets and its effects in terms of migration and distribution of labour*. When it comes to urban livelihoods in Kisumu, Kenya needs to take into account the migration into the slums, access to different forms of capital and how the employment and food markets in Kenya are affected by global developments. The factors Woodhouse mentions are affecting the incentives on urban farming, food and income. We are expecting that households that own land and have improved access to water, are more likely to perform urban farming for a livelihood, and have more resources and coping strategies that help dealing with shocks.

1 In Foeken, Owuor & Mwangi (2007)

Photo 2.1 Urban farmer in practice

Source: Fieldwork (2009)

2.7 Hypotheses

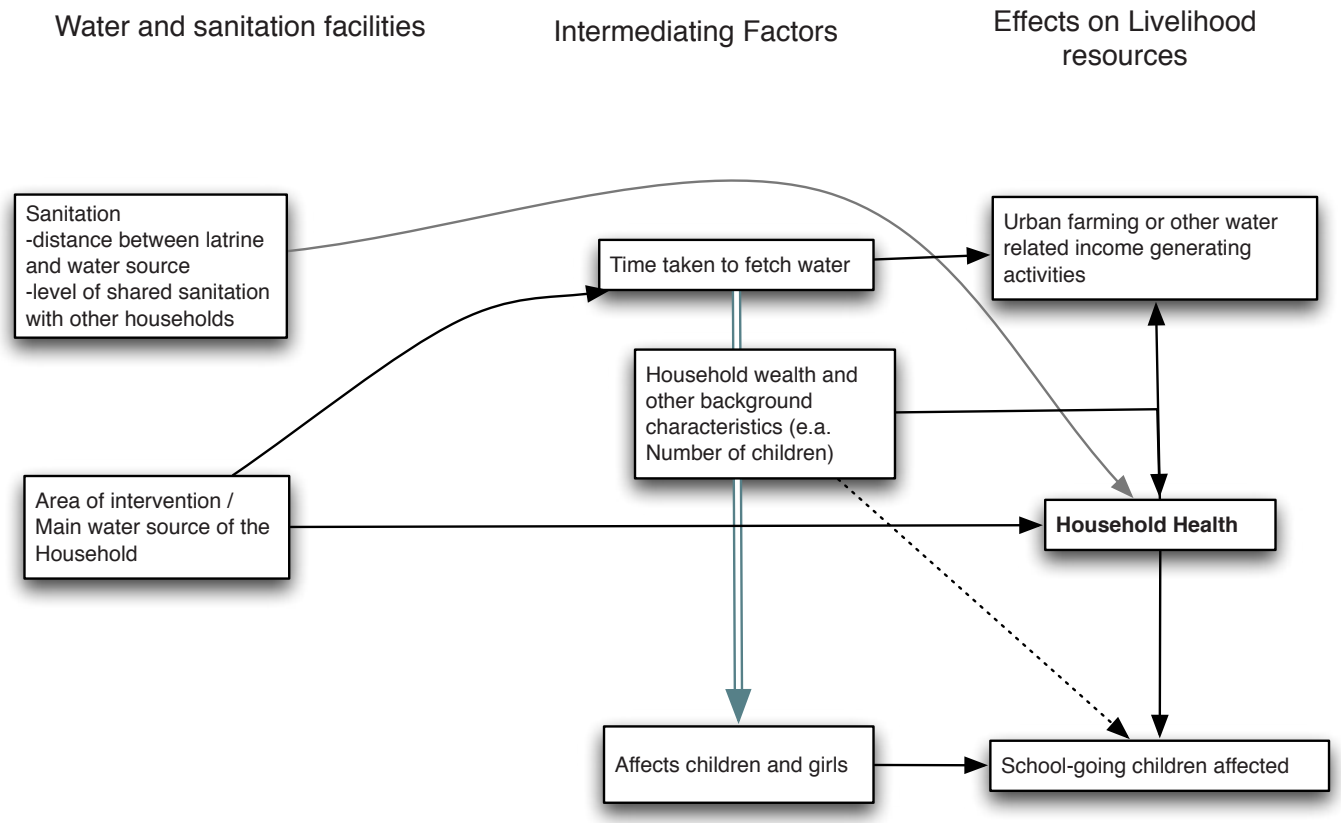
Chapter 2 has elaborated on numerous subjects and the linkages with access to water and sanitation of the urban poor. From the ideas behind these subjects and linkages with access to water and sanitation various hypotheses can be derived. Regarding the limited sources and the fieldwork conducted, this thesis will focus on the household situation and its access to water and sanitation. A schematic overview of our expectations is displayed in Figure 2.7.

The figure describes the general concepts used in this thesis, and the relations for livelihoods: household health, urban farming and school attendance of children. In more concrete terms, the following relations are expected:

- The distance between the source and latrine affects the vulnerability context in terms of a higher exposed risk to contaminated environments and unsafe water.
- The higher the level of sharing of the sanitation, the higher the chance on disease in the household.
- The area of intervention and type of water source affect household health and the time taken to fetch water
- Household health affects the presence of urban farming and school going attendance of children
- Time taken to fetch water affects whether urban farming is present and the school attendance of children
- The school going behaviour of girls is more affected than the behaviour of boys.
- Household wealth will increase the ability to cope with diseases and will have beneficiary effects on household health, presence of urban farming and school attendance of children
- The number of children in the household increases the vulnerability and chances on disease in household.
- The number of children increases the chance on non-school attendance of girls in particular.

Moreover, this chapter has discussed how a country and its population are affected by economic development, development aid and reforms in the water sector. A household is affected in their assets, resources and available coping strategies, as the livelihood approach confirms. Households with a certain living standard; access to safe water, sanitation and increased household health, are more likely to contribute to society in various ways. Examples are in forms of labour, but also in setting up and helping their communities. An improved household situation will also improve the communal context and economic development on meso and macro level, as previous research shows Ching-Chung (2009). Although the conceptual model and the application of the livelihood theory aims attention at the effects of the context on the household situation, the opposite is equally plausible. The subtitle of this chapter; The development nexus, refers to these linkages and complexity when analysing micro and macro factors. In the next chapters the top-down approach will be analyzed more extensively.

Figure 2.7 Conceptual model and implicit propositions



Source: Author (2011)

Data & Methodology

3.1 Introduction

This chapter will be looking at the study set-up, units of analysis, sampling procedures and methods of data collection. The chapter starts off by describing the study set-up. A description will be given on how the variables are measured, what choices have been made and how the data is shaped.

Kisumu is the third largest city in Kenya, the principal city of western Kenya, the capital of Nyanza Province and the headquarters of Kisumu District. It is the second most important city after Kampala in the greater Lake Victoria basin. The population of Kisumu stood at 355,024 inhabitants according to the 1999 population census. This concerns Kisumu Town only. The Kisumu administrative district adds another 172,335 people making a total of 504,359 people. The population projection[1] for 2009 was estimated at 574,280. The provisional results of the 2009 census, made available during the write-up of this thesis, suggest a fast growth in the last decade. For the wider district of Kisumu the census counted a total population of 968,909 people (474,760 men and 494,149 women)[2]. Kisumu has grown more than expected. This will obviously have consequences for the provision of sufficient water to all of the Kisumu inhabitants.

The city and its surrounding occupy an area of approximately 417 km2 of which some 297 km2 is land and 120 km2 is water. Kisumu city ranges between 800 to 1900 m above sea level. The temperate climate ranges from 18°-29°C. In general there are two rainy seasons, one from March to May, and one from July to October. The rainfall during these periods ranges from an all time minimum of 258 to a maximum of 817 mm per month, with a mean annual rainfall of 1300 mm. The levels of ground water show a huge seasonal variation and range from 2 – 5 m. This has consequences for the many wells, as they dry up near the end of the dry season[1].

Map 3.1 Map of Kisumu area

Source: Google Maps (2010) and author (2010)

1 In the 1999 GOK census
2 Kenya 2009 population and housing census highlights, KNBS (2009)
3 http://www.world66.com/africa/kenya/westernkenya/kisumu/lib/climate

3.2 Data and fieldwork

Box 3.1 Fieldwork characteristics

- Fieldwork dates: 11 November 2009 – 25 November 2009
- Fieldwork Institutes: African Studies Centre Leiden, Radboud University Nijmegen, University of Nairobi
- Fieldwork methods: Face to face home interviews, structured questionnaires
- Sample size: 184 households, 63 in Wandiege, 61 in Nyalenda B and 60 in Bandani
- Language: English, interviews in Swahili or 'Sheng'
- Weighted: No

Study set-up

This study is part of a wider field of research and collaboration between the African Studies Centre (ASC) in Leiden and the University of Nairobi, Kenya looking into urban water provision in Kenya. In addition, the Municipal Council of Kisumu and SANA international - a local NGO that is active in the research areas - assisted in finding research assistants and making local contacts. The fieldwork was conducted by me, Howard Ching Chung (Radboud University Nijmegen/ The African Studies Center Leiden), and Terry Mutune (University of Nairobi).

Household unit of analysis

The study is foremost conducted at household level. In the household questionnaires characteristics of all household members were asked, including the characteristics of the school going children. Special attention was devoted to water, health and education.

Challenges fieldwork

In this section the design technicalities and challenges encountered during the fieldwork will be discussed. The most important ones are the following:

- Sampling
- Migration in the informal settlements
- Practical issues & social barriers
- Validity of the data & causality between factors

The household questionnaires of Nyalenda and Wandiege took about 60 to 90 minutes, whereas the questionnaire for Bandani took 35-55 minutes because it consisted of fewer questions. In the latter case specific questions on water development interventions in the area were not present because there has not been any type of intervention in these locations.

Sampling

In total, three research areas were chosen based on predetermined criteria.

1. Wandiege, in Manyatta B: A low-income informal settlement with a project run, started and maintained by the community itself, independent from the municipal water company.

2. Katuoro, in Nyalenda B: A low-income informal settlement with a project collaborating where the community is collaborating with the municipal water company, KIWASCO.

3. Bandani: A low-income informal settlement with no water intervention at all.

Wandiege is an area in the informal settlement called Manyatta B. The main water source of this area, the borehole, is situated in the Wandiege Primary School. We choose a sample of 63 households geographically dispersed throughout the coverage area of the Wandiege Water supply project. Initially aiming at 30 connected and 30 unconnected households getting their water from water kiosks, in the end 34 connected, 28 unconnected and 1 disconnected household were sampled. In consultation with the officials of the water supply projects of Nyalenda and Wandiege, we managed to get a list of households that were connected. The households were sorted per plot. From this list we picked households at random, covering all the plots in the coverage area. While we were walking through the neighbourhoods, we looked for unconnected households near the connected households. This way, we attempted to have an equal spread of interviews over connected and non-connected households throughout the study area.

At the time of the fieldwork (November 2009), the Wandiege Community Water Supply Projects served 83 households through an individual water connection. According to the numbers of the Wandiege administrative

Table 3.1 Sub-location area population including the informal settlements

Area	Male	Female	Total	Area in Km2	Density pp/Km^2
Manyatta "B"	10 891	10 136	21 027	3.3	6 372
Nyalenda "B"	13 162	12 482	25 644	6.1	4 204
Bandani	7 150	6 811	13 961	13.1	1 066
Manyatta "A"	20 700	21 210	41 910	2.0	20 955
Nyalenda "A"	12 507	11 224	23 731	2.8	8 475

Source: KNBS and Government of Kenya (1999) in UN-Habitat (2005),

office, approximately 10,000 of the 25,000 people in the area were served, accordingly. Presuming these numbers are accurate and using a household size of 5 people on average[1], some 1,900 households will need to collect their water from water kiosks. A number of households, though, expressed they shared a piped connection with a neighbouring household. Still, a lot of households appear to get their water from water kiosks. The question now remains whether the numbers of served households, as displayed in the Wandiege water supply office, is not over-estimated. As can be imagined, the available numbers on access to water and sanitation have a high probability of being inaccurate.

Nyalenda is the most densely populated of the three research areas. Here we sampled households around the main water project, the Delegated Management Model (DMM) 'Katuoro'. The Katuoro line was chosen because it was the oldest and most evolved in the project. At the time there were 5 DMM-lines in Nyalenda.

In Bandani, we discussed with the local chief where most of the people lived, and attempted to interview at least one household per group of houses. The second criterion we used was one of geographical dispersion. Although Bandani is the largest of the three areas (see map 3.1), not all parts are equally populated. The part closest to the railway, road and facing Kisumu town is the most densely populated. The local chief gave us a tour through Bandani and its different sections. We were shown where all the water sources and clinics were. During this orientation we decided to pick a few households per block, then continue to the next group of houses in another more densely populated part of Bandani. After that we continued interviewing households with a different type of housing from different blocks in the remaining parts of Bandani. In the Appendix section 4, histograms of the households, in total and per area, by level of wealth can be observed. In the sample population the households are normally distributed. The sample of Bandani was drawn on location with help of the local guides and the distribution of clusters of houses we observed during our tour, covering a couple of interviews in each one. In total 60 households in Bandani were sampled.

Representation and sampling in the informal settlements is difficult to conduct according to predetermined guidelines. Addresses, plots and houses are not registered in a system. Also, the ownership of the plot is not always clear, nor, who exactly are living on the estate. This makes it hard to pick households representing the criteria of the population or weigh the importance of certain households.

Similar problems exist concerning the demographic statistics of these areas. While local guides were helping us choosing households geographically dispersed throughout the area, no feedback with the actual population of the informal settlement could be made. During the fieldwork we made an effort to get a good balance between households connected and those non-connected to the water source. However, the question remains if this is plausible and gives a good overview of the actual population. Although the demographic statistics to weigh households are missing, the households in the informal settlements are homogeneous, meaning the differences in demographic characteristics are minor. Differences in wealth seem to be more significant in the informal settlements. Reasons for this may be the composition of the household and the number of children per household or differences in household composition in each area (e.g. number of young people in each area). We will come back to this in the analysis presented in chapter 4.

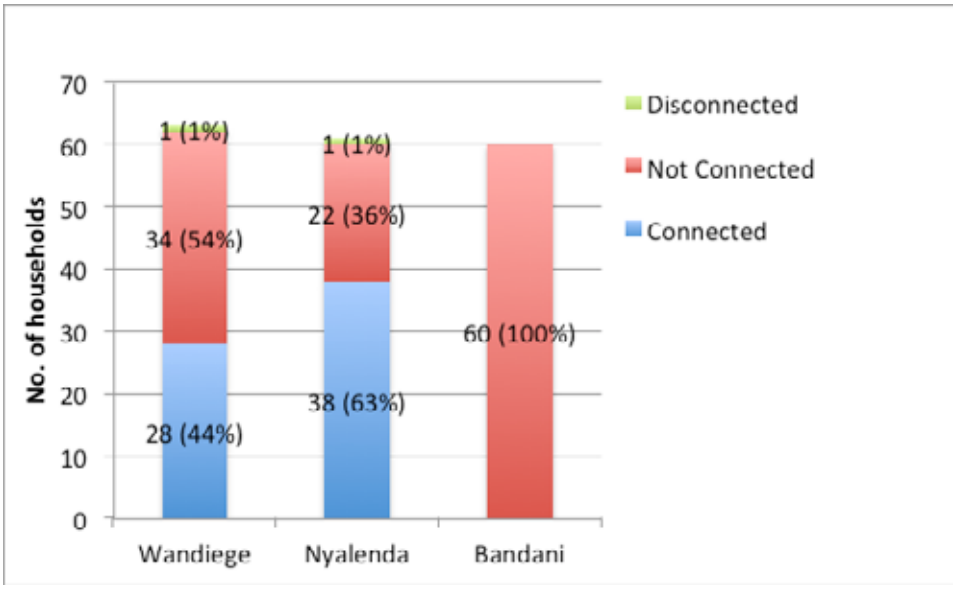
Other interviews conducted include owners of water kiosks, representatives of the water supply projects and local hospitals. Also data on water quality and the frequencies of hospital visits were collected. The fieldwork was carried out in the span of two weeks, from 11 to the 25th of November 2009. During this phase 184 households were surveyed. Considering our time and resources, the goal was to interview 60 households per area and 180 in total.

The numbers of households and whether they possess a private water connection is displayed in Figure 3.1. Owning an individual connection implies safe water that is, if necessary, treated at the source. To avoid mistakes in recording of piped water from water kiosks versus piped water at home, the cases were checked whether the household receives a monthly bill for their water connection or not. Households that are getting their water at the water kiosks do not receive bills.

Our total sample of 184 households consists of 116 (63%) households that do not have an individual connection; and 66 (36%) households that are connected by an individual line. In Wandiege 44.4% of the households are connected, this number is lower than in Nyalenda where 62.3% of the households have an individual connection. In Bandani, there is no household that has an individual connection, according to our sample.

1 According to our data for Wandiege, the average number of people per household was 4.79.

Figure 3.1 Households and registration of an individual water connection, by area



The majority of the households have to fetch their water somewhere else.

Migration patterns in the informal settlements

Many respondents came living on site after the start up of the water project in the area. As a result they are missing the reference base of the situation before the intervention. This affects the number and representation of households suitable for analysing the impact of the intervention. However, our method of analysis is hardly affected because we are comparing between areas and not following areas over time.

In Table 3.2, a brief overview is presented on the number of years households have been living in their current location. As we can see, 48.4 % of the households started living in their estate in 1999 or earlier. The Wandiege Water Supply Project started in 2002 and was operational in early 2004 (late 2003). DMM in Nyalenda started in 2001 and was operational in 2004. Almost 30% of the households we interviewed moved in after both projects were operational. This normal deviation has to be taken into account when households give statements about change in their situations. Our questionnaire is focussed on cross-household questions, comparing households to water source and intervention type. In the questionnaires of areas with an intervention - Nyalenda and Wandiege, - there are a set of questions that are primarily focussed on the set up and implementation of the water supply project. Only the validity of these factors, in particular opinions and intervention specific issues, are affected by the year of living in estate.

Practical issues & social barriers

When asking sensitive questions on moral issues or the financial situation of households, the respondents tended to give socially desirable answers. Also, word was around that the households did not see any significant improvement in their situation in spite of frequent visits by researchers.

Communication was in some of the cases challenging. In general, the households in the informal settlements were not proficient in speaking English. The medical doctors and officials of the water supply system could speak English fluently. For the households, research assistants that could speak and interpret the native dialect were used to overcome the language barrier. A local guide, research-assistant and/or translator are key in overcoming such issues of communication. Also, we were of the impression that some of the households might deliberately overemphasize the negative parts of the situation they are in, as a cry for attention.

Table 3.2 Migration patterns: Year of settling in estate

	N	%
Before 1999	89	48.4
Between 1999 and 2004	40	21.7
2005 and later	55	29.9
Total	184	100

Source: Fieldwork (2009)

Inaccuracy, validity and causality between factors

While checking the work of the research assistants during data entry, a few things regarding the accuracy of the household questionnaires concerned me. At some times, the research assistants misinterpreted the questions or answer categories. Sources of water were swapped or misunderstood. The research assistants or respondent said they were using piped water individually, while it was obviously they were getting it from a different source, e.g., a water kiosk. Those respondents were not receiving a bill, which means they were not having an individual pipeline. When explaining e.g. the time taken to fetch water, lack of validity of the main water source of the household may have distorted the results. In obvious cases this has been corrected during data entry. Furthermore, some questions posed did not get the attention needed during the interview. For example, a question asking for the distance between a pit latrine and the water source if both available on the plot, was often left blank, in spite of the respondents' answer of the latrine being on plot.

The household questionnaire was rather extensive and we had to be careful not making it too big. However, this has some limitations. When explaining urban farming, no specific questions were asked on the causality with income. We measured the household wealth and whether the household has an income generating activity such as urban farming, but the causality between the two factors remains inconclusive. Unfortunately, specific questions on what is decisive for a household to set up urban farming or other income generating activities were not asked.

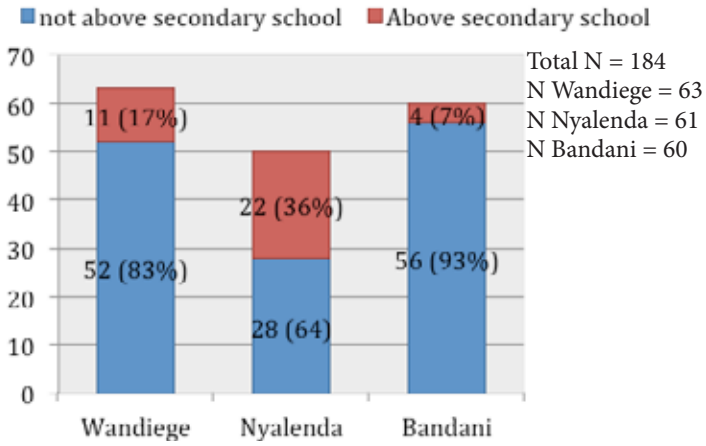
3.3 Main household characteristics

The household questionnaires will be used for a quantitative analysis. Some questions were open-ended and some answers were conditional. The questionnaire and data needed to be transformed in order to analyse them. In this section the decisions made during the preparation of the data for the analysis will be discussed, along with a brief description of each variable. Discussing these household characteristics will serve as an introduction an explanation on the factors used in the analysis in Chapter 4.

Education

It is useful to get a quick overview of the level of education of the households, as the school participation of children is a central topic in this research. Figure 3.2 illustrates the proportions of households with an education beyond secondary school of the head of the household.

Figure 3.2 Households with education above secondary school by area



Source: Fieldwork (2009).

Bandani has the lowest number of households with an education beyond secondary school. Of all these educated households, 59% live in Nyalenda, 30% in Wandiege and only 11% in Bandani. Table 3.3 presents an overview of the three areas and the way they differ in age, educational level and household wealth. The households in Bandani have the least resources in terms of household wealth and education. Nyalenda has the most resources in terms of education and household wealth.

An analysis of possible correlations between age and education shows that there is no significant correlation between these two variables. The effect found may be at random. Table 14A in the Appendix shows the results of the correlation analysis between the level of household wealth and age. From a relatively low correlation coefficient (0.11) and a weak level of significance (0.136) it can be concluded there is no strong relation between age and wealth in our sample population.

Household Wealth

The level of wealth of the household is measured by the possession of seven types of (luxury) goods: electricity, a cell phone, a radio, a television, a gas cooker, a fridge, and a bicycle (boda-boda). According to our reliability analysis the possession of these seven items are all pointing to one theoretical concept; the household's level of wealth. This is confirmed by the reliability analysis, where the scale of these seven items scores a Cronbach's alpha of 0.702[1]. According to the literature (Santos, 1999) a Cronbach's alpha of 0.700 refers to a strong scale, where a Cronbach's alpha of 0.500 refers to a medium scale. The scale was constructed by adding up the scores of possession of each (luxury) good. When possessing one of each of the seven goods, a household would get the score 100, with every item weighed equal. However, it is possible to get a score above 100 when the household has multiple cell phones, televisions, bicycles and/or radio. In the sample population, the maximum score of the household was 243. For level of wealth, the sample population is distributed normally. Appendix section 4 on sample population per area by level of wealth shows there are very little households with a level of wealth above 100. The average level of wealth of each area is shown in Table 3.3. The households in Bandani have the lowest level of wealth. The level of wealth in Bandani differs significantly according to an independent t-test for the equality of means. The results of the t-test can be observed in the Appendix, Table 3A.

A regression analysis was used to determine the household level of wealth in more depth, taking into account the household size and the tenure status of a household. This is done in chapter 4. An overview of the tenure status in each of the areas is displayed in the Figure 3.3.

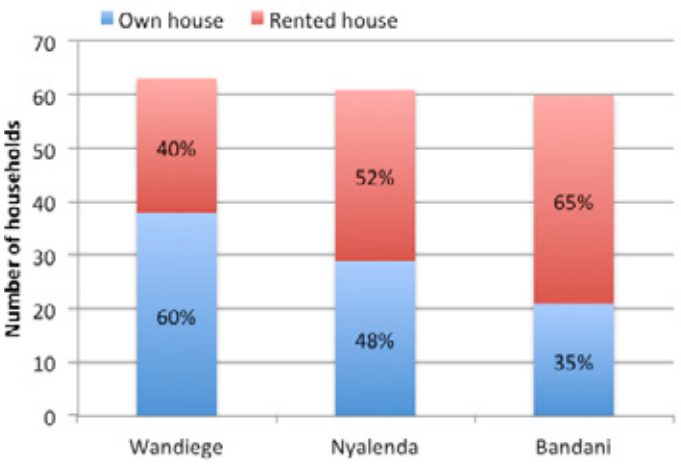
1 The possession of a motorbike (piki-piki) has not been taken into account, since only five households in our sample showed possession of such a luxury good. Also, a reliability analysis showed a stronger scale of household wealth when leaving the possession of a motorbike out.

Table 3.3 Average age and education in Wandiege, Nyalenda and Bandani

		Wandiege	Nyalenda	Bandani
	Range	Mean (s.e.)	Mean (s.e.)	Mean (s.e.)
Age	17-80	36.44 (12.88)	35.75 (10.36)	35.87 (15.10)
Education in years	0-16	10.29 (3.78)	12.13 (3.58)	9.73 (3.07)
Level of Household Wealth (s.e.)	0-243	69.8 (5.9)	72.6 (4.9)	43.8* (4.0)
*Differs significantly with the household level of wealth of Wandiege at $p < 0.05$				

Total N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60
Source: Fieldwork (2009)

Figure 3.3 Tenure status by area



Total N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60
Source: Fieldwork (2009)

Age

Table 3.3 also shows the average age of the households in Wandiege, Nyalenda and Bandani. The composition of each neighbourhood could explain the differences in wealth in each area. However, it can be seen that average age of the heads of the household, 36 years, is similar in all three areas. A higher average age of the household could lead to a higher level of wealth, since young households are often poorer. There are no significant differences in age between the households in each area.

Consumer/worker ratio

The level of wealth within a household is relative to the household size and composition. Researchers often use the ratio between dependents and working members within a household. In the questionnaire the occupational type of every household member was asked. Based on this question a new variable could be constructed measuring the number of workers. All forms of employment (temporary, informal/formal and self-employed) were recoded as workers. Unemployed household members, children and students were recoded as consumers. The consumer/worker-ratio variable was constructed by dividing the number of consumers through the number of workers in the household. Now all households have a score on the new consumer/worker-ratio variable, as is presented in Table 9A in the Appendix.

Household Health

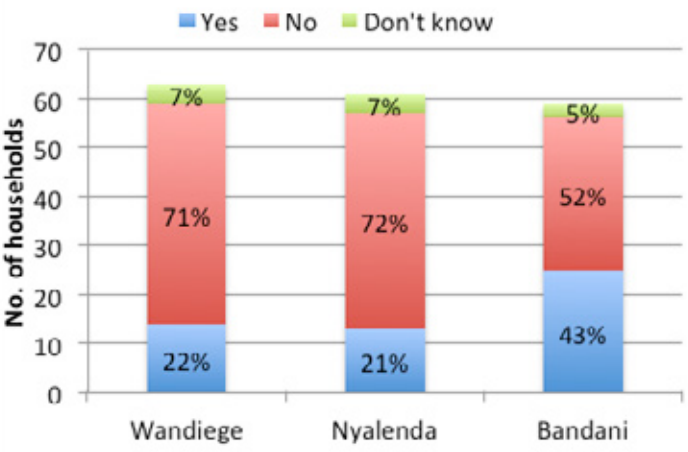
The household health was measured with the following question: Has any member of this household suffered from any diseases this year? Also, a correction was made for the number of people in the household that got sick, as respondents filled in also the number of members in their household that got sick. However, in the analysis the original variable seemed to fit the model better. A score 1 means a household member has had a disease in the last year, where 0 means no one in the household has a disease. In the sample population 65% of the households did not experience any disease this year (see Table 7A in the Appendix). In Figure 3.4 an overview of the numbers of households experiencing a disease this year is presented. An indepth analysis of household health is presented in chapter 4.

Water source and area of intervention

The main topic of this thesis is the type of water source households use and what consequences this has on their wellbeing. The type of water source available to each household was recorded, and the results can be seen in Figure 3.5. Each area is characterized by a single type of water source in use. Because of this homogeneity, strong correlations between the area in which a household lives and the type of water source are expected to be found. This means the type of water source and the area of intervention share the same variance and only one of them will be used in the regression analysis.

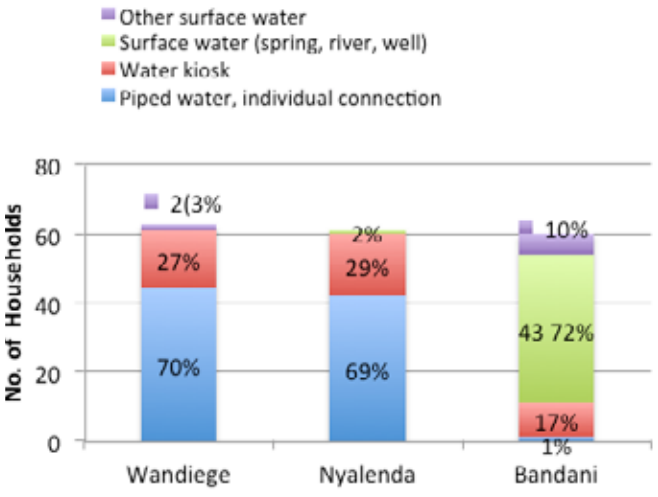
- In Wandiege, 69.8% of the households get their water from an individual/piped connection, which is similar to Nyalenda (68.9%). The main water sources of Bandani is surface water, which is water from the mosque or spring (72%)
- High correlation between water source and research areas
- Clear distinction and similarity between the main source of water of the areas

Figure 3.4 Has any member of this household suffered from any diseases this year? - by area



Total N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60
Source: Fieldwork (2009)

Figure 3.5 Type of water source by area



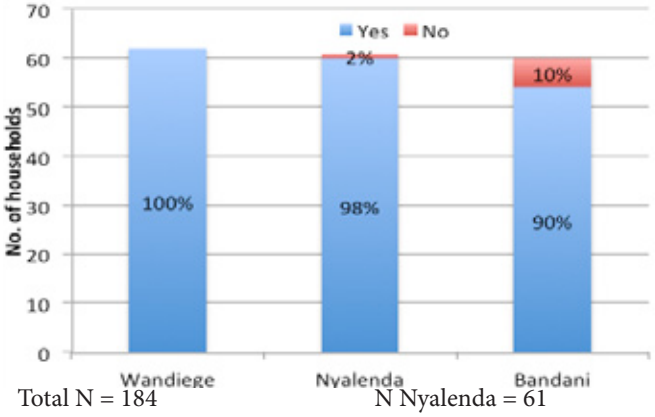
Total N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60
Source: Fieldwork (2009)

Sanitation

In periods of rain the toilets get flooded and there is a high chance of an outbreak of cholera". In interview with community health worker Carolin Achimba (23/11/2009)

Clean and proper sanitation can benefit a households' health in a variety of ways. As argued earlier, in periods of heavy rainfall pit latrines can overflow, where excrements come to the surface increasing the chance of contamination of faecal bacteria. Proper sanitation, sensitization and washing of hands can prevent diseases, contribute to a stable household and decrease of expenses on health and medication. In Figure 3.6 the households' access to sanitation in all the three areas is presented.

Figure 3.6 Access to a sanitation facility by area

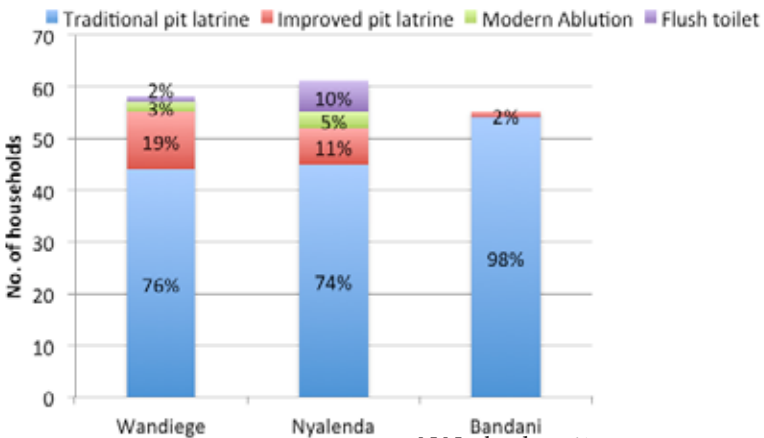


Total N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60
Source: Fieldwork (2009)

While a toilet or pit latrine may be self-evident in most cases, in Bandani this is not always the case. A total of 6 households indicated they had no access to any type of sanitation facility at all. Although, this finding could be due to the misunderstanding of question in particular, no confirmed cases, only rumours, of the flying toilet[1] were found. However, this does not make the situation more satisfactory. Bandani scores lowest in numbers of improved, modern or flush toilets when compared to Nyalenda and Wandiege (see Figure 3.7). Nyalenda score highest in the case of flush toilets, although also here the traditional pit latrine is the dominating sanitation facility.

1 http://news.bbc.co.uk/2/shared/spl/hi/picture_gallery/07/africa_flying_toilets/html/1.stm retrieved 30/03/2010

Figure 3.7 Type of sanitation by area



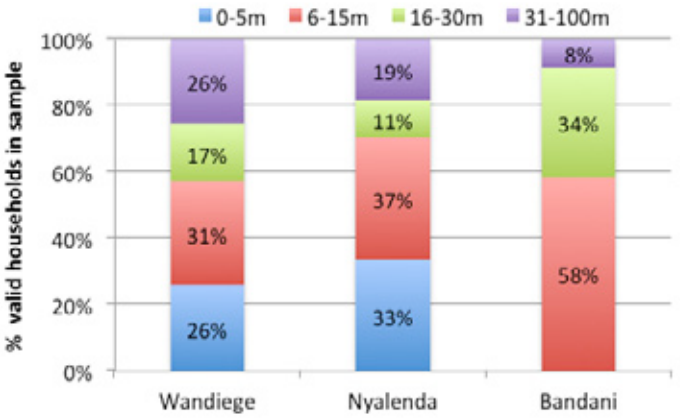
Total N = 174
N Wandiege = 58
N Nyalenda = 61
N Bandani = 55
Source: Fieldwork (2009).

Distance from latrine to the water source

Respondents were asked to estimate the distance between their latrine and the water source, if applicable. In a vast share of the cases, if the water source was far away and off plot, the question was not applicable. The 'not applicable' category has not been presented in Figure 3.8, and that is also the reason the percentage of households was used instead of the absolute number of households. The idea behind this question is that when the latrine is close to the water source, there is a higher chance the water source is contaminated, than when they are far away from each other. The outcome shows that Bandani has no households with a sanitation facility close to or at home. The latrines are at least 6-15 meters from the house. This confirms the picture of Bandani's lack of basic facilities.

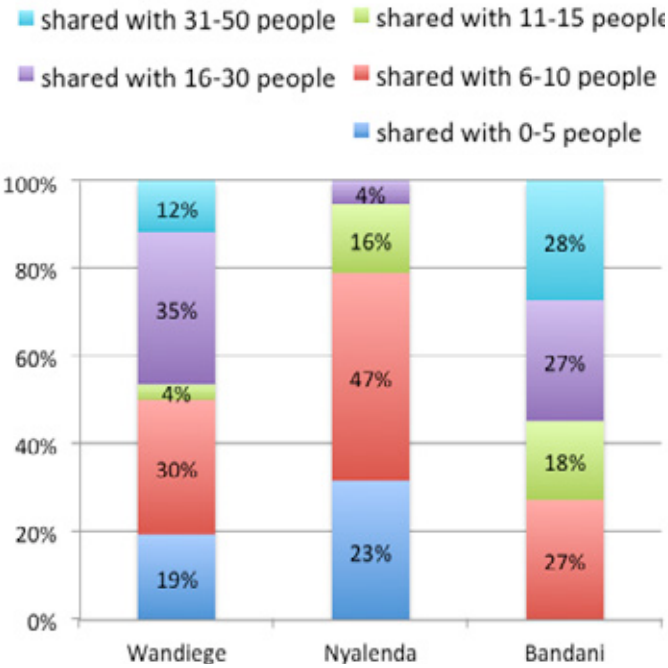
The same measurement was taken with the degree of latrine sharing among households in Figure 3.9.
In Figure 3.9 the proportion of sharing of sanitation facilities is displayed.

Figure 3.8 Distance between latrine and water source by area



N = 74
N Wandiege = 35
N Nyalenda = 27
N Bandani = 12
Source: Fieldwork (2009).

Figure 3.9 Level of sharing of sanitation by area



Total N = 56
N Wandiege = 26
N Nyalenda = 19
N Bandani = 11
Source: Fieldwork (2009)

It seems that Bandani is worse of, as it has no households that share their sanitation with a decent – 0 to 5 – number of people. A regression analysis in chapter 4 will point out to what extent the level of sharing of each area is affecting household health.

Perception of safe water sources

Concerning the perception on the safety of water sources, the households were asked to air their opinion on the most common sources of water and whether they considered each safe or not safe for human consumption.

Table 3.4 Perceptions on types of water

	Safe		Fairly safe		Not safe	
	N	%	N	%	N	%
Piped water	111	60.7	60	32.8	12	6.6
Borehole water	42	23.3	80	44.4	58	32.2
Shallow well	1	0.6	47	27.5	171	71.9
Private water vendors	31	17.8	72	41.4	71	40.8
Rain water	68	37.8	73	40.6	39	21.7
Surface water	6	3.3	18	10	156	86.7

Source: Fieldwork (2009)

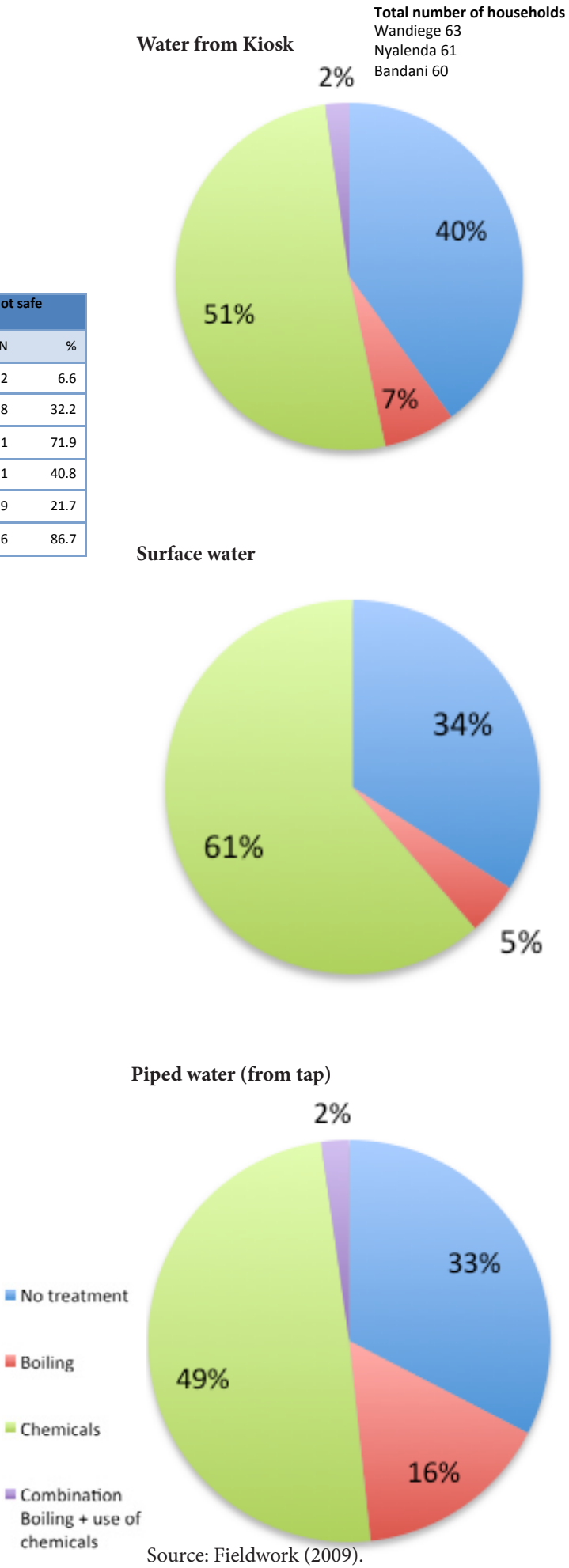
Depending on the usage, the perception on the safety of water sources may affect whether a household treats their water and to what extent they consider a source as safe. However, table 3.4 clearly demonstrates that a majority of the respondents considered surface water (86.7%) and shallow wells (71.9%) as not safe sources of water whereas piped water (60.7%) and to some extent rain water (37.8%) are. Note that a large number of the respondents felt that private water vendors were not delivering safe water (40.8%).

Treatment of water

Although the majority of the household treats their water with either chemicals or by boiling, they should know when to treat the water, where their water comes from, and to what extent it is safe. The households generally know that surface water is less safe, but still a significant part (around 30%) of the households do not treat possibly unsafe surface water. The treatment methods are limited to boiling and the use of chemicals. The most used chemical is WaterGuard, which costs about Ksh 30 per bottle and serves up to 2,500 litres of water[1]. The figures on water treatment provide information concerning if and the way the population treats water. Almost 65% of the households confirmed the treatment of their water. However, this differs per water source. Water coming from springs, shallow wells, and rivers do have a risk of containing potential harmful bacteria. Contrary to expectation it was found that water originating from an individual connection or water kiosk, in general considered to be safe, was still treated by about 58% of the respondents. Surprisingly, a similar but opposite relation was found when looking at unsafe surface water. Here, 34.1% of the households do not treat surface water.

1 Alekal (2005). Appropriate water treatment for the Nyanza Province of Kenya. p67

Figure 3.10 Water treatment differs per water source



Source: Fieldwork (2009).

Table 3.5 Cost of treatment per month

	N	%	Mean in Ksh per month
Water Guard			
Uses WG but does not now how much	14	16.1	
Between 5 and 30 Ksh	56	64.4	
between 35 and 80 Ksh	14	16.1	
between 100 and 120	3	3.5	
Total	87		Ksh 34
Fuel for boiling			
Uses, but does not know how much	4	20	
Between 150 and 200 Ksh	7	35	
Between 200 and 400 Ksh	4	20	
Between 400 and 600 Ksh	5	25	
Total	20		Ksh 320

Source: Fieldwork (2009).

How does the current water situation, fetching water off plot, affect the school going children?

The methodology for this analysis differs from the testing methods for explaining *household health* and *urban farming & income generating activities that require water.* First of all, the units in this analysis are household members, not the households itself. The household members and their characteristics were transformed to cases. Other household characteristics and factors were copied to each household member. In total this resulted to an increase in cases from 184 original households to 840 cases in total. Of these 840 cases, 368 cases were children up to 16.

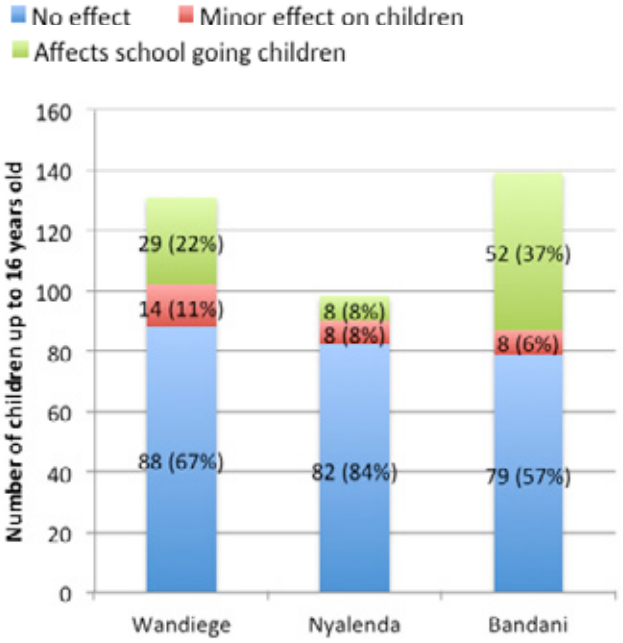
School non-attendance of children

The analysis on school going children was only done on children up to 16 years. This range was chosen because young children are more vulnerable in comparison with 17 and 18 year olds. With regard to the situation of households on access to water, the households were asked: *How does this affect the school going children or those working?* This was an open-ended question. Most answers were straightforward e.g.: *They go to school late* – or – *does not effect school going children because water is on plot.* Other answers were *fetching water eats up the time for other activities and It affects the family and mostly the children because they fetch the water. A reason why a child is affected in his or her school going behaviour is because he or she has to go fetch and queue for water. In some areas, water is only available during certain hours of the day.*

The range of answers could clearly be divided into three categories:

- No effect (240 answers, 67.7%)
- Minor effect (30 answers, 8.2%)
- Affects school going children (89 answers, 24.2%)

Figure 3.11 Effects of household situation on school going children by area



N=368
N Wandiege = 131
N Nyalenda = 98
N Bandani = 139
Source: Fieldwork (2009)

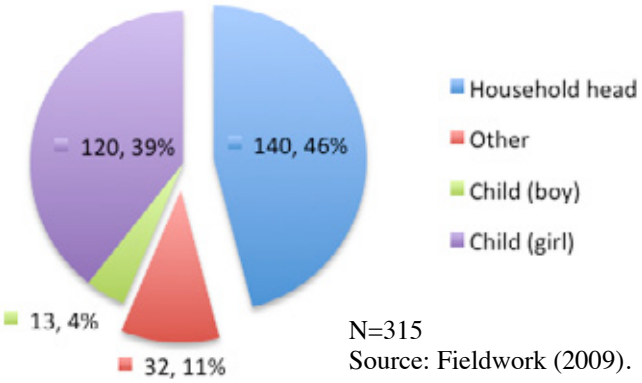
If water source is off plot; who fetches?

In the questionnaire, households could indicate who fetches water. Respondents could choose the following answers:

- Household head (female)
- Household head (male)
- Child (male)
- Child (female)
- All fetch water
- Private Water Vendors
- Worker
- Female household head + children (female)
- Female household head + children (male)

For the construction of this variable, the household members were converted into cases. This means that the level of analysis is not the household, but the household members. By doing so, the children could be distinguished to gender. In this specific case, again only children up to 16 years of age were selected, which results in 182 boys (49.5%), 186 girls (50.5%) of the 368 cases in total. Although in Figure 3.12 both the male and female

Figure 3.12 Of all the children in the sample population, who is responsible for fetching water?



N=315
Source: Fieldwork (2009).

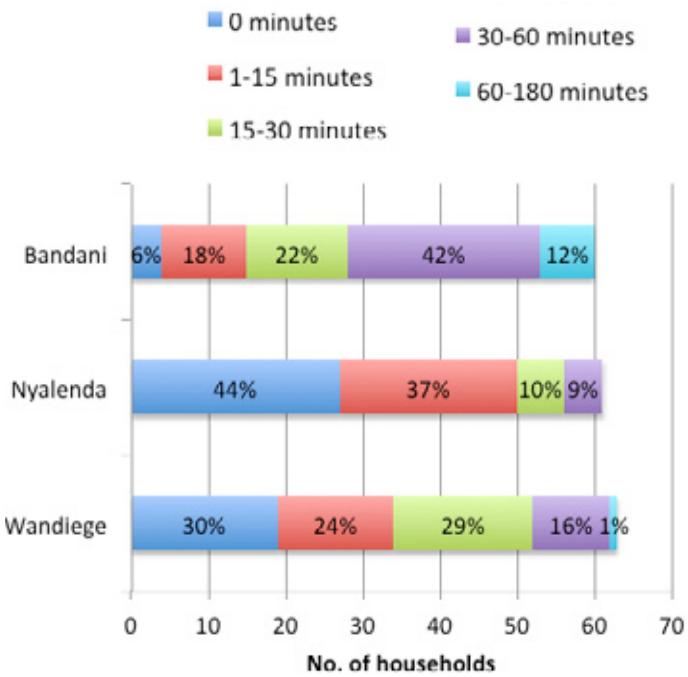
household head are combined into one category, it is in almost all cases the female head of the household that is responsible for this domestic task. The Table 10A can be observed in the Appendix. Since the analysis on the school going behaviour only concerns children up to 16 years of age, the categories containing any *child* have been recoded to *child (boy)* or *child (girl)*, depending on the gender of the case. Households that have children, but have their water source on plot, do not have to fetch water. These children and households are not taken into account in Figure 3.12, but have been selected in the analysis in chapter 4. The numbers in Figure 3.12 only concern children up to 16 years of age that have their water off plot (315 cases). In those cases someone in the household has to go fetch water.

Of all the children that are part of households that require fetching of water, in 46% of the cases the child does not have to fetch water; the household head is responsible for that. In 39% of the cases the child (girl) is responsible for fetching water. In only 4% of the cases the child (boy) is responsible. Considering that gender is equally divided within the (sample) population, 182 boys (49.5%) and 186 girls (50.5%), the difference between child (boy) and child (girl) is remarkably present. In 11% of the cases a worker or private water vendor takes care of the water transportation.

Time to fetch water (daily)

Time is a valuable resource. Time is valuable when setting up or maintaining a business. Some of these income generating activities require water, e.g. urban farming. The respondent was asked: *if water source is off plot, how long do you spend on fetching water (daily)?* The results per area are displayed in Figure 3.13. People who have their water source on plot and do not spend any time fetching were coded as 0 minutes.

Figure 3.13 Time taken to fetch water (daily) by area



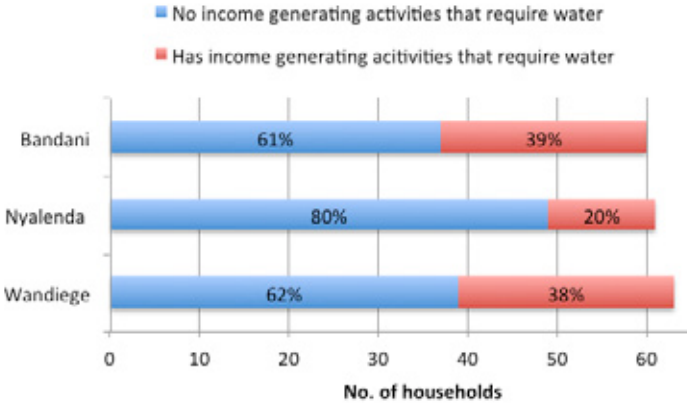
N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60

Source: Fieldwork (2009)

Urban farming

Respondents were asked open-ended question on their livelihoods. While the answers to these questions were varying from all kinds of business, a vast share of the households answered *urban farming*. They were also asked whether this certain livelihood required any access to water. The results on urban farming are displayed in Figure 3.14.

Figure 3.14 Urban farming by area



N = 184
N Wandiege = 63
N Nyalenda = 61
N Bandani = 60

Source: Fieldwork (2009).

In this chapter we have discussed the fieldwork and the steps that have been taken to prepare the data. This included recoding qualitative answers to quantitative ones. In this process various ratio, interval, dummy and interaction variables were recreated. The recoding of data was necessary in order to proper analyse the correlations and variance in chapter 4: Analysis and Results.

Chapter 3 also described the household characteristics to such extent that it illustrates the situation of the households of Kisumu. Although this chapter presents an elaborative prequel to answering the research questions, the descriptions are a reflection of the data, and not an analysis as such. The analysis of the correlations between these household characteristics controlled for other factors will be done in chapter 4.

4

Analysis & Results

4.1 Introduction

This chapter will present a detailed analysis of the results from our fieldwork. Various types of data including household surveys, interviews with clinic workers, photographic material and scientific literature have been used. For analysis of the household questionnaires a (logistic) regression analysis will be used. For each of the three locations the topic of analysis will be introduced by givin a quick overview how the three areas differ on relevant factors. Thereafter, an in depth analysis of these factors and will be presented by using a regression analysis, controlling for other possibly explaining variables.

In section 4.2, the level of household wealth will be discussed. Household wealth is often thought of as an important predictor, including the ones of this research: household health, school (non-) attendance of children and urban farming. A higher level of household wealth would imply less vulnerability for e.g. disease in a household. A higher level of wealth would also imply better education opportunities for the children and more resources that stimulate urban farming. However, as this chapter will demonstrate, this is not always the case and there are better explanations for school non-attendance than the level of household wealth. Before testing how the level of household wealth relates to household health, school attendance and urban farming, a prior analysis on the key variables that affect household wealth will be provided

The regression analyses are conducted by a build up of subsequent models. The first model is often a basic model with a limited set of predictors. In this model the level household wealth is analyzed by area. In later models, predictors additional are added that:

a) explain a previous effect such as the differences between the areas,
b) explain the independent variable in question (e.g. household wealth, household health, school attendance or urban farming),

c) tests for factors relevant to the research questions of this thesis,

d) add interaction- or conditional effects to see if an effect is stronger for e.g. females.

e) checks whether an effect is still significant when controlling for other factors.

Special attention goes to the * (asterix) predictors in the regression tables. The effects of factors with a * have been statistically tested significant at the given probability. For presentation purposes, only the most important models are displayed in this chapter. Other models have been moved to the Appendix: section 2 (regression tables).

Based on the coefficients of the regression analysis, graphic versions of the effects on the independent variable can be calculated and drawn, while controlling for other important predictors. The method and formula's to estimate the regression lines of the predictors used in these graphs are explained in the Appendix section 1, Method of analysis: Regression- and logistic regression analysis.

4.2 Household wealth

As data on the occupational types point out: Wandiege and Nyalenda turn out to be similar when it comes to occupational types of work and educational level. Households in Bandani, though, seem to be more self-employed in the informal sector, and also have a lower educational level. For a complete overview of all the households and the background characteristics see Table 1A in the Appendix. The level of wealth of the households and the dispersion (the standard error) of wealth over the three areas are presented in Table 3.3. The composition of each neighbourhood could explain the differences in wealth in each area. However, in the previous chapter, Table 3.3, can be seen that average age of the head of the household, is similar in all three areas. A higher average age of the household could imply a higher level of wealth, since young households are often poorer. This however does not seem to be the case. The level of household wealth is displayed as an average of all the households in the respected areas. The standard error indicates how much dispersion there is in each area. Wandiege has an standard error of 5.9, indicating that 68.2% of the cases in score within the range of 69.8 on the scale of household wealth, give or take 5.9 points. The dispersion within Bandani is the lowest, indicating a more homogeneous area when it comes to household wealth.

Besides that Bandani is significantly poorer than Wandiege, Figure 3.3 in the previous chapter illustrates that there are also relatively more rental houses in Bandani. When correcting for the tenure status of a household, Bandani is still less wealthy than Wandiege, this can be observed in Table 4.1 in model 2. In model 2, the difference in wealth between Wandiege and Bandani has been controlled for the tenure status, household size, age and the number of consumers in the household.

Model 1 shows that the level of wealth of the households is significantly lower in Bandani, when compared to Wandiege. In this exercise we took Wandiege as the reference category, meaning that the coefficients of Nyalenda and Bandani have to be interpreted in comparison to Wandiege. The result is that the parameter for Bandani is negative and significant in 95% of the cases. Nyalenda shows no significant difference in wealth when compared to Wandiege. In model 2 it can be seen that the tenure status of a household, the level of wealth, has a significant consequence for whether a household owns a house or rents a house. Keeping in mind that score 1 on tenure status is 'own house' and score 2 is 'renting a house'. Households that rent their homes are significantly less wealthy.

The household size also has an impact on the level of wealth of the household. The bigger the household, the wealthier is the household. However, since the level of wealth of the household is measured by the possession of goods, this is an expected finding. In model 2 we also included the number of consumers in a household. The number of consumers has a negative b-coefficient and is significant in 95% of the cases ($p < 0.05$). The result from this analysis is the higher the number of consumers, the lower the level of household wealth. In model 3 the number of workers in the household was added to the analysis. It can be concluded that the higher the number of workers, the higher the level of wealth. Another observation worth mentioning is that the household size is not significant in model 3. This is because the number of workers in a household correlates with the household size. Also keep in mind that the number of workers, and other found effects, have been corrected for the other predictors in the model. This means that the number of workers increases household wealth while controlled for: the area of the household, the tenure status, the household size and age.

Table 4.1 Regression Analysis: Household level of wealth

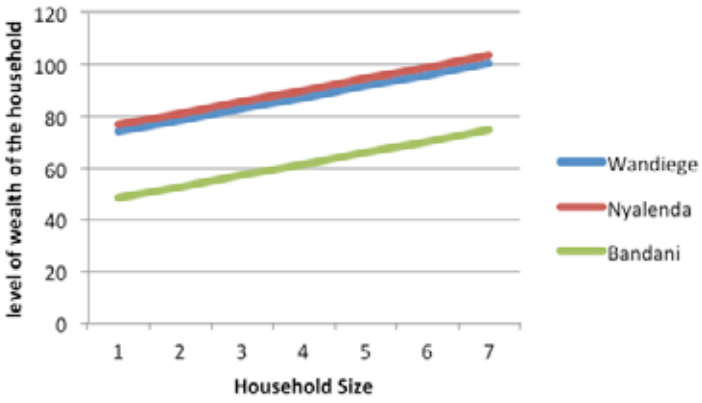
Variables	Model 1			Model 2			Model 3		
	B		Se	B		Se	B		Se
Constant	0.698	*	0.050	0.790	*	0.186	0.623	*	0.185
Area Wandiege (=ref)									
Nyalenda	0.028		0.071	0.029		0.067	0.037		0.067
Bandani	-0.260	*	0.071	-0.245	*	0.068	-0.230	*	0.068
Tenure status				-0.136	*	0.067	-0.139	*	0.067
Household size				0.131	*	0.029	0.020		0.016
Age				-0.002		0.002	-0.002		0.002
Number of consumers				-0.094	*	0.027			
Number of workers							0.105	*	0.029
N=184									
R-square			0.098			0.213			0.215
Level of significance	* p < 0.05			** p <0.10			*** p<0.15		

Source: Fieldwork (2009).

In model 2 can also be seen that age does not affect the level of wealth in the household. Because of this finding, it is also not necessary to test for composition effects of the area: whether there are more young people in Bandani, and if this difference in composition affects the measured level of wealth in the three areas.

Two important findings from Table 4.1 are displayed in the figures below. In Figure 4.1, the estimated level of wealth can be observed as per household size. When the size of the household increases, so does the measured level of wealth. It can be concluded that although Bandani is poorer than Nyalenda and Wandiege, this is not only because the households in Nyalenda or Wandiege are bigger. The effects displayed in Figure 4.1 are graphic versions of the found effects in Table 4.1, meaning the effect of the size of the household on the level of wealth of the household has been controlled for the other factors in the model (household age, tenure status and number of workers or consumers). The difference between Bandani and Wandiege has been proven to be statistically significant at $p < 0.05$. The same does not apply to the difference between Wandiege and Nyalenda. The effect of household size however, applies to all the three areas.

Figure 4.1 Estimated Level of household wealth and household size, corrected for age and tenure status by area

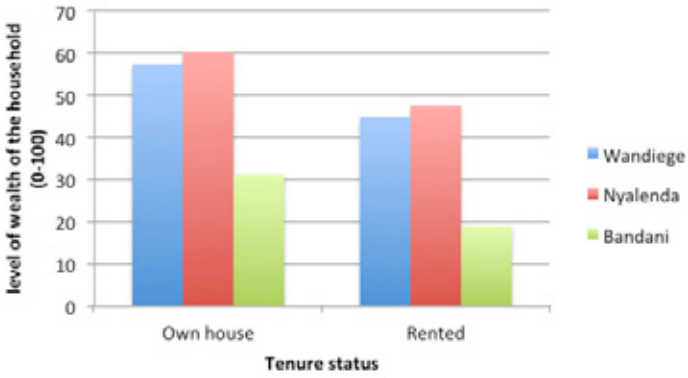


Source: Fieldwork (2009).

In Figure 4.2 the level of household wealth can be observed for people with an own house, and people with a rented house. The level of household wealth is significantly lower for people with a rented house. Figure 4.2 is based on the regression analysis in Table 4.1, meaning the results in Figure 4.2 have been checked for other predictors in the model.

Two conclusions can be drawn from Figure 4.2; in all the three areas, a high level of wealth is strongly related with owning a house. The level of wealth of the household in Bandani is still lower when taking into account the tenure status. In the next sections we are going to discuss whether the level of wealth of the household is related to household health, urban farming, and the school attendance of children. More importantly, the level of wealth of the household will be compared with other factors such as the main source of water of the household. Owning a house and a certain level of wealth are prerequisite for a sustainable livelihood. Adequate water supply, household health (section 4.3) and urban farming (section 4.4) contribute to this improved situation greatly.

Figure 4.2 Level of wealth of the household and tenure status by area



Source: Fieldwork (2009).

4.3 Adequate water supply and household health

Carolin Achimba is a community Health Worker in Bandani's DePaul Health Centre, getting about 15-20 people a day, most of them for having malaria and diarrhoea. *"Most households here in Bandani get their water from the spring. But the spring dries at times. Most people have a general sense they should only drink tapped water, or treat the spring water with for example Water Guard. Common waterborne diseases in the area are for example amoebiasis, which causes abdominal pains, diarrhoea and at sometimes also dysentery. From the symptoms it is hard to tell at times, because they look similar to malaria and typhoid. In most cases, children get diagnosed in a late phase of the disease. Children suffer mostly from malaria, which is also related to diarrhoea. The big problem related to these sufferings is the problem of malnutrition and poverty. Also, many people share the toilets. The low hygiene standards and overflowing during periods of rain cause the outbreaks of cholera.* Cases of typhoid are referred to a larger hospital, because more extensive testing and medication is needed than available in her small private hospital. *I asked the Ministry of Health for medicine, mainly for malaria but I couldn't get them free of charge. The price of the medicine has an effect on the way the patients will be treated.*

The nurse relates the problem of sanitation, the lack of latrines and health also to land ownership. *Responsibility of taking care of the hygienic condition of rented estates is far to be found. Neither the landlord nor the tenant will set up a proper sanitation facility since no one takes the responsibility. - Interview 23/11/2009*

The water supply of a household directly and indirectly affects the household health. In areas with an intervention in the water supply system, households are expected to be healthier. This may be because of safe drinking water decreases the chance on consuming potential diseases, but there are also explanations that may indirectly affect the household health. The context in which the household lives plays a significant role in the resources and assets of the livelihoods of , the level of household wealth will be taken into account in this analysis, as well as other factors that are related to a higher standard of living. These factors include treatment of the water, the type of sanitation used, but also the number of children in the household.

Table 4.2 presents the regression analysis of the household health. When a b-coefficient is positive and significant at e.g. p<0.10, - which means that in 90% of the cases - increase in the factor contributes to decline in household health. Also note that for the models displayed in Table 4.2, *the area of intervention* was used instead of the *households' main water source.* Table A2 in the Appendix confirms the overlap in these two factors. Due to correlation between these two factors a choice between these two factors has to be made which one is going to be used for the analysis. Using the *area of intervention* instead of *main water source of the household* however, resulted in a higher explanatory power (Nagelkerke R-Square).

Table 4.2 Logistic Regression Analysis: Was one of the household members sick this year? (0=no, 1 = yes)

	Model 1				Model 2				Model 3			
	B	Exp(B)		s.e.	B	Exp(B)		s.e.	B	Exp(B)		s.e.
Household Wealth	-0.169	0.845		0.462	0.369	1.447		0.565	0.27	1.309		0.589
Area												
Wandiege (=ref)												
Nyalenda					0.448	1.566		0.598	0.485	1.624		0.602
Bandani					1.481	4.396	*	0.626	2.237	9.368	*	1.088
Main water source: Piped water (=ref)												
Water from kiosk									-0.907	0.404		0.718
Surface water									-0.877	0.416		1.027
Other (roof catchment, well)									-1.335	0.263		1.538
No. of children					0.296	1.345	*	0.137	0.288	1.333	*	0.139
Treat the water?					0.082	1.085		0.455	0.042	1.043		0.464
Level of shared sanitation					0.629	1.875	*	0.165	0.744	2.104	*	0.193
Distance source-latrine												
not applicable					0.716	2.046		0.951	0.789	2.202		0.942
0-5m (=ref)												
5-15m					0.457	1.580		1.050	0.577	1.781		1.040
15-30m					0.197	1.218		1.171	0.369	1.446		1.171
30-100m					1.621	5.060	***	1.230	1.705	5.500		1.221
Perceptions on safety of water from:												
Piped connection	0.419	1.521	**	0.293	0.157	1.170		0.342	0.108	1.114		0.346
Borehole	-0.226	0.798		0.258	-0.059	0.942		0.303	-0.049	0.952		0.313
Shallow well	-1.069	0.343	*	0.429	-0.781	0.458	**	0.542	-0.701	0.496		0.550
Private water vendors	-0.332	0.717	***	0.270	-0.340	0.712		0.318	-0.357	0.700		0.325
Roof catchment and rain	0.269	1.308		0.249	0.521	1.683	**	0.298	0.516	1.675		0.303
Surface and spring	0.356	1.428		0.470	0.502	1.652		0.652	0.437	1.549		0.665
Constant	1.184	3.268		1.456	-3.333	0.036		2.204	-3.145	0.043		2.227
Nagelkerke R-Square				0.121				0.341				0.354
Level of significance	* p < 0.05			** p <0.15		*** p<0.25						

Source: Fieldwork (2009)

Model 1 takes into account the perceptions on the safety of water, while model 2 includes also the household wealth, area of intervention, number of children, treatment of the water, sanitation facilities. The latter explains 34.1% of all the variance in household health (R-Square). In the appendix more models on explaining household health are presented. When looking at the B-coefficients and level of significance of the factors, the following conclusions can be made:

- The **area of the household** is a better predictor for explaining household health, in comparison with the water source of the household (see Table A2, appendix section 2). There is a big overlap and correlation on the type of water source and the area where the household lives. This can be seen in Figure (3.5).

- **Households in Bandani** have a higher chance that one or more members were sick during the year, as compared to Wandiege. This effect is still significant after controlling for other factors such as household wealth, whether or not a household treats their water, sanitation facilities and perceptions on safety of their water sources. In regard to household health, the households in Nyalenda do not differ with the households in Wandiege.

- **Household wealth** does not improve household health. The level of wealth of the household does not have any effect on household health in any of the tested models. Although treatment of disease costs money, there is no sign of wealthy households in preventing diseases better than poor households. In spite of the differences in wealth between Wandiege, Nyalenda and Bandani as displayed in Table 4.1, the analysis shows no relation between household wealth and health. Also when not controlling for other factors, there is no significant relation between household wealth and health.

- **Households that share sanitation** with more people have a higher risk on catching a disease (see Figure 4.5).

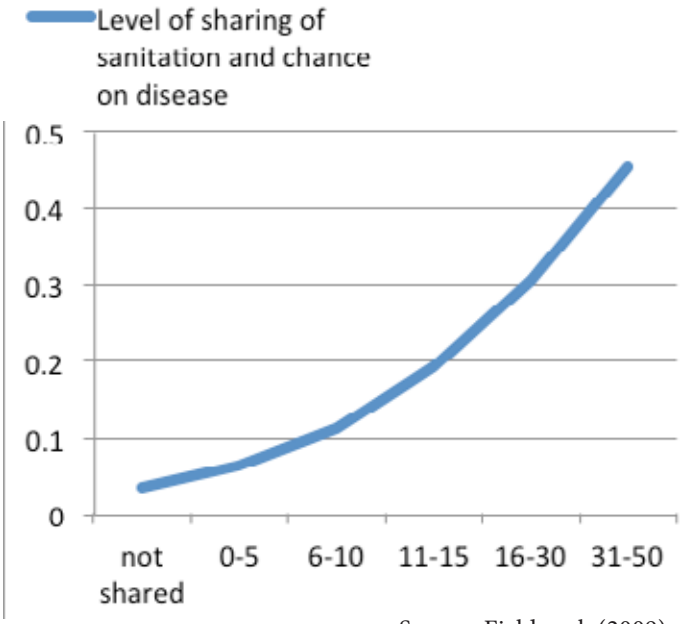
- **The number of children** of a household greatly affects chances of one of the household members being sick. This indicates a higher vulnerability of children, but it also due to more possible bodies to catch a disease (see Figure 4.6).

- **Perceptions on the safety of water** indicate the effects of knowledge on safe water usage. Although treatment of water does not make a difference in the tested models, perceptions on the safety of water do. Households that perceive a shallow well as unsafe, have a smaller chance of one of their members being sick. This indicates that good knowledge on the safety of water sources affects the behaviour of households. Also, when water from rain and roof catchment is considered unsafe, which in general is safe for drinking, the chance of a one of the members of a household being sick increases (positive b-coefficient).

- **Distance between latrine and water source** does not affect the household health as expected. According to the ideas on the contamination of water it was expected that the less distance between the water source and latrine, the higher the chances on contamination. This idea does not apply in this case. The coefficients of the distance between source and latrine are positive, while they were expected to be negative.

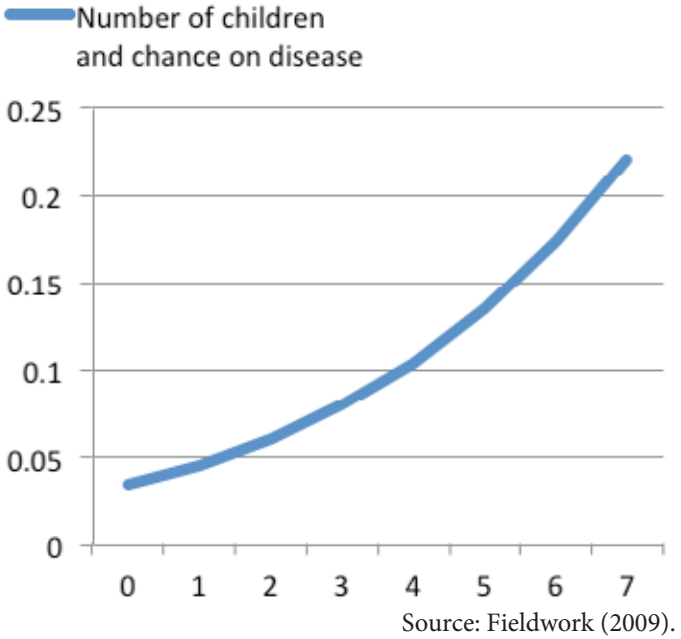
Model 5 of Table A2 (see appendix) shows that use of surface water increases chances of the occurrence of diseases in the household. When controlling for other effects, the area of the household in particular such as in model 3 (Table 4.3), the effect (in Figure 4.7) is not significant anymore. This is to be expected as the area of the household strongly correlates with the type of water source.

Figure 4.3 Level of sharing of sanitation and the increase in the chance on disease



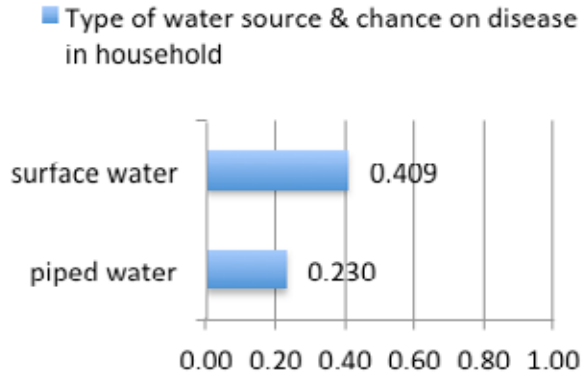
Source: Fieldwork (2009).

Figure 4.4 Number of children in household and increase in the chance on disease



Source: Fieldwork (2009).

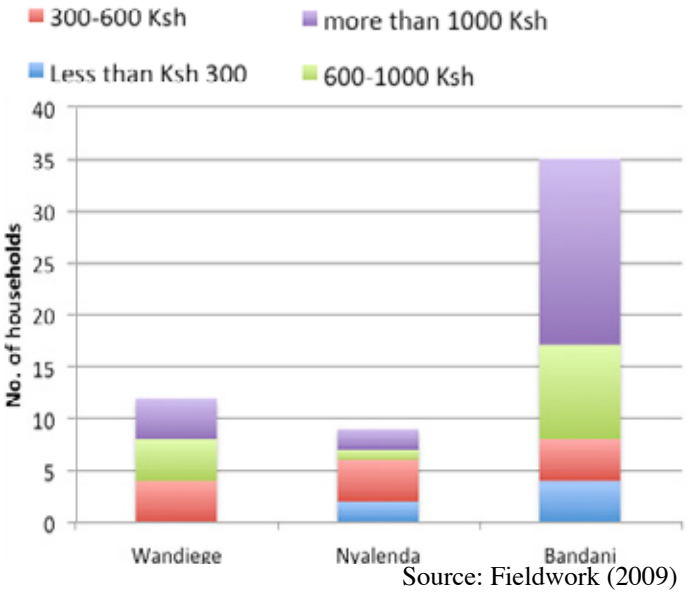
Figure 4.5 Difference between surface water, piped water and the chance on disease in a household (logistic regression analysis, Table 4.2, Model 3)



Source: Fieldwork (2009).

Health is a big issue in the informal settlements of Kisumu. The type of water source and the level of sharing of sanitation greatly affect the household health, and have consequences for the household in terms of resources. Financial resources, as well as human capital are affected by the lack of access to water and sanitation. People have to go to the hospital and buy medication. During the period when they are sick, they cannot go to work. Children are affected because they cannot go to school in this period. Figure 4.8 presents the costs and proportion of households per area. No distinction has been made to public or private hospitals. It is a basic overview of the costs of visiting a local clinic. The number of households that needed to go to a hospital is much lower in Wandiege and Nyalenda, when compared to Bandani. Due to disease, the households in Bandani are more affected in their financial situation. This has consequences on the resources and opportunities to invest education or housing. Access to clean water is key aspect in this matter.

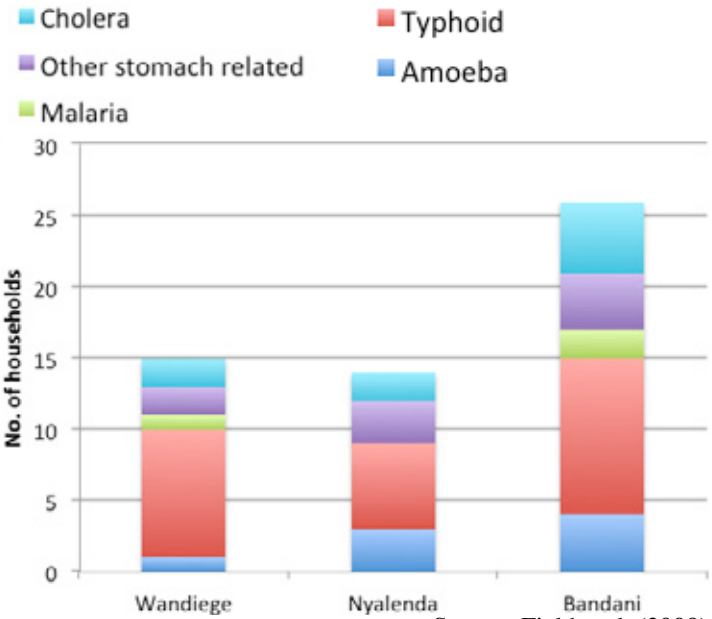
Figure 4.6 Costs of visit to a hospital by area



Source: Fieldwork (2009)

Rose Adhiambo lives in Bandani, one of the informal settlements of Kisumu. She has five children. "There are not many choices when it comes to water." She can either get water from the local spring or from the neighbourhood mosque. The mosque has a protected well with a pump. Private water vendors are expensive and unreliable. Everyone she knows in the neighbourhood is getting their water from one of these two sources. That is why she considers the water from the spring and mosque safe. She does not know why her children get sick. Water Guard is making the water safe for drinking and is not really expensive, about 30Ksh for a month's supply. She mentions that 'things' here are not good. "There are not enough toilets. Children just go around the house. That is the way it is."

Figure 4.7 Type of disease experienced in the household during last year by area



Source: Fieldwork (2009)

The households were asked for which diseases they went to the hospital. The results are displayed in Figure 4.9. The number of households with diseases is higher in Bandani, when compared to Wandiege and Nyalenda. Figure 4.9 shows that according to the household interviews typhoid fever is the most common disease in all of the three areas. Households in Nyalenda are the least affected followed by Wandiege leaving Bandani as the most affected region. Also, in Nyalenda malaria seems to absent. This may be because Nyalenda is located on the upper hill of town, but may also be random. Caution should also be taken in the identification of the diseases by the respondents because they sometimes share similar symptoms. The similarity of typhoid, malaria and cholera make it hard to diagnose without the right equipment.

Table 4.4 shows the visitor data in a hospital in Nyalenda. Comparison of Table 4.4 and Figure 4.9 confirms inconsistency in the household and hospital data.

Explanations for these inconsistencies may be a) seasonal fluctuations, b) knowledge the household has of the different diseases, and c) a selection of visitors by geographic region. No final conclusions can be made concerning this finding. The frequency of diseases is related to the households' lack of economic resources, whether via doctor visits, medication, treated malaria bed nets, or hygiene circumstances.[1] Lack of proper sanitation and the distance of the water source to the pit latrine increase the chance of cholera[2] outbreaks. In periods of heavy rainfall, pit latrines overflow, increasing the odds of contamination of food with faecal coliforms. However, these symptoms also seem to correspond with typhoid.

Actual water safety

Consequences of perceptions on the safety of water are hard to predict because of a couple of reasons. First of all, perceiving the safety of water does not say anything about the behaviour and if they treat their water. During our fieldwork, water samples were taken from five water points households expressed they used. These locations were also mentioned in the interviews on the main source of water. The water supply from individual connections and water kiosks in Nyalenda is treated at the source with chlorine, by KIWASCO.

Table 4.4 provides the results of laboratory analysis of water from different sources in the study area. We decided to test the water for bacteriological inconsistencies, as well as physiochemical components. Testing was performed by a team of chemists from the Lake Victoria Environmental Management Programme, part of the Lake Victoria South Water Services Board (LVSWSB).

Laboratory results of the water sampling show an overview of the various sources used by the households in the informal settlements of Kisumu, in particular of Wandiege and Bandani. The surface water in water used for domestic activities and consumption are all not potable, meaning that they are not safe for drinking. The water available from the Wandiege borehole, though, is safe for drinking. However, water from the other sources, such as the much used Bandani protected spring outlet and mosque shallow well, are not potable at all, and may cause diseases, health problems and might likely have a negative impact on households livelihoods in general.

Transmission of Typhoid: Flying insects feeding on faeces may occasionally transfer the bacteria through poor hygiene habits and public sanitation conditions. Public education campaigns encouraging people to wash their hands after defecating and before handling food are an important component in controlling spread of the disease. According to statistics from the United States Center for Disease Control, the chlorination of drinking water has led to dramatic decreases in the transmission of typhoid fever in the U.S. From "Rain spreads Cholera in West-Africa (http://www.time.com/time/health/article/0,8599,2017441,00.html visited 30/09/2010)"

Stroke At 68. Carrier of Disease, 1 "'Typhoid Mary' Dies Of A Blamed for 51 Cases and 3 Deaths, but She Was Held Immune". New York Times. Retrieved 2010-02-28.

2 Interviews with a community health worker, doctor and nurse confirm this general notion of the effects of lack of resources on the households health. Fieldwork, 2009

Table 4.3 Patients and disease for September, October 2009, Nyalenda Clinic

6 years & above	**Sep-09**	***6 years & above***	**Oct-09**
Confirmed Malaria	49	Clinical Malaria	117
All other diseases	49	Respiratory diseases	98
Clinical Malaria	45	Confirmed Malaria	87
Skin diseases	38	All other diseases	51
Respiratory diseases	28	Skin diseases	38
Typhoid (fever)	23	Typhoid Fever	36
Sexually Transmitted Infections	16	Tuberculosis	19
Tuberculosis	12	Sexually Transmitted Infections	11
Pneumonia	10	Pneumonia	7
Accidents, fractures, injuries	10	Accidents, fractures, injuries	7
5 years & below		***5 years & below***	
Confirmed Malaria	39	Respiratory diseases	61
Respiratory diseases	34	Clinical Malaria	48
Clinical Malaria	23	Confirmed Malaria	41
All other diseases	20	Skin diseases	16
Skin diseases	18	All other diseases	9
Diarrhoea	11	Chicken Pox	5
Pneumonia	3	Diarrhoea	4
Accidents, fractures, injuries	2	Tuberculosis	4
Burns	2	Eye infection	1
Tuberculosis	2		

Source: Fieldwork (2009)

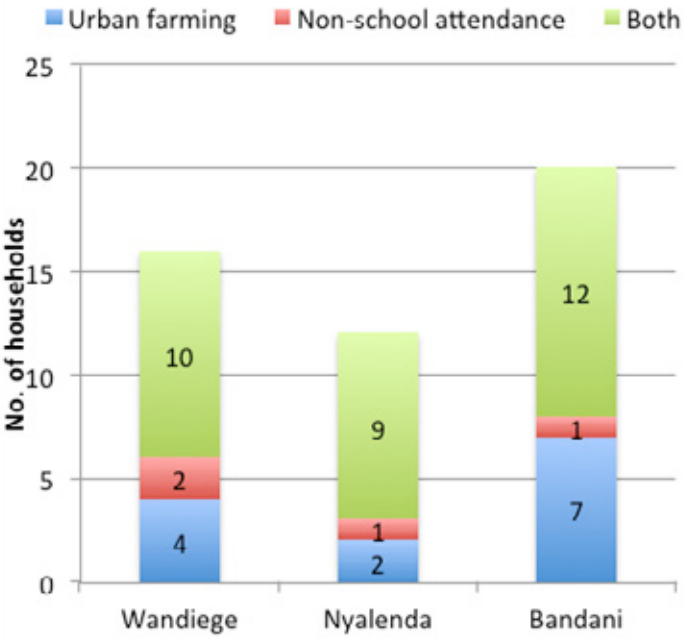
Table 4.4 Results water sampling

Exact site sample taken from	Is it protected?	if so, how?	Is there a pump	Total Coli form Count (MF, 37 degrees C)	Faecal Coli form Count (MF, 44 degrees C)	Report
				*TNTC - Too numerous to count		
Nyamasaria River	Open River flow	N/A	N/A	TNTC/100mL	TNTC/100mL	Water is severely contaminated by faecal coliforms
Wandiege Primary Borehole	Protected Borehole	Sealed at well mouth	Yes, electric pump	1 cfu/100mL	NIL/100mL	Water is potable
Bandani Mosque shallow well	Protected Shallow well		Yes, hand pump	TNTC/100mL	TNTC/100mL	Water is severely contaminated by faecal coliforms, water is NOT potable
Forest water spring (near Coca-Cola factory Bandani)	Unprotected spring	N/A	N/A	TNTC/100mL	TNTC/100mL	Water is severely contaminated by faecal coliforms, water is NOT potable
Bandani Protected spring outlet	Protected spring	Completely Covered		98 cfu./100mL	49 cfu./100mL	Water is severely contaminated by faecal coliforms, water is NOT potable

Source: Fieldwork (2009)

This section has illustrated the in depth relations between household health and water. Firstly, household health and the context in which households exist were analyzed, as well as the possible relations with sanitation, treatment of the water and household wealth. Continuing, possible consequences such as the costs and type of disease were presented. The type of water source and an intervention in the water supply system may affect the household also in more indirect ways, such as the school attendance of children and urban farming. Figure 4.10 shows variation between the number of households affected in these factors. The next sections elaborate on the school non-attendance of children and urban farming to more extent.

Figure 4.8 Effects of disease on schooling and urban farming by area



Source: Fieldwork (2009)

4.4 School non-attendance of children, disease & fetching water

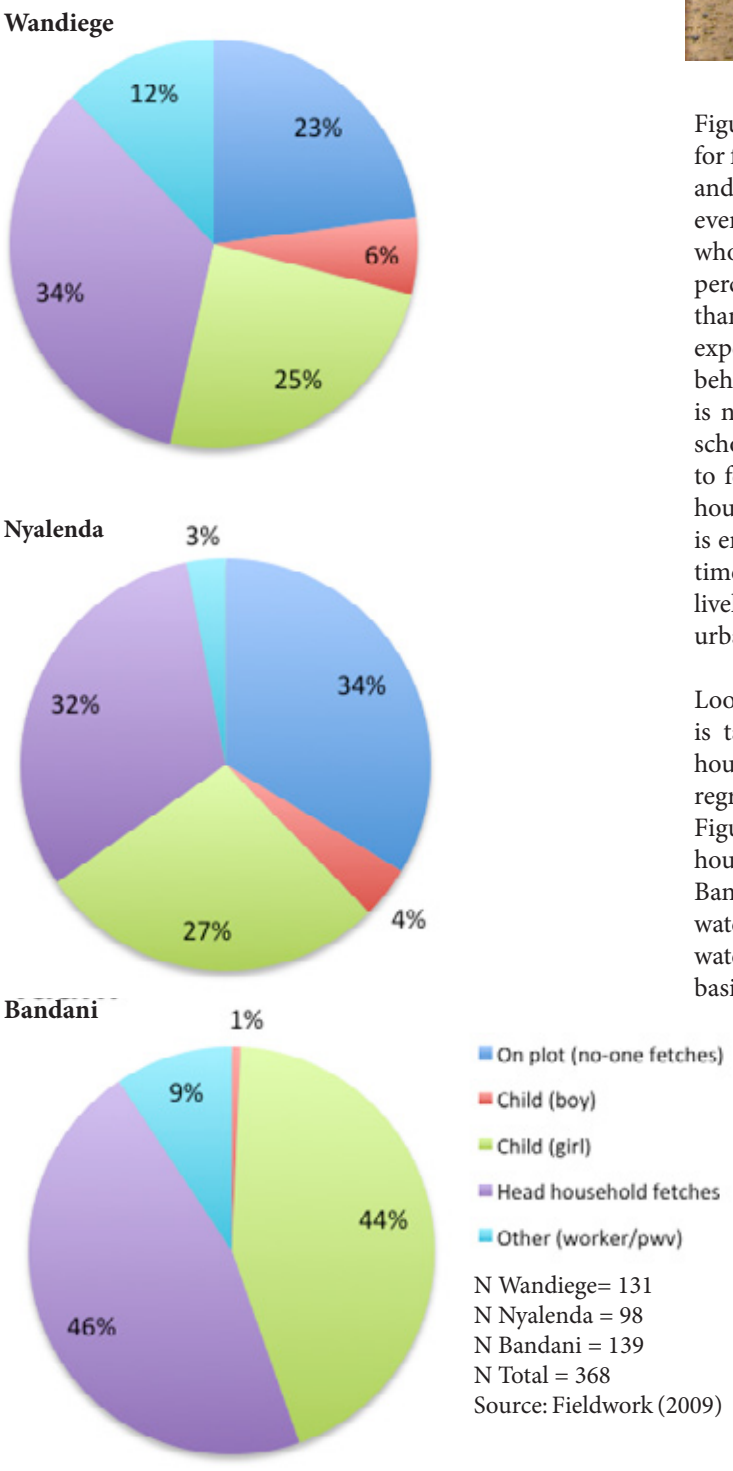
> *Cases of typhoid she refers to a bigger hospital, because more extensive testing and medication is needed than that is available in her small private hospital.* - 4 From interview with community health worker Bandani Clinic "Carolin Achimba" (23/11/2009)

In this section we are going to focus on several topics: The fetching of water and who affects this the most, differences between boys and girls, the school-attendance of children, how this relates to household health, fetching water and whether this affects boys and girls differently.

Photo 4.1 Kid and females (background) fetching water

Source: Author, Fieldwork (2009)

Figure 4.9 Who fetches water? - by area

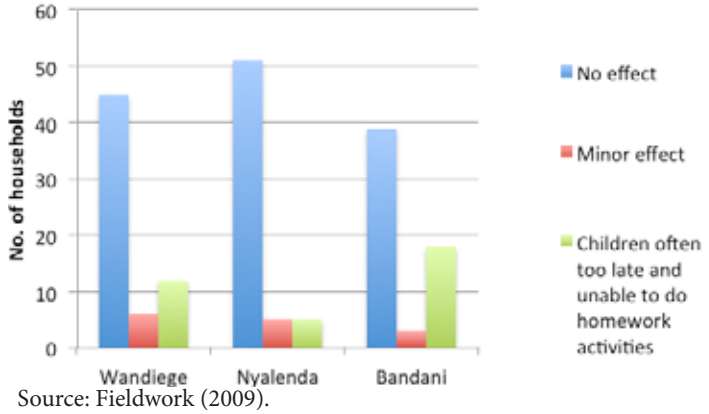


N Wandiege= 131
N Nyalenda = 98
N Bandani = 139
N Total = 368
Source: Fieldwork (2009)

Figure 4.11 shows which household member is responsible for fetching water. When comparing Wandiege with Nyalenda and Bandani a few conclusions can be drawn. First, in Bandani everyone has to fetch water, since there are no respondents who have a water source on the plot. Second, in every area, the percentage of boys that has to fetch water is strikingly lower than the percentage of girls. Because of this difference, we are expecting that girls will be affected more in their school going behaviour compared to boys. In cases where fetching water is not necessary, we expect girls not to be affected in their school attendance in a negative way, since they do not have to fetch water. We are also expecting that when the head of household is not fetching water, it is more likely the household is engaged in urban farming (section 4.5). Resources such as time, energy and household health will influence available livelihood strategies and income generating activities such as urban farming.

Looking at the time taken to fetch water, we see that Bandani is taking the most. Figure 3.13 shows the distribution in households in time taken to fetch water, per area. In the regression analysis the fetching time in minutes was used. Figure 3.13 illustrates that in Bandani, the majority of the households take more than 30 minutes per day to fetch water. Bandani's main source of water is surface water, has very little water kiosks and even less piped connections. Using surface water implies more time needed to fetch water on a daily basis. Time that could be spend in different ways.

Figure 4.10 Children affected in school activities by area



Source: Fieldwork (2009).

Spending a lot of time for fetching water is not the only way children are affected negatively. Drinking unsafe water can lead to an infection or disease; affect children's health and children's school going behaviour (Figure 4.10). In Table 4.5, the logistic regression analysis of the school attendance of children is displayed. In the questionnaire a question was asked if children have to fetch water for the household. The follow-up question was whether the children are affected, because of this fetching of water, in their school going behaviour. In this analysis, only children up to 16 are taken into account, resulting in a number of 368 cases.

The most relevant findings from the data presented above can be summarised as follows:

- **Children in Bandani** have a higher chance in being affected in their school-going behaviour. This means that more children in Bandani do not go to school, when compared to Wandiege. Time spent on fetching water due to the use of surface water plays an important role, more important than disease in the household. Unfortunately data on the occurrence of disease was only available on household level, not on child-level. This means it was only controlled for if someone in the household was sick during the year, and not whether the child was sick.
- **Children in Nyalenda** have a lower chance in being affected in their school-going behaviour in comparison with children in Wandiege (negative coefficient, significant in 95% of the cases). In Nyalenda fetching water is not necessary, because often the water source either is on plot or close to home.
- **Disease in the household** increases chances of school non-attendance of children. Related to this,
- **Households that do not share their sanitation** have a lower chance of their children missing school, in comparison with households that share their sanitation with 11-15 people.

Table 4.5 Logistic Regression Analysis: Water, health and school going behaviour of children

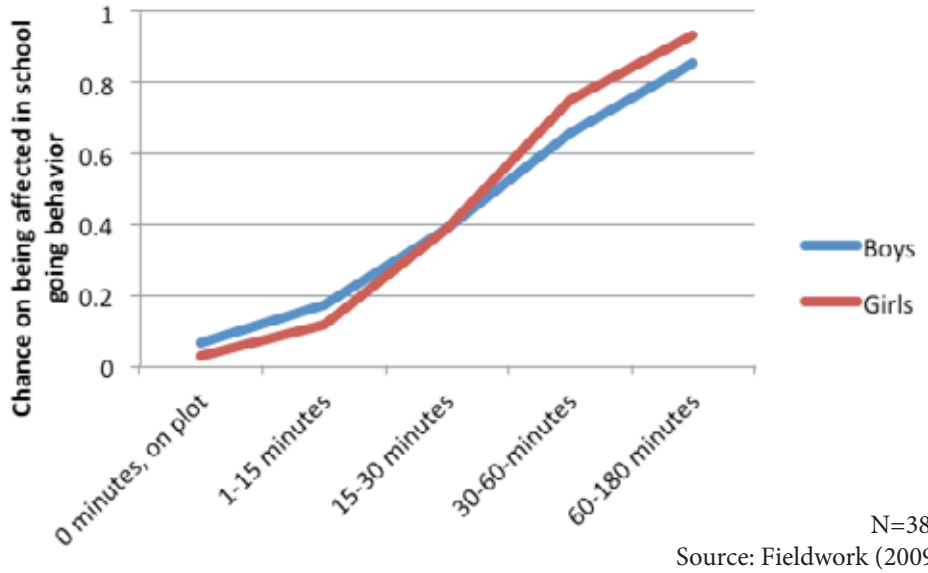
	Model 1				Model 2			
	B	Exp(B)		s.e.	B	Exp(B)		s.e.
Area								
Wandiege (=ref)								
Nyalenda	-0.775	0.461	*	0.351	-0.657	0.518	**	0.413
Bandani	0.580	1.787	*	0.302	-0.250	0.779		0.595
No. of children					-0.060	0.942		0.120
Age								
Gender (1=female)					-0.870	0.419	***	0.676
Disease in household this year?	0.800	2.224	*	0.259	0.138	1.148		0.324
Time taken to fetch water					1.115	3.048	*	0.233
Girl fetches					1.524	4.592	*	0.348
Boy fetches					2.218	9.191	**	1.377
Time taken to fetch water * gender (female)					0.439	1.552	**	0.282
Main water source: Piped water (=ref)								
Water from kiosk					0.319	1.375		0.408
Surface water					-1.487	0.226	*	0.665
Other (roof catchment, well)					-0.564	0.569		0.844
Level of sharing of sanitation	0.238	1.269	*	0.094				
Constant	-1.327	0.265		0.246	-2.690	0.068		0.625
Nagelkerke R-Square				0.163				0.481
Level of significance	* p < 0.05		** p <0.15		*** p<0.25			
N=368								

Source: Fieldwork (2009)

- **Households expressing that their children fetch water,** experience an increased chance of school non-attendance.
- **The more time the household spends on fetching water,** the higher the chances of school non-attendance of the children.
- **This effect is significantly stronger for girls than for boys** (see Figure 4.14).
- **Having surface water as main source, implies fetching for water.** When controlling for the fetching of water, the use of surface water does not decrease the school non-attendance of the children as expected.
- **The school attendance of the children** has been explained by other factors besides living in Bandani. Examples of this are: time taken to fetch water and the responsibilities of young girls in particular, in model 2.

To check whether factors such as time spend on fetching water explain the area of intervention, we tested additional models which can be observed in the Appendix section 3A. These models are similar to the models presented. The models in the appendix build up, adding factors per model. In this way we can control for intermediating effects when adding one factor at a time.

Figure 4.11 Odds on being affected in school non-attendance



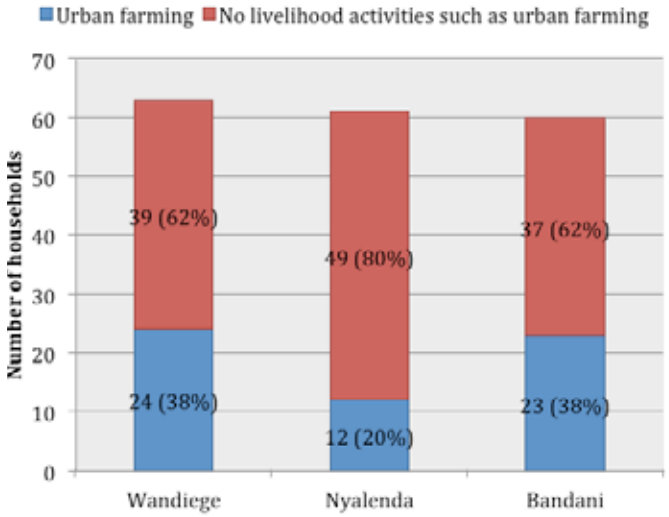
N=386
Source: Fieldwork (2009)

Figure 4.14 shows an important finding. The Figure displays the effects of fetching time for boys and girls. The effect differs significantly according to Table 4.5, and is stronger for girls. Figure 4.14 shows the estimated logistic regression line, which is somewhat difficult to interpret. First of all, in the cases where fetching water is not or little necessary, girls are more likely to go to school on a regular basis, when compared to boys. When the fetching time increases the girls have an increased chance of not going to school. This effect is stronger for girls.

4.5 Urban farming

In this paragraph we will analyse the households that perform urban farming. We will pay attention in particular to which household resources are of relevance. Figure 4.15 shows the occurrence of urban farming in Wandiege, Nyalenda and Bandani.

Figure 4.12 Urban farming by area



Source: Fieldwork (2009). n=184

- **Households in Nyalenda** have a lower chance to have perform urban farming. Explanations for this may be the type of soil in Nyalenda. Households in Bandani do not have a different chance on urban farming, compared to the households in Wandiege;
- **The higher the number of children** in the household, the smaller the chance urban farming is practised (see Figure 4.16);
- **Households that rent a house** are less frequently practising urban farming (see Figure 4.18). In some cases households are not allowed by the landlord to farm their land. In other cases people just rent the house, not land;
- **The level of household wealth** has no significant relation with urban farming. Although the analysis shows a positive correlation, when controlling for other factors such as health, the differences in wealth between households that engage in urban farming, is not significant.
- **The more time taken to fetch water**, the more likely urban farming is practised. We expected with less time available urban farming would be less often part of the household activities. This does not seem to be the case;
- **Healthier households** and urban farming are strongly positively correlated. A stable and healthy household increases the time and energy required for urban farming.

Table 4.6 Logistic Regression Analysis: Urban farming in relation to water, health, tenure status, wealth and children

	Model 1				Model 2			
	B	Exp(B)		s.e.	B	Exp(B)		s.e.
Area								
Wandiege (=ref)								
Nyalenda	-1.122	0.492	*	0.326	-0.998	0.369	*	0.499
Bandani	-0.120	0.471		0.886	0.652	1.920		0.767
Household resources:								
No. of children	-0.273	0.125	*	0.761	-0.269	0.764	*	0.127
Tenure status	-0.897	0.397	*	0.408	-1.114	0.328	*	0.435
Time taken to fetch water	0.395	0.188	*	1.484	0.462	1.588	*	0.203
Household wealth	0.251	0.486		1.286	0.276	1.318		0.495
Household health	1.009	0.416	*	2.743	1.052	2.865	*	0.426
How regular is your main water source?	-0.685	0.253	*	0.504	-0.552	0.576	*	0.263
Main water source: Piped water (=ref)								
Water from kiosk					0.192	1.212		0.535
Surface water					-1.099	0.333	***	0.892
Other (roof catchment, well)					0.047	1.049		1.012
Constant	1.721	1.031	*	5.588	1.561	4.765	**	1.041
Nagelkerke R-Square				0.295				0.312
Level of significance	* p < 0.10		** p <0.15		*** p<0.25			N=184

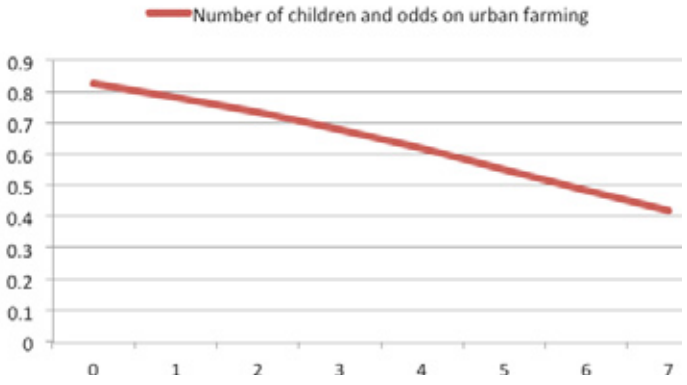
N=184 households
Source: Fieldwork (2009)

Conversely, urban farming improves the food security and general household health;

- **When compared to households with an individual connection,** households that use surface water as their main water source, have a decreased chance to perform urban farming. An individual piped connection helps when maintaining an activity such as urban farming (see Figure 4.17);

- **Having an individual connection,** a good health and land, are beneficial for urban farming.

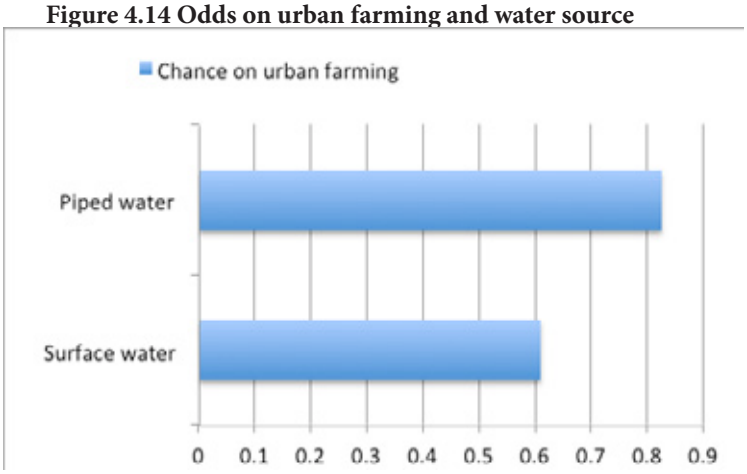
Figure 4.13 Odds on urban farming and household size



N=184 households
Source: Fieldwork (2009)

When relating the number of people to an event such as urban farming, a larger household size could mean more workforce required for maintaining an urban farm. The analysis on urban farming proves otherwise. A high number of children can also be a limitation when it comes to urban farming. Spending time taking care of the children, especially when sick, can be a constraint in available resources desirable for urban farming. Furthermore, a livelihood strategy that includes urban farming requires also an adequate water supply and investment, in terms of land for growing crops or owning a house.

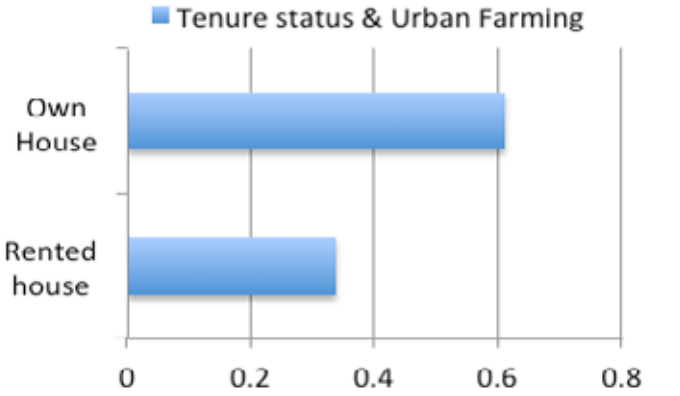
Figure 4.14 Odds on urban farming and water source



N=184 households
Source: Fieldwork (2009)

Figure 4.17 illustrates that households with an adequate water supply (piped water) are more likely to have a livelihood strategy that includes urban farming. Households that have to go fetch water from the surface have a smaller chance to engage in urban farming. Another important requirement for urban farming is available land to put crops on. Although urban farming is also practices in bags and pots, available land and an own house benefit this type of livelihood strategy (Figure 4.18). Households that have an own house are more likely to practice urban farming. Households with a rented house have a smaller chance to practice urban farming.

Figure 4.15 Tenure status and urban farming



N=184 households
Source: Fieldwork (2009)

Photo 4.2 Children fetching water from the side of the road in Bandani

Source: Fieldwork (2009)

Photo 4.3 Shallow well (Bandani)

Source: Fieldwork (2009)

Photo 4.4 Inside the shallow well (Bandani)

Source: Fieldwork (2009)

5

Conclusions

This thesis attempted to take on macro theories on economic development and link ineffective governance to the lack of water and sanitation. However, the fieldwork of this thesis was mainly focussed on households and less on institutions. Therefore, this thesis has been unable to elaborate sufficient on linking the macro theories to the institutional level. This is possible if comparable data on other communities and cities or regions is available. Moreover, the quest for a magical solution to development problems and poverty, as this thesis illustrates, does not lie in a single factor such as water.

Development is very diverse. Van Naerssen et al (1997) point out that research in the Third World, focussed on the practical sides, development activities (e.g. training and sensitization) should be expanded, instead of being reduced. In this concluding section I will try to point a direction where I think it should be going, along with implications for policymakers and researchers.

This thesis presented an overview and comparison of three informal settlements in Kisumu, Kenya. Special attention was given to the type of water sources in each area; whether this water is safe for drinking and the consequences for household health, school going behaviour, and urban farming. Households that enjoy an individual water connection are healthier. Better household health assists the family to progress. Next, we will discuss our most important findings and relate these to the used theories and research questions.

Areas with adequate water supply have less disease. Private and community-based interventions in Manyatta B and Nyalenda B show significantly less households that got any type of disease when compared to Bandani, the area without any type of intervention in the water supply. There is no significant difference between private and community based interventions and level of the diseases. A decent water supply; whether via a borehole that is deep enough and safe, via water kiosks and jerrycans or via piped connections, decrease the number of diseases no matter what type of intervention in the water supply has been implemented.

Access to proper water and sanitation is important for household health. Good sanitation decreases the chance of one of the household members to get sick. People who share their sanitation with a lot of people do this with increased risk of being exposed to contaminated environments. Households that share their sanitation with many people become sick more often.

The number of children in a household increases the vulnerability of the household and the odds on disease. The greater the number of children in a household, the higher the chance that household will be affected by disease. Diseases affect us all. Diseases affect people without adequate access to water and sanitation more. Disease affects well-developed areas and countries less. Living in a society that provides basic needs, clean water, proper sanitation, housing, infrastructure, healthcare and education helps in many ways. Waterborne diseases affect the children in the slums. Some children get sick. Some get better by spending money on medicine. Some households do not have the resources and children may die.

The young girls are the ones responsible in the household for fetching water. Young males have to fetch water in very few cases. In the majority of households the female children and the female head of the household are responsible for water collection. Young girls have to fetch water and cannot go to school because of it and are more affected than boys. An adequate water supply minimises fetching time and responsibilities of young girls to fetch water on a daily basis.

Fetching water on a daily basis affects the school-attendance of children. This effect is stronger for young girls. Households with children that have to go and fetch water on a daily basis are more likely to be affected in their school-attendance than children of households who have their water source on plot or close to the house. In Bandani the people also have to wait in long queues. The pressure of the local spring is low and there are a lot of people waiting. Also, the water sources are contaminated with faecal coliforms and it is not safe for drinking without proper water treatment.

Good household health and access to proper water and sanitation greatly increases the resources needed for urban farming. When having an individual connection for water, the household enjoys safe drinking water and has a better household health. This may result in more time, energy, water and other prerequisites for growing crops.

The Water Act of 2002 still has many challenges. Not all communities have access to state institutions, and some cannot obtain a legal identity, permit or resources required to set up a water supply system. Some form of capital and investment is required to help these communities set up their own Water Service Provider. Resources could be allocated by the Water Resources User Associations (WRUAs) to community based entities as opposed to an individual land owner.

Wandiege is a good example of a community based intervention. The Wandiege community combined their forces and set up their own water supply project. The new Water Act of 2002, assistance from donors and NGOs made this intervention possible. A Water Service Provider such as the Wandiege Community Water Supply Project and other small-scale and local interventions are easier to set up when the incentives for the community are in place. This approach will be easier and more fruitful than executing a top-down slum upgrading project such as the KENSUP programme. Here, I see room for progress, to facilitate and enable communities to set up their own borehole and water source. The DMM-model in Nyalenda is also a good initiative. Here, the community does not own the borehole, but a private company does. This thesis bypasses the in depth analysis of the consequences of private or public ownership. But as Easterly (2002) points out clearly, with the right incentives, practical application of economic policy, many things are possible. This thesis suggests that it does not really matter if the project is publicly or privately owned. As long as the involved actors: the community, the master operators and private company have the right incentives, people will work and put effort in it.

The findings of this thesis do fit Sachs' ideas on the importance of health, basic infrastructure and access to water. The relations between access to water and sanitation found in this thesis play a significant role in the lives of the urban poor. Sachs (2005) work The End of Poverty has been inspiring. Sachs proposes to increase the Official Development Assistance to fund the Poverty Reduction Strategy Papers. A theme this thesis brings forward questions whether this is a realistic solution. It is true that ODA is a currently a needle in the world's leading countries hay-stacking GDP spending. Our experience is that increasing ODA is not enough and vague in general. By improving policies and strengthening the institutions in the water sector, communities can be empowered to set up their own water supply system. The Water Act of 2002 is a good example how more transparency and clear responsibilities can facilitate communities, private companies and the government. However, the money available for the urban poor is in practice very limited. Concerning the Wandiege Community Water Supply Project, the government promised to finance a petty share of KShs 500 000 (about 14% of the initial costs of the borehole), but later withdrew their contribution. On paper, the governments are promising all kinds of improvement, but in reality the budget on eradicating poverty is still lacking behind, especially when compared to absolute military expenditures that have been 'invested' in for decades. So much capital has been and is being spent on something, allegedly, more important. Global, but also local politics play an important role in the water sector of Kenya. Mechanisms to enforce regulations between the local demand of water use versus the commercial use of water cannot be maintained as resources in the state institutions are limited. The in depth dynamics of the effectiveness of state institutions, commercial water exploiters and rights of local communities are bypassed by the focus on households in the livelihood approach. A prosperous challenge still lies at research, implementation and strengthening of the Water Act of 2002, the strengthening of institutions and the conflicting interests over water as a resource.

Incentive for the community and change through practical development policy. Allowing communities to set up their own project is a great initiative. A choice has to be made to channel the flows of capital into small efficient projects that have a proven effect on the change one wishes to see, in this case increased opportunity for the urban poor. While this may be easer said than done, a framework that provides empowerment for the urban poor themselves, enforces the urban poor come up for their own rights. Chang's ideas on protecting infant economies is also applicable on a more regional level, where communities are in charge of their own water supply.

This thesis has not talked about individual and household incentives. Some important processes lie deeper than just the rule of law, the strength of institutions and the numbers on Official Development Assistance. Woman inequalities for example, are deeply rooted in tradition and culture. These values are based on the incentives on which people act. These have to be communicated clearly, and should be incorporated in economic development theories. In my previous work The individual contribution to democracy (2009), I have elaborated on a bottom-up approach as well as on the importance of cultural values as explanation of the individuals' contribution to society. Strong self-expression values and secular-rational values emphasize values on freedom, public expression, tolerance, self-direction and human trust, which increase one's contribution to society. Although the cultural values of an individual cannot be enforced nor changed, the incentives on which people behave and contribute to their community can be managed through practical economic policy. Related to these cultural values lie the attitudes towards women and their traditional roles. In this thesis we have seen that there is a big difference in the vulnerability of young boys and girls. Fulfilling basic needs such as water can change these traditional views on gender. Girls cannot choose going to school, but instead they have to wait in line, wait for water and wait for improvement.

The incentives we talked about do not only concern the people in the slums that require a community project. These incentives also concern us academics, policy makers, investors, donors and private companies. In order to make progress in the research agenda, in order to make this agenda get more attention, we need to focus the incentives we would have to set up an initiative such as community supply project. As a researcher it would benefit me in terms of experience and knowledge. For poor communities this would be the water itself. That is what we have to see and understand.

So what do we do? What can you do? What can we academics do? What can students do? What can policy makers do? Do we have to do anything? Maybe this thesis should have been focussed on that. Doing. Cause we know much of the information in this thesis already. We have known it for years, if not more. And now it is statistically proven, now it is real. With an existentialist note I end this research on access to water and sanitation. That we can be held responsible for our actions and make a difference. What we do matters. It makes a difference, first of all in physical and material terms. Second, it matters for the people around us, and it sets an example. This research has set example in the importance and research agenda on access to water and sanitation for households, small community level interventions and local development.

The scarcity at the heart of the global water crisis is rooted in power, poverty and inequality, not in physical availability

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Appendix

Appendix section 1 **Method of analysis: Regression- and logistic regression analysis**

Appendix section 2 **Additional Regression models**

Table A1: Additional models regression analysis household level of wealth
Table A2: Additional models logistic regression analysis household health
Table A3: Additional models logistic regression analysis school non-attendance
Table A4: Additional models logistic regression analysis urban farming

Appendix section 3 **Additional tables**

Table 1A: Head household Demographics
Table 2A: Household residential status
Table 3A: Independent T-test household wealth in Wandiege and Bandani
Table 4A: Household source(s) of water and characteristics
Table 5A: Main source of water and type of treatment
Table 6A: Fetching water
Table 7A: Household Health
Table 8A: Sanitation
Table 9A: Number of households and Consumer/Worker-ratio
Table 10A: Who fetches?
Table 11A: Tariff structures Wandiege
Table 12A: Tariff structures Nyalenda
Table 13A: consumption prices per m3
Table 14A: Correlation analysis age and household wealth

Appendix section 4 **Distribution of sample population and normal curve**

Distribution of sample population and normal curve of sample population
Distribution of sample population and normal curve of Wandiege
Distribution of sample population and normal curve of Nyalenda B
Distribution of sample population and normal curve of Bandani

Appendix section 1 **Method of analysis: Regression- and logistic regression analysis**

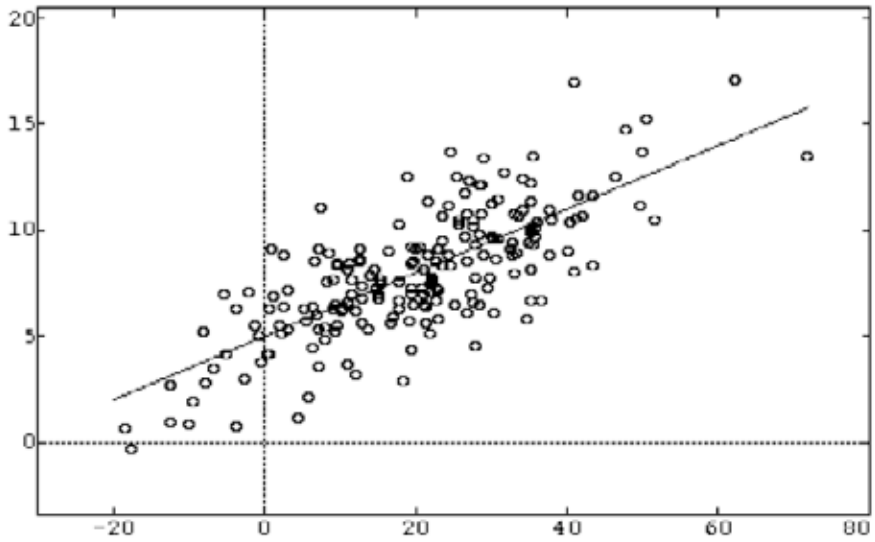
In this section the method of analysis will be discussed. The main method of analysis is regression analysis. This method helps us understand how the dependant variable (Y) changes when one of the independent (X's) changes. This is illustrated in a simple formula:

$$Y = B\ (\text{constant}) + (A_{children} * X_{children})) + (A_{variable2} * X_{variable2} \ldots.) \text{ etc..}$$

Where
- Y = expected outcome on e.g.household wealth
- $X_{children}$ = estimated 'strength' of variable, b-coefficient.
- A = factor of X(e.g. number of children)
- B = a constant factor in the regression analysis

In the analysis, the dependent variables (X's), factors such as the number of children, or the level of sharing of the sanitation can be tested whether these factors have a significant effect on Y, the independent variable, household wealth. Imagine all households having a different level of wealth. The regression analysis calculates to what extent the level of wealth is correlated with another factor. More concrete, it explains variance between the level of wealth between the households by chosen factors. The results of these factors are given in B-coefficients, standard errors, and levels of significance. When a factor or B-coefficient is significant, it means that in a given percentage (mostly between 80-95%) of the cases the factor contributes to change in the independent variable. The level of significance is important when interpreting the results. Factors that are based on error and coincidence, weak factors, are not estimated well by the regression line. In such cases the household score on the level of wealth is far away from the estimated regression line.

Figure 3.5.1 Example regression line



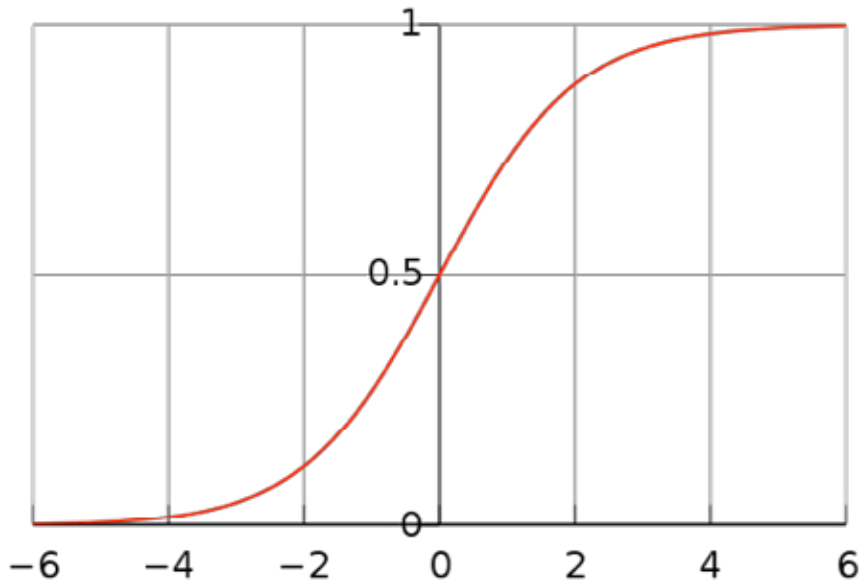
The main variables of this research are:
- Was one of the household members sick this year?
- Do you have an income generating activity, and if so, does it require access to water? E.g. urban farming
- Are the children affected in their (non-)school attendance?

Our independent variables are events that may happen or not. A household can get either the score 0 or 1 on these factors. Regression analysis is good for ratio variables such as household wealth. A household can have a score on the independent variable in compliance with the household wealth scale (e.g. 0-100). However, in our case, the independent variables are not a ratio variable (as health is), but dichotome (0/1). For dichotome variables a logistic regression fits the model better (Lammers & Pelzer et al, 2007). This is because a household or a case can either get the score 0 or 1, not anything in between. The figure on the next page presents this model, a logistic function. In our case, a household member is either sick (1) or not (0), and thus fits the analysis better than a regular regression. In the analysis, households that score high on certain factors (e.g. level of sharing of sanitation) and their chance to get sick (get score 1) are compared with households that score low on those factors. More concrete the analysis tests whether there is a relation between the dependant and independent variable, controlled for by other chosen predictors. The logistic curve is estimated with the following formula.

Risk of getting sick = $1 / (1 + e^{-y})$

Where $Y = B \text{ (constant)} + (A_{children} * X_{children})) + (A_{variable2} * X_{variable2} \ldots .)$ etc..

Figure 3.5.2 Example Logistic Curve



With this formula graphs can be made how the chances of household getting sick increase, when a certain factor increases. This will be done in chapter 4, Analysis and Results.

Appendix section 2 **Additional Regression models**

Table A2 Additional models logistic regression analysis household health
Table A3 Additional models logistic regression analysis school non-attendance
Table A4 Additional models logistic regression analysis urban farming

Table A2 Logistic Regression Analysis: Was one of the household members sick this year? (0=no 1=yes)

	Model 4			Model 5			Model 6		
	B	Exp(B)	s.e.	B	Exp(B)	s.e.	B	Exp(B)	s.e.
Area									
Wandiege = ref									
Nyalenda	-0.060	0.941	0.436				-0.067	0.935	0.436
Bandani	1.003	2.728 *	0.420				1.267	3.551 *	0.697
Water source									
Piped water = ref									
Water kiosk				0.197	1.218	0.423	-0.131	0.878	0.474
Surface (spring) water				0.841	2.319 *	0.399	-0.415	0.660	0.758
Roof/Rain/PWV/Shallow well				0.110	1.117	0.855	-0.930	0.395	1.037
Household wealth	0.315	1.371	0.427						
Constant	-1.479	0.228 *	0.437	-1.209	0.299 *	0.255	-1.196	0.303 *	0.330
R-Square			0.063			0.035			0.065
Level of significance	* p < 0.05		** p <0.10	*** p<0.15					

Table A2 (continued) Logistic Regression Analysis: Was one of the household members sick this year? (0=no 1=yes)

	Model 7			Model 8		
	B	Exp(B)	s.e.	B	Exp(B)	s.e.
Household Wealth	0.286	1.331	0.434			
Area						
Wandiege (=ref)						
Nyalenda	0.028	1.028	0.449			
Bandani	0.965	2.625 *	0.427			
Main water source: Piped water (=ref)						
Water from kiosk						
Surface water						
Other (roof catchment, well)						
No. of children	0.243	1.276 *	0.107			
Treat the water?	-0.177	0.838	0.361			
Level of shared sanitation				0.429	1.535 *	0.119
Distance source-latrine						
not applicable				1.247	3.481 **	0.798
0-5m (=ref)						
5-15m				0.879	2.408	0.890
15-30m				0.868	2.382	1.034
30-100m				1.075	2.930	0.967
Perceptions on safety of water from:						
Piped connection						
Borehole						
Shallow well						
Private water vendors						
Roof catchment and rain						
Surface and spring						
Constant	-1.881	0.152 *	0.544	-2.371	0.093 *	0.776
Nagelkerke R-Square	0		0.103			0.135
Level of significance	* p < 0.05		** p <0.15	*** p<0.25		

Table A3 Logistic Regression Analysis: Children are affected in their schoolgoing behaviour

	Model 3			Model 4			Model 5			
	B	Exp(B)		s.e.	B	Exp(B)		s.e.	B	Exp(B)		s.e.
Area												
Wandiege (=ref)												
Nyalenda	-0.946	0.388	*	0.333	-0.917	0.400	*	0.342	-0.627	0.534	*	0.394
Bandani	0.440	1.553	*	0.257	0.928	2.530	*	0.481	-1.441	0.237	*	0.378
No. of children	0.013	1.013		0.087	0.060	1.062		0.092	0.039	1.040		0.106
Age	0.022	1.022		0.026	0.040	1.040	**	0.027	0.009	1.009		0.030
Gender (1=female)	0.230	1.259		0.231	0.251	1.285		0.239	0.366	1.442	***	0.271
Disease in household this year?									0.512	1.669	**	0.282
Time taken to fetch water									1.347	3.846	*	0.180
Girl fetches												
Boy fetches												
Time taken to fetch water * gender (female)												
Main water source: Piped water (=ref)												
Water from kiosk					1.090	2.975	*	0.325				
Surface water					-0.383	0.682		0.546				
Other (roofcatchment, well)					-0.737	0.479		0.737				
Sanitation shared?												
not shared												
5-10 people												
11-15 people (=ref)												
16-30 people												
30-50 people												
Constant	-1.057	0.347	*	0.394	-1.709	0.181	*	0.454	-3.201	0.041		0.557
Nagelkerke R-Square				0.081				0.154				0.388

Level of significance * p < 0.05 ** p <0.15 *** p<0.25

N=368

Source: Fieldwork (2009).

Table A3 (continued) Logistic Regression Analysis: Children are affected in their schoolgoing b

	Model 6			Model 7			
	B	Exp(B)		s.e.	B	Exp(B)		s.e.
Area								
Wandiege (=ref)								
Nyalenda	-0.723	0.485	**	0.408	-0.548	0.578	***	0.391
Bandani	-1.457	0.233	*	0.396	-1.448	0.235	*	0.380
No. of children	-0.122	0.885		0.114	0.056	1.058		0.104
Age	-0.013	0.987		0.032	0.010	1.010		0.030
Gender (1=female)	0.080	1.083		0.289	-0.353	0.703		0.626
Disease in household this year?								
Time taken to fetch w	1.329	3.778	*	0.183	1.261	3.529	*	0.215
Girl fetches	1.526	4.601	*	0.325				
Boy fetches	1.736	5.672	**	1.188				
Time taken to fetch water * gender (female)					0.331	1.393	***	0.265
Main water source: Piped water (=ref)								
Water from kiosk								
Surface water								
Other (roofcatchment, well)								
Sanitation shared?								
not shared								
5-10 people								
11-15 people (=ref)								
16-30 people								
30-50 people								
Constant	-2.694	0.068		0.579	-2.878	0.056	*	0.616
Nagelkerke R-Square				0.446				0.384

Level of significance * p < 0.05 ** p <0.15 *** p<0.25

N=368

Source: Fieldwork (2009).

Table A4 Logistic Regression Analysis: Do your income generating activities require access to water?

	Model 1			Model 2			Model 3			
	B	Exp(B)		s.e.	B	Exp(B)	s.e.	B	Exp(B)		s.e.
Constant	-0.516	0.597	*	0.291	0.804	2.235	0.718	0.315	1.370		0.835
Area											
Wandiege (=ref)											
Nyalenda	-0.932	0.394	*	0.415	-0.746	0.474	0.448	-0.755	0.470	*	0.450
Bandani	0.759	2.136	***	0.664	0.288	1.334	0.714	0.370	1.448		0.726
Main water source: Piped water (=ref)											
Water from kiosk	0.172	1.187	***	0.431	-0.254	0.776	0.481	-0.177	0.837		0.486
Surface water	-0.980	0.375		0.749	-1.352	0.259	0.823	-1.334	0.264	*	0.832
Surface and spring	-0.580	0.560		0.926	-0.240	0.787	0.980	-0.182	0.833		1.007
Household resources:											
No. of children											
Tenurestatus											
Time taken to fetch water					0.453	1.572	0.176	0.499	1.648	*	0.182
Household health					-1.018	0.361	0.329	-0.994	0.370	*	0.329
Household wealth								0.511	1.668		0.459
How regular is your main water source?											
Nagelkerke R-Square				0.074			0.209				0.217

Level of significance * p < 0.10 ** p <0.15 *** p<0.25

N=184

Source: Fieldwork (2009).

Table A4 (continued) Logistic Regression Analysis: Do your income generating activities require access to water?

	Model 4			Model 5			Model 6			
	B	Exp(B)		s.e.	B	Exp(B)	s.e.	B	Exp(B)		s.e.
Constant	1.721	5.588	*	1.031	0.674	1.963	0.597	-0.895	0.409	***	0.676
Area											
Wandiege (=ref)											
Nyalenda	-1.122	0.326	*	0.492	-0.916	0.400	*	0.424			
Bandani	-0.120	0.886		0.471	0.212	1.236		0.389			
Main water source: Piped water (=ref)											
Water from kiosk											
Surface water											
Surface and spring											
Household resources:											
No. of children	-0.273	0.761	*	0.125	-0.108	0.898		0.105			
Tenurestatus	-0.897	0.408	*	0.397	-0.681	0.506	*	0.340			
Time taken to fetcl	0.395	1.484	*	0.188				0.400	1.492	*	0.158
Household health	1.009	2.743		0.416				0.872	2.393	*	0.378
Household wealth	0.251	1.286		0.486				0.402	1.495		0.447
How regular is you	-0.685	0.504		0.253				-0.522	0.593		0.221
Nagelkerke R-Square				0.295			0.084				0.202

Level of significance * p < 0.10 ** p <0.15 *** p<0.25

N=184

Source: Fieldwork (2009).

Appendix section 3: Additional tables

Table 1A: Head household Demographics

			Wandiege		Nyalenda		Bandani	
	N	%	N	%	N	%	N	%
Gender head household								
Male	39	21.2	11	28.2	19	48.7	9	23.1
Female	145	78.8	52	35.9	42	29.0	51	35.2
Total	184	100.0	63	34.2	61	33.2	60	32.6
Age (categories)								
17-24 years old	33	17.9	12	36.4	5	15.2	16	48.5
25-30	45	24.5	13	28.9	20	44.4	12	26.7
31-36	28	15.2	14	50.0	8	28.6	6	21.4
37-44	33	17.9	7	21.2	16	48.5	10	30.3
45-55	26	14.1	7	26.9	9	34.6	10	38.5
56-80 years old	19	10.3	10	52.6	3	15.8	6	31.6
Total	184	100.0	63	34.2	61	33.2	60	32.6
Occupational Type								
Regular (formal) employment	31	16.8	14	45.2	14	45.2	3	9.7
Temporary (formal) employment	3	1.6	0		2	66.7	1	33.3
Self-employed/formal sector	17	9.2	6	35.3	4	23.5	7	41.2
Self-employed/informal sector	75	40.8	22	29.3	20	26.7	33	44.0
Casual labor	4	2.2	3	75.0	1	25.0	0	
Unemployed (looking for a job)	8	4.3	1	12.5	4	50.0	3	37.5
None (student/child)	3	1.6	3	100.0	0		0	
Home maker	40	21.7	13	32.5	15	37.5	12	30.0
Other (specify)	3	1.6	1	33.3	1	33.3	1	33.3
Total	184	100.0	63	34.2	61	33.2	60	32.6
Education								
None	6	3.3	3	50.0	1	16.7	2	33.3
Primary	72	39.1	28	38.9	13	18.1	31	43.1
Secondary	63	34.2	20	31.7	21	33.3	22	34.9
Above Secondary	37	20.1	11	29.7	22	59.5	4	10.8
Not stated	6	3.3	1	16.7	4	66.7	1	16.7
Total	184	100.0	63	34.2	61	33.2	60	32.6

Sources: Fieldwork (2009).

Table 2A: Household residential status

	Total (n=184)		Wandiege		Nyallenda		Bandani	
	N	%	N	%	N	%	N	%
Own house	88	47.9	38	43.2	29	33.0	21	23.9
Rented	96	52.1	25	26.0	32	33.3	39	40.6
Total	184	100	63		61		60	
	Mean	Se	Mean	Se	Mean	Se	Mean	Se
Level of HH wealth	0.6227	0.41257	0.6984	0.46759	0.726	0.38624	0.4381	0.30771

*T-test of significance in areas

Source: Fieldwork (November, 2009)

Table 3A : Independent T-test household wealth in Wandiege and Bandani

	Levene's Test for Equ		t-test for Equality of Means						
Household Wealth								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-taile	Mean Differe	Std. Error Differe	Lower	Upper
Equal variances assumed	5.354	0.022	3.628	121	0	0.26032	0.07175	0.11827	0.40236
Equal variances not assumed			3.664	108	0	0.26032	0.07105	0.11948	0.40116
									n=184

Source: Fieldwork (2009).

Table 4A: Household source(s) of water and characteristics

	Total (n=184)		Wandiege		Nyallenda		Bandani	
	N	%	N	%	N	%	N	%
Household Connection								
Not connected	116.0	63.1	34.0	29.3	22.0	19.0	60.0	51.7
Connected	66.0	35.9	28.0	42.4	38.0	57.6	0.0	0.0
Disconnected	2.0	1.0	1.0	50.0	1.0	50.0	0.0	0.0
Total	184.0	100.0	63.0	34.2	61.0	33.2	60.0	32.6
Main source of water								
Piped water, individual connection	87.0	47.3	44.0	50.6	42.0	48.3	1.0	1.1
Water kiosk	45.0	24.5	17.0	37.8	18.0	40.0	10.0	22.2
surface water (spring/river/well)	44.0	23.9	0.0	0.0	1.0	2.3	43.0	97.7
Other surface water	8.0	4.3	2.0	25.0	0.0	0.0	6.0	75.0
Total	184.0	100.0	63.0	34.2	61.0	33.2	60.0	32.6

Sources: Fieldwork (2009).

Table 5A: Main source of water and type of treatment

	All types (Total)		Individual connection/piped water		Water kiosk		Surface water		Other type of source	
	N	%	N	%	N	%	N	%	N	%
Treat the water?										
No	65	35.3	29	44.6	20	30.8	15	23.1	1	1.5
Yes	119	64.7	58	48.7	25	21.0	29	24.4	7	5.9
Total	184	100.0	87	47.3	45	24.5	44	23.9	8	4.3
Type of treatment										
No treatment	60	32.6	29	48.3	18	30.0	15	25.0	1	1.7
Boiling	21	11.4	15	71.4	3	14.3	2	9.5	1	4.8
Chemicals	100	54.3	44	44.0	23	23.0	27	27.0	6	6.0
Boiling + Chemicals	3	1.6	2	66.7	1	33.3	0	0.0	0	0.0
Total	184	99.9	90	48.9	45	24.5	44	61.5	8	4.3

Table 6A: Fetching water

	Total (n=184)		Wandiege		Nyalenda		Bandani	
	N	%	N	%	N	%	N	%
Who fetches?								
On plot (no-one fetches)	42	22.8	16	38.1	24	57.1	2	4.8
One of the children	38	20.7	13	34.2	9	23.7	16	42.1
Head household fetches	77	41.8	22	28.6	20	26.0	35	45.5
Worker/Private Water Vendor	16	8.7	9	56.3	1	6.3	6	37.5
All fetch	11	6	3	27.3	7	63.6	1	9.1
Total	184	100	63	34.2	61	33.2	60	32.6
Time taken								
0 minutes	50	27.2	19	38.0	27	54.0	4	8.0
1-15 minutes	49	26.6	15	30.6	23	46.9	11	22.4
15-30 minutes	37	20.1	18	48.6	6	16.2	13	35.1
30-60 minutes	40	21.7	10	25.0	5	12.5	25	62.5
60-180 minutes	8	4.3	1	12.5	0	0.0	7	87.5
Total	184	100	63	34.2	61	33.2	60	32.6
School going children								
No effect	135	73.4	45	33.3	51	37.8	39	28.9
Minor effect	14	7.6	6	42.9	5	35.7	3	21.4
Affects children school going behavior	35	19	12	34.3	5	14.3	18	51.4
Total	184	100	63	34.2	61	33.2	60	32.6

Sources: Fieldwork (2009).

Table 7A: Household Health

	Total (n=184)		Wandiege		Nyalenda		Bandani	
	N	%	N	%	N	%	N	%
Has any member of this household suffered from any diseases this year?								
Yes	52	28.3	14	26.9	13	25.0	25	48.1
No	120	65.2	45	37.5	44	36.7	31	25.8
Don't Know	12	6.5	4	33.3	4	33.3	4	33.3
Total	184	100	63	34.2	61	33.2	60	32.6
Costs of visit to hospital								
Less than Ksh 300	6	3.3			2	33.3	4	66.7
300-600 Ksh	10	5.4	4	40.0	5	50.0	1	10.0
600-1000 Ksh	9	4.9	4	44.4	1	11.1	4	44.4
More than 1000 Ksh	15	8.2	4	26.7	2	13.3	9	60.0
Total	40	21.7	12	30.0	10	25.0	18	45.0
Diseases (if applicable)								
Amoeba	8	4.3	1	12.5	3	37.5	4	50.0
Typhoid	26	14.1	9	34.6	6	23.1	11	42.3
Malaria	3	1.6	1	33.3	0	0.0	2	66.7
Other stomach related	9	4.9	2	22.2	3	33.3	4	44.4
Cholera	9	4.9	2	22.2	2	22.2	5	55.6
Total	55	29.9	15	27.3	14	25.5	26	47.3
Effect on school going children and income activities of disease(s)								
Income generating activities	13	7.1	4	30.8	2	15.4	7	53.8
School activities	4	2.2	2	50.0	1	25.0	1	25.0
Both	31	16.8	10	32.3	9	29.0	12	38.7
Total	48	26.1	16	33.3	12	25.0	20	41.7

Table 8A: Sanitation

	Total (n=184)		Wandiege		Nyalenda		Bandani	
	N	%	N	%	N	%	N	%
Access to a sanitation facility								
Yes	176	95.7	62	35.2	60	34.1	54	30.7
No	7	3.8	0	0.0	1	14.3	6	85.7
What type?								
Traditional pit latrine	143	79.9	44	30.8	45	31.5	54	37.8
Improved pit latrine	19	10.6	11	57.9	7	36.8	1	5.3
Modern Ablution	5	2.8	2	40.0	3	60.0	0	0.0
Flush toilet	7	3.9	1	14.3	6	85.7	0	0.0
Distance in meters between pit latrine and water source, or distance from home to pit latrine?								
0 - 5 m	18	24.3	9	50.0	9	50.0	0	0.0
6 - 15 m	28	37.8	11	39.3	10	35.7	7	25.0
16 - 30 m	13	17.6	6	46.2	3	23.1	4	30.8
31 - 100 m	15	20.3	9	60.0	5	33.3	1	6.7
Sanitation shared?								
Yes	128	72.7	36	28.1	40	31.3	52	40.6
No	47	26.7	25	53.2	19	40.4	3	6.4
With how many people?								
0 - 5	11	20.6	5	45.5	6	54.5	0	0.0
6 - 10	20	37.7	8	40.0	9	45.0	3	15.0
11 - 15	6	11.3	1	16.7	3	50.0	2	33.3
16 - 30	10	18.9	9	90.0	1	10.0	3	30.0
31 - 50	6	11.3	3	50.0	0	0.0	3	50.0

Sources: Fieldwork (2009).

Table 9A: Number of households and Consumer/Worker-ratio

score	N	Percent
0.2	1	0.5
0.29	1	0.5
0.33	5	2.7
0.5	6	3.3
0.6	2	1.1
0.67	7	3.8
0.71	1	0.5
0.8	2	1.1
1	21	11.4
1.25	1	0.5
1.4	1	0.5
1.5	23	12.5
1.67	11	6
1.75	1	0.5
2	37	20.1
2.33	6	3.3
2.67	2	1.1
3	22	12
3.5	8	4.3
4	6	3.3
4.5	5	2.7
5	8	4.3
7	4	2.2
8	3	1.6
Total	184	100

Table 10A: Who fetches?

Area of Interview		Frequency	Percent
Wandiege	not applicable/o nplot	30	22.9
	household head	45	34.4
	child (male)	8	6.1
	child (female)	32	24.4
	other	16	12.2
	Total	131	100
Nyalenda, Katuoro	not applicable/o nplot	33	33.7
	household head	31	31.6
	child (male)	4	4.1
	child (female)	27	27.6
	other	3	3.1
	Total	98	100
Bandani	household head	64	46
	child (male)	1	0.7
	child (female)	61	43.9
	other	13	9.4
	Total	139	100
Total N		384	

Table 11A: Tariff structures Wandiege

Type (connection charges)	Domestic	Kiosk	Institutions
Application	100 Ksh	100	100
Water deposit	1000 Ksh	10000	5000
Allocation	1000 Ksh	2000	3000
Meter rent	75 Ksh	100	150
Total	2175 Ksh	12200 Ksh	8250 Ksh

Table 12A: Tariff structures Nyalenda

Type (connection charges)	Domestic	Kiosk	Institutions
Application	200	200	200
Water deposit	1800	10000	2500
Allocation			
Meter rent	Dependant on meter size? From 150ksh to 5000 ksh		
Total			

Sources: Fieldwork (2009).

Table 13A: consumption prices per m3

	Wandiege	Ksh		Nyalenda	Consumption ksh/m3
Domestic	0 - 6 m3	200,=		0-6	200
	7-20	25		6-20	50
	21-40	30		21-40	65
	41-60	45		41-100	80
	Over 60	75		100-300	100
				Over 300	130
Approved kiosks	0-180	27.50		Fixed	35
	181-250	31.50			
	Over 250	40.95		0-6	40
Institutions	0-20	30		6-20	50
	21-40	35		21-40	65
	41-60	40		41-100	80
	Over 60	50		100-300	100
				Over 300	130

Table 14A: Correlation household wealth and age

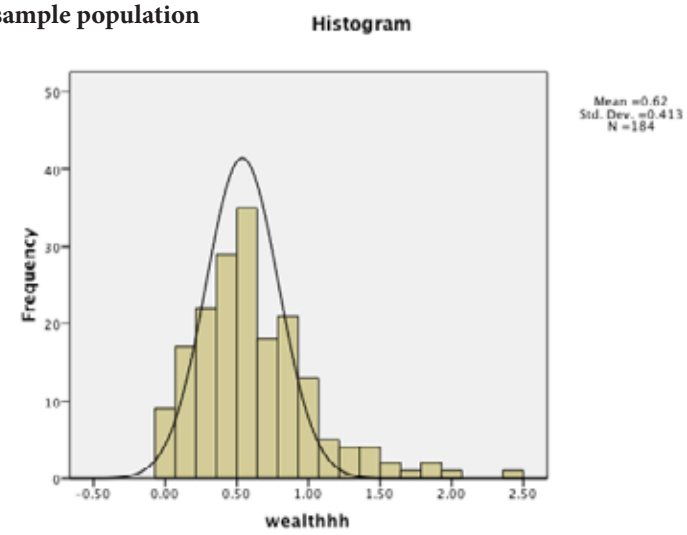
		Age
Pearson Correlation	Wealth	0.11
Level of significance		0.136
N		184

source: Fieldwork (2009)

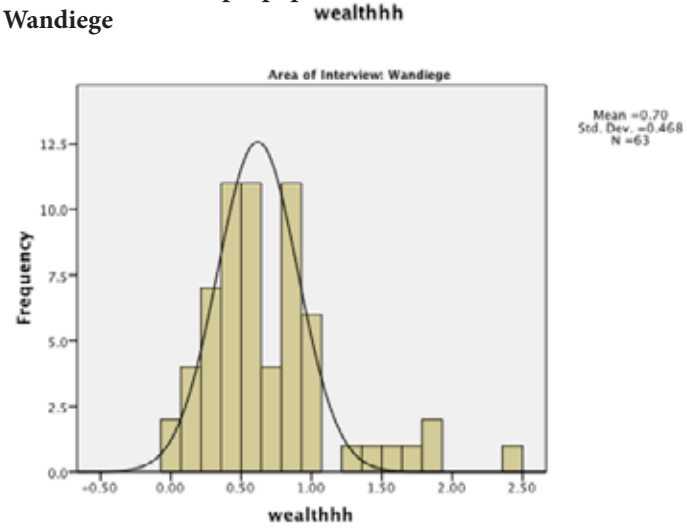
Sources: Fieldwork (2009).

Appendix Section 4 Distribution of sample population and normal curve

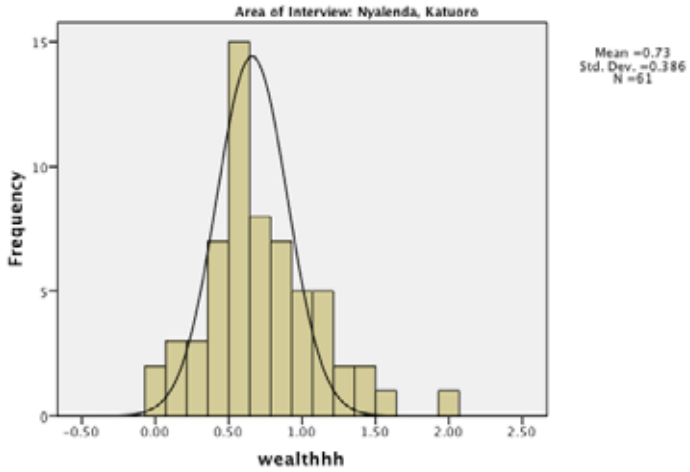
Distribution of sample population and normal curve of sample population



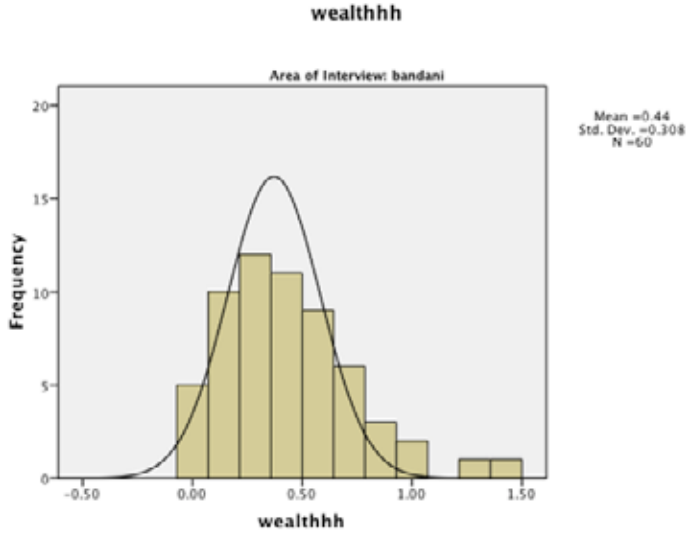
Distribution of sample population and normal curve of Wandiege



Distribution of sample population and normal curve of Nyalenda B



Distribution of sample population and normal curve of Bandani



source: Fieldwork (2009)