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Pre-paid water handpumps in West-Uganda

Evaluating the outcomes from the perspectives of communities, NGOs and local governments

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List of abbreviations

CBM	Community Based Management
CPR	Common Pool Resource
DP	Design Principle
FWG	Framework for Water Governance
NGO	Non-Governmental Organization
OMS	Online Monitoring System
SCOT	Social Construction of Technology
SSA	Sub-Saharan Africa
UGX	Ugandan Shillings
WASH	Water, Sanitation and Hygiene
WUC	Water User Committee

1. Introduction

1.1 Problem statement

The majority of people in Sub-Saharan Africa (SSA) rely on hand pumps for their safe drinking water supply (Nekesa & Kunanyi, 2012). Yet, around thirty-five percent of these rural hand pumps are not functioning, often due to technical breakdowns (Harvey & Reed, 2006; Jiménez et al., 2017). Among multiple reasons for these technical breakdowns are a lack of affordability by communities and improper management structures within the community (Harvey & Reed, 2006). Other reasons for technical breakdowns are system age and an absence of user fee collection, which is a prerequisite of handpumps to function well (Foster, 2013). As a result, large numbers of water points are not being repaired and are left dysfunctional (Whittington et al., 2009).

In the 1990s it was broadly recognised that the state-led ideal for provision of water ignored and declined rural areas in Sub-Saharan Africa (Harvey & Reed, 2006; Moriarty et al., 2013). In places where the state did provide water, users expected access to be free. Next to that, they did not see maintenance as their responsibility. This attitude is still present (Jones, 2011; Whittington et al., 2009).

To improve access to water in those rural areas, the Community Based Management (CBM) model was widely implemented and trialled (Briscoe & Ferranti, 1988; Van den Broek & Brown, 2015). In this model communities request access to water, they decide together on which technology to use, they contribute towards the construction of the technology (only 5-10%, the bigger part is subsidized by Non-Governmental Organizations (NGOs) and the local government), they voluntarily manage the water source and financially contribute to its repair (Briscoe & Ferranti, 1988; Van den Broek & Brown, 2015).

Managing the water source requires forming a self-regulating institution, the key concept of the CBM model (Mosse, 2006). This concept arises from the Common Property Resource (CPR) theory and Ostrom's work (Ostrom, 1990; Ostrom et al., 1999).

Ostrom's work results from her wide-ranging study of CPR systems, after which she enumerated eight design principles (DPs), see fig. 1 (Ostrom, 1990). Those principles empower users to participate in collective action leading to sustainable management. The DPs were present in CPR systems that lasted for a long time, but they were absent in collapsing CPR systems.

<p>1. Clearly defined boundaries Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined, as must the boundary of the CPR itself</p> <p>2. Congruence between appropriation and provision rules and local conditions Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labour, material, and/or money</p> <p>3. Collective-choice arrangements Most individuals affected by the operational rules can participate in modifying the operational rules</p> <p>4. Monitoring Monitors, who actively, audit CPR conditions and appropriator behaviour, are accountable to the appropriators or are the appropriators</p> <p>5. Graduate sanctions Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, by officials accountable to these appropriators, or by both</p> <p>6. Conflict-resolution mechanisms Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials</p> <p>7. Minimal recognition of rights to organise The rights of appropriators to devise their own institutions are not challenged by external governmental authorities <i>For CPRs that are parts of larger systems:</i></p> <p>8. Nested enterprises Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities, are organised in multiple layers of nested enterprises</p>

Figure 1: Ostrom's design principles for managing a CPR (Ostrom, 1990)

In Ostrom's work individuals collectively develop institutions to control their behaviour. This way, they enhance 'productive outcomes in situations where temptations to free-ride and shirk are ever present' (Ostrom, 1990). Managing the water source is often done by a Water User Committee (WUC), which consists of 6 till 9 members with at least 3 women, all elected by the users of the water pump. The WUC involves a chairperson, a treasurer, a secretary, a caretaker and general committee members. The WUC manages the water source, takes care of the hygiene in the area surrounding a water pump, the maintenance of the water pump and many other organisational tasks (Whittington et al., 2009).

However, water management is often fixed in social life; networks, personal interactions and the use of social norms. These social networks often exist outside the developed institutions to govern users' behaviour (Cleaver, 1999). Therefore, it is questionable whether or not the success stories from Ostrom (1990) about small-scale collective actions in fisheries, canal irrigation schemes and forests are applicable to drinking water.

As mentioned before, users do not only manage the water source, they should also pay for the water; treat it as a commodity. This coincides with the 1992 Dublin Principles, in which international donors and governments declared water to be an economic good (Sara & Katz, 1998). However, the Human Right to water makes water an unusual case, because excluding users for not paying (a penalty of the CPR theory and a design principle from Ostrom) is hard to enforce on social and ethical level. Multiple studies indicate that the most challenging task of the WUC is to collect fees from the users, since WUCs find it hard to enforce sanctions to those who refuse to pay (Van den Broek & Brown, 2015; Mugabi & Kayaga, 2010). Therefore, water is also known as an 'uncooperative commodity' (Bakker, 2003).

Because excluding users for non-payment seems impossible, solutions have to be put forward to make sure that those who use the pump pay for fetching water. One of them is a technical solution within the existing CBM approach; a pre-payment system, in which users are required to pay before they fetch water.

A pilot with a pre-payment system has been running in the surroundings of Fort Portal, West Uganda, where two pre-payment systems are installed in two villages in October 2016. It is unknown what the effects of these pre-payment systems are on the current management strategies in use (CBM), and thus, how and why the community arranges itself around the new technology. This includes views from the water users and other stakeholders, such as the involved NGOs and the local government, on the new technology. Next to that, it is unknown whether or not paying for water leads to social exclusion, something multiple academics fear for (Whittington, Davis & McClelland, 2009; Marson & Savin, 2015).

1.2 Research aim and sub-research questions

Therefore, the **aim of this research** is to evaluate the outcomes of pre-paid water handpumps in West Uganda from the perspective of communities, NGOs and local governments.

This evaluation is disaggregated by answering the following sub research questions:

1. *What are the effects of the pre-paid water handpump implementation in rural West Uganda?*
2. *What are the perceptions of communities, NGOs and local governments in rural West Uganda on the pre-paid water handpump technology, and what recommendations do they make to manage the pre-paid water handpump?*

The first sub research question will focus on the pre-paid system itself, e.g. how it functions and how it differs from the previous system. Furthermore it will focus on the direct effects of

the pre-payment system, e.g. exclusion, both short and long term. In this research question the link with the CBM approach is present; what has changed regarding people's behaviour, choices and management? Lastly, this question serves to make a comparison with villages with a different payment strategy. This links with the CBM approach as it unravels how the communities in the villages with different strategies arrange themselves. The second sub research question will look into the views and opinions of all relevant stakeholders towards the pre-payment technology. Furthermore, this question will focus on recommendations by the relevant stakeholders to improve the pre-payment technology. This also includes a link with the CBM approach. This question will not look into what has changed, but why it changed, e.g. why people make and made certain choices.

2. Theoretical Framework

Ostrom's DPs are widely used to characterise and analyse self-governance strategies. During the analysis the DPs are assessed as present or absent (Delgado, Ramos & Zapata, 2017). However, Delgado, Ramos & Zapata (2017) argue this is simplifying the real situation, as DPs can be present at a certain level (a gradation of presence). Next to that, using DPs to analyse self-governance strategies gained more critiques: the measurement validity for small samples (Araral, 2014), the troubles in measuring outcomes reliably (Agrawal, 2014), the complications to unravel causal complexity and the lack of comparability between different cases (Delgado, Ramos & Zapata, 2017).

Therefore, the combination of two other theories (see fig. 2) is used to analyse the change in management strategies after introducing pre-payment systems; the theory of Social Construction of Technology (SCOT) (Bruun & Hukkinen, 2003; Pinch & Bijker, 1987; Mackenzie, 1999) and the Framework for Water Governance (FWG) (Franks et al., 2013; Franks & Cleaver, 2009; Franks & Cleaver, 2007).

SCOT argues that human action is not determined by technology, but that human action determines technology. To understand the reasons for rejecting or accepting a technology and to understand the way that a technology is used depends on its embedding in its social context. Therefore SCOT looks at human actions and social context for understanding the use of a new technology. SCOT identifies three aspects of technological change; interpretative flexibility, closure and stabilization, and technological frame. Interpretative flexibility means that different actors have different meanings and understanding of the technology. Closure and stabilization is the process in which different social groups come to an agreed understanding of the technology. Lastly, the technological frame are the social and material conditions which are present. Looking at human actions and social context by focusing on these three aspects will help to unravel the different levels at which DPs can be present, rather than simply marking them as present or absent. Next to that, by focusing on the three aspects SCOT asks the question which social groups and which interests shaped the the new technology.

The FWG is an analytical framework for understanding water governance as interlinked processes with variable practical outcomes for users rather than a set of abstract principles. The framework is based on linkages between resources which are available to the society, the mechanisms that shape access to water and the outcomes of these mechanisms. Those linkages are influenced and shaped both by management processes and by stakeholders. The framework is able to account for complexities of water governance, because agents, processes, resources and mechanisms form a complete construct. Therefore, the framework is better able to unravel causal complexity than the DPs. Next to that, by using a complex framework the reliability of the measurement of the outcomes will be higher.

In short, SCOT and the FWG dive more into the reasons for the way communities arrange themselves around the new technology. The focus is put on the *why* of these types of arrangement; *why* do people make certain choices, and more importantly, on the *connection* between the different elements in the framework, something Ostrom's theory lacks. The adapted FWG analyses the actors' behaviour by looking at their resources, mechanisms and processes. This shows that a community's behaviour is linked to different aspects, and thus, that CBM depends on different factors. The framework shows well that it is a non-linear process in which all elements are connected to each other, and is thus also able to show why certain outcomes are as they are, e.g. whether or not, and why, people are socially excluded. The three aspects of SCOT are included in this figure.

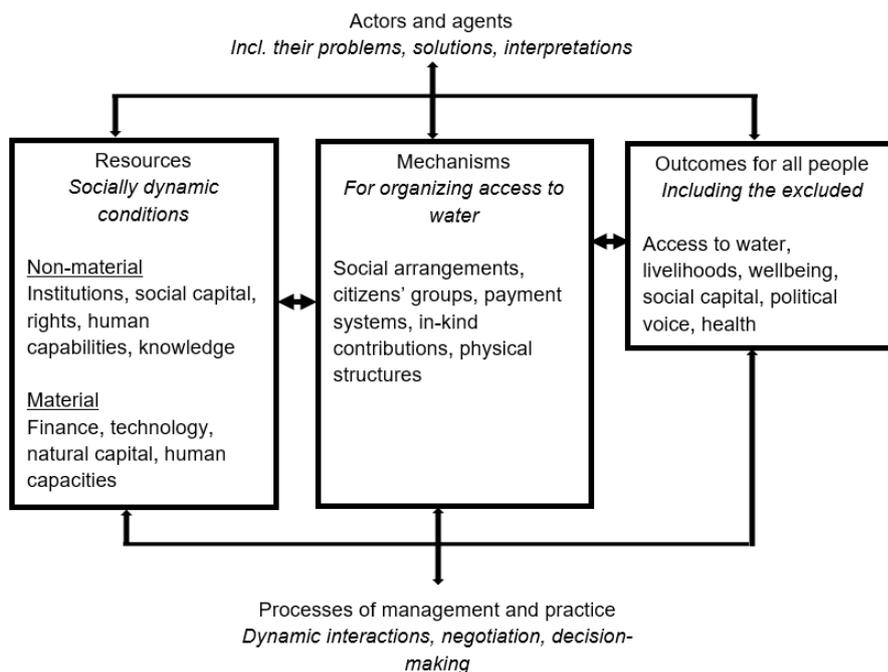


Figure 2: Framework for Water Governance including SCOT (adapted from Franks & Cleaver, 2009)

In the FWG *agents* are all actors one could think of, e.g. the government, public sectors, private sectors, third sectors and citizens. This will help to identify and describe the actors, and to show controversy by identifying actors' problems, solutions and interpretations. This will also show which groups are able and/or willing to pay for their water. This is complementary to the first aspect of SCOT, which only shows the differences in interpretation per group. However, the FWG also reminds researchers to think of groups who are somehow associated with the new technology, but who did not (yet) develop an interpretation or attitude towards the new technology. In short: the FWG reminds to not forget those who are not directly clearly involved (and perhaps not seen by SCOT).

Processes are the conscious and unconscious activities of negotiation and decision-making, e.g. processes of management and practices of daily lives. These influence both the resources, mechanisms and outcomes of water governance. Looking at these processes will help to examine what interactions took place before the pre-payment system was installed. SCOT hereby helps with its focus on closure; which social groups interacted with each other? Did they come to an agreed understanding or not? This will also provide information about whether or not all groups were involved in the decision-making processes, as Bijker (1996) argues that

some groups might be excluded from the decision-making process in reaching closure. Investigating the narratives of all relevant social groups provides rich insight and understanding of interactions, and thus helps to analyse the sense-making process (MacNaghten, Davies & Kearnes, 2015).

Resources are split up in material resources, such as finance and technologies, and non-material resources, such as social capital, knowledge, human capabilities and institutions. Identifying these will help to unravel the conditions that are currently present to manage the pre-payment system. For example, this will provide valuable information about the fact whether or not the water handpump is likely to be repaired or not due to the presence or absence of financial resources. SCOTs third aspect of technological change, the technological frame, is complementary to the element resources in the FWG, as SCOT puts more focus on the wider socio-political milieu. Identifying the socialcultural and political situation of a social group is useful, as this shapes the groups norms and values and thus influences the meaning given to an artefact (e.g. the payment system).

Mechanisms are context-specific arrangements for organizing the access to water, for example institutions (arrangements between people, e.g. WUCs) or particular technologies, e.g. payment systems. Those mechanisms are not fixed arrangements, but are arrangements that are negotiable and likely to change over time. For example, a mechanism drawing on *social resources* includes arrangements to access water through gendered relations or particular families, and a mechanism drawing on *resources of rights* includes legislated minimum quantities of water. SCOT only mentions dynamic interaction between social groups, but does not mention *why* these interactions take place. Therefore, the key concept *mechanisms* from the FWG is expected to be of added value to SCOT. In line with the question whether or not all social groups are able or willing to pay, this could provide information on whether or not special mechanisms are developed for those groups. Next to that, SCOT is expected to be of added value to FWG; SCOT identifies the specific construction of the technology (closure), and thus the mechanisms that are developed, which are crucial for the outcomes.

Outcomes are for example social relations, processes of inclusion and exclusion or power structures. Again, SCOT only mentions dynamic interaction and closure between people, but leaves out outcomes for all people affected. By only focusing on the dynamic interaction, SCOT does not show structural exclusion, e.g. minority groups who are not mentioned in the whole process (MacKenzie, 1999), e.g. poor people. Furthermore, outcomes may include well-being and health status, which are likely to change when people vary in using different water sources.

Looking at all aspects described above, some predictions about the outcomes of the pre-payment system are made. First, it is clear that the new system is accessible for those who have sufficient money (financial resources) at the moment they fetch water. However, people without much financial resources will not be able to make use of the pre-payment mechanism, and will therefore be excluded from access to the water source. Secondly, the pre-payment mechanism is expected to solve the problems of collecting user fees and thus ensures the WUC of receiving sufficient money, needed for repair and maintenance. Performing regular maintenance will make sure that the system keeps working (outcome; continuous access). Therefore, the following **hypotheses** are formulated: *1. The pre-payment system decreases water accessibility for poor villagers. 2. The pre-payment system prevents that, in case of a break down of the handpump, the hand pump remains out of function due to lack of funds for a repair.*

3. Methodology

The objective of this study was to evaluate the outcomes of pre-paid water handpumps in West Uganda from the perspective of communities, NGOs and local governments. According to SCOT and the FWG two hypotheses are formulated. The hypotheses state that poor villagers have no access to the pump, and that the pump is not likely to remain out of function after a break down. To test these hypotheses first an investigation of the actors is needed; who are they and what interests do they have? Next to that, it is valuable to know whether those social groups fetched water from the borehole before installation of the pre-payment technology or not. If this has changed, the social and technical mechanisms which caused these changes must be examined. Furthermore, other outcomes which popped up after installing the pre-payment system must be investigated, as well as the mechanisms that lead to these outcomes. Those mechanisms are influenced by management processes, so they have to be investigated as well. An adequate way to investigate all these elements is a case study. In the following paragraphs will be explained how this case study was performed.

3.1 Area background information

As mentioned before, a pilot with a pre-payment system has been running in the surroundings of Fort Portal, West Uganda, where two pre-payment systems are installed in two villages in October 2016. This is done by two local NGOs in cooperation with two Dutch NGOs. Fort Portal lies in the district Kabarole, which has an equatorial climate, with a lot of rain and sunshine, however moderated by the average altitude of around 1500 meters. The region has two rainy seasons, March till May and September till November (Uganda Bureau of Statistics, 2017b). Due to logistical reasons the data was collected mainly in the rain season, from the 18th of September till the 24th of November.

In Uganda 82% of the inhabitants lives in rural areas and water stress in 2025 is estimated due to rapid population growth of 3% per annum and ongoing degradation of wetlands that regulate the groundwater system (World Bank, 2016).

Two pre-paid systems are installed on already existing boreholes, one in the village Kibasi and one in Rwankenzi. These villages lie in the sub-counties Hakibaale and Kasenda. In both sub-counties access to safe water is a big issue, with respectively 49,2% and 65,2% households lacking access to safe water (see fig. 3). Safe water means clean and uncontaminated drinking water from a protected water source, which is defined as piped water, a protected well or spring, gravity flow systems, bottled water or boreholes (Uganda Bureau of Statistics, 2017a).

Map 9: Percentage Distribution of Households without access to Safe Water; Kabarole District, 2014

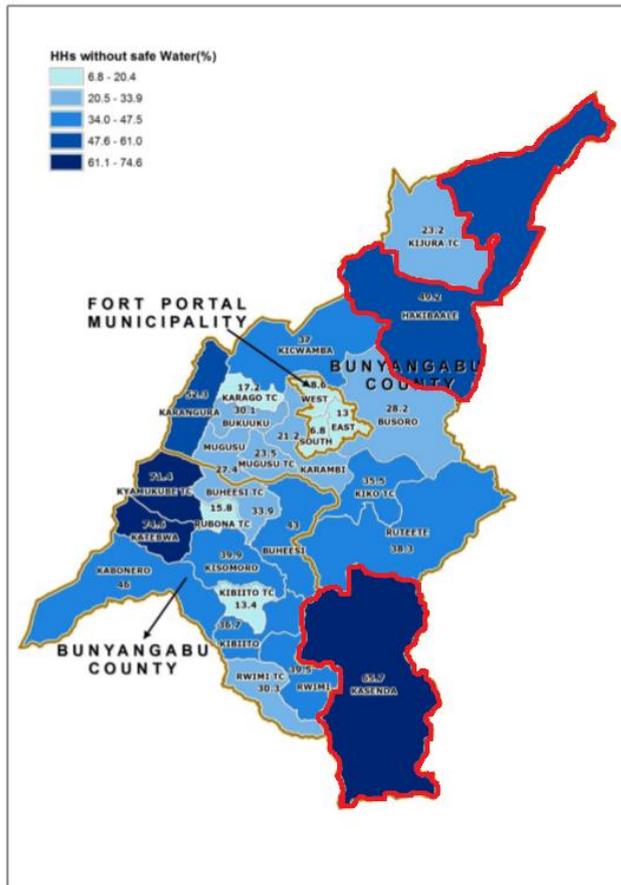


Figure 3: % Households lacking safe water access, Hakibaale and Kasenda sub-county (adapted from Uganda Bureau of Statistics (2017a))

A household survey from Uganda Bureau of Statistics (2017b) shows that in Hakibaale sub-county almost 50% of the households use an un-protected source of drinking water. In Kasenda sub-county this percentage is even slightly higher than 65%. In 2014 in Kabarole district 23,6% of the households were using a borehole (Uganda Bureau of Statistics, 2017a). Furthermore, in 2008/2009 in Uganda only 37% of rural households are used to paying for their water (Foster & Hope, 2017).

The population size of the villages is comparable; according to records from the Local Council there were 232 households in Rwankenzi in early 2017. Precise records from Kibasi are lacking, but in early 2017 there were between 200 and 250 households in Kibasi. In the district the average amount of people per household is 7.

3.2 The case

As mentioned before, the two pre-payment systems are installed on already existing boreholes. Users receive a token to get access to the pump; after payments at a kiosk in the village users receive virtual credits on their token. Only then they are able to fetch water at the pump, where they will lose a certain amount of credits for every litre water they fetch. All transactions, both the transactions at the kiosk and the water pump, are recorded in an Online Monitoring System (OMS). This OMS contains information about the amount of transactions, the size of the transactions and the amount of water users fetch, all including date and time specification. Next to that, all tokens contain profiles with socio-economic information, such as the size of the

household, the household income, etc.). Therefore, those two cases offer the opportunity to collect quantitative (the OMS) and qualitative data (observations, interviews, etc.) as well.

Therefore, a mixed-methods approach was used to collect data. The OMS was examined and the researcher looked for patterns as well as inconsistencies in the water use over time and for relations between socio-economic characteristics of water users and water use. In line with the first hypothesis, it is expected that people with a lower income will use less water than those with a higher income. Furthermore, the researcher looked for other inconsistencies which came to light during the investigation. This dataset was then used as input for semi-structured interviews, which, together with (participant) observations, were used to interpret the quantitative data.

3.3 Informants

The objective from this study states to gain understanding of the perspectives of communities, the NGOs and the local government. Therefore these three groups were approached and were the main subjects for investigation in both villages.

There has been contact, knowledge-sharing and interviews with five local NGO workers. Both NGOs are situated in Fort Portal. One of them works in Rwankenzi, the other one in Kibasi. In Rwankenzi 5 WUC members and the kiosk owner are interviewed, in Kibasi 7 WUC members, including the kiosk owner (also WUC member). Furthermore, 23 and 13 inhabitants were interviewed in Rwankenzi and Kibasi respectively.

Next to that, the researcher went to villages with boreholes without the pre-paid system, to be able to compare that situation with the situation in Kibasi and Rwankenzi. Both villages, Kakinga and Mugusu, were situated in the same sub-counties to reduce the change of big differences in external factors (matching (De Vaus, 2013)). In both villages two WUC members and two villagers were interviewed.

Moreover, the Kabarole District Officer and Secretary of the Kasenda council (both local government) were interviewed.

Additionally, the researcher attended a WASH (Water, Sanitation and Health)&Learn meeting in Kibaale district (West Uganda), organised by one of the cooperating Dutch NGOs, where different NGOs from Kenya, Tanzania and Uganda, including the two NGOs from Fort Portal, discussed, among other things, water as a business. Experiences and knowledge was shared and provided valuable information for the researcher.

3.4 Methods and analysis

Fieldwork of ten weeks gave the opportunity to go back to respondents to ask new questions and to do more elaborate in-depth interviews. By participant observation (collecting and carrying water at the pumps/lakes/river/shallow wells, paying at the kiosks, repairing malfunctionalities at both the pumps and kiosks and observing household life such as cooking, washing and boiling water) the researcher was able to familiarize herself to the ethnographic field, which is the site where people collect the water (borehole compound). This opened up the research topic and reduced reactivity (Bernard, 2011), which means that studying the process of collecting water in real-time avoided people from adapting their story or behaviour. Furthermore, this way cultural empathy was gained by experiencing events and phenomena from the perspective of the investigated people. Notes were taken during observing the borehole-compound. Those observations were unstructured, which means the data was recorded without predetermined criteria (O'Leary, 2004), in order to search for emergent patterns later on.

The interviews with the local government, the two involved local NGOs, WUC members and inhabitants of the villages (users and non-users of the pump) were semi-structured. During the semi-structured interviews, a topic-list (see attachment 1) was used to make sure all topics that needed to be covered were so. Questions about factual information were asked, such as where, when, why and how much water people take at which water source. Also, questions about factual information about the WUC were asked, such as management of the money, and task division within the WUC. Next to that questions about people's opinion on the pre-payment system were asked, such as the benefits from the new system compared to the old system and recommendations people make to improve the new system. Those improvements could range from social improvements, such as communication or WUC arrangements, to technical improvements for the pre-payment system. Furthermore, for each respondent the social position was evaluated, to unravel what kind of person was talking, e.g. social welfare, number of people in household, job, etc.

Performing semi-structured interviews gave the researcher freedom to elaborate on topics further when this seemed to be relevant. Furthermore, in this way the researcher showed the participant to be prepared, but did not exercise excessive control (Bernard, 2011). The interviews were performed one-on-one as well as in groups, e.g. during WUC meetings, to enhance discussions between the WUC members. Inhabitants were interviewed one-on-one, when approaching them at the borehole compound or at their homes when walking through the villages. One-on-one interviews allowed the researcher to control the process and gave the respondent the freedom to express his or herself (O'Leary, 2004).

The users and non-users were selected non-randomly. The researcher went by households or spoke to them at the borehole compound. This was not just convenience sampling, but the researcher focused on interviewing both men, women and children, both people who lived close and far away from the borehole and people with different backgrounds (jobs). This way of sampling, handpicked sampling, allowed the researcher to study intrinsically interesting cases (O'Leary, 2004). Furthermore, since tokens contain certain profiles (socio-economic data) this information was also used to track down certain households in particular. Next to that, the WUC members, owners of the kiosks and involved NGOs are not chosen randomly as they are fixed.

The interviews with the WUC members, owners of the kiosks and inhabitants of the village in general were informal since the setting was not an office but rather inside households or outside at the borehole compound. This way trust from the respondents was gained. A natural environment was created which was open for honest communication. This way of interviewing closed the gulf between the respondent and the researcher. The interviews with the NGOs and the local government were formal to show a professional behaviour. The researcher showed to be neutral and objective.

Depending on the level of English of the respondents a translator was used. The translators came from the villages itself, in order to gain trust from the respondents. The translators were present at the interviews to translate at the spot.

The interviews were not fully transcribed, but summaries of the relevant answers were put down. These relevant answers were structured (manual coding) according to the topics addressed (see topic-list, attachment 1) to get a clear overview of the results. After manual coding, summaries per topic were made to get an overview of the key points per topic. Those key points were analysed using the theoretical framework, thus, linking the key points to the aspects and relations described by the framework.

3.5 External validity

As for the external validity of this research, it is expected that the results of this study cannot be representative for more villages in SSA, as context per village highly differs and as only two specific villages are examined. However, by comparing and gathering information about multiple sites one might be able to predict certain outcomes of the pre-paid system in other places. However, developing a further theory based on this case study will not be possible.

4. Results: Handpump implementation

In this chapter first the governance will be discussed, followed by the data of the OMS. After that, the situation before the pre-paid installation and the transition period of installing the system will be discussed. Then, the current situation of the villages will be discussed. At last, two villages with boreholes without pre-payment system will briefly be discussed to be able to make a comparison.

4.1 Governance

The Kabarole Water District Officer deals with water supply in the district. His team and NGOs guide communities to maintain the water sources themselves by providing training. The involved NGOs and sub-counties collect data about new constructed water sources and the existing sources and their change of functionality, which is updated by the district government in an online database every year. Concerning this database the Kabarole District Water Officer mentions the following: *‘Once a year is not enough. Because in the dry season the water level will drop and some sources will not function, the water won’t be available. So it would be better when the database was updated every quarter. That would be more accurate, because the functionality depends on the season.’* At this moment the main problem in the villages is mobilisation; villagers do not collect enough revenue to maintain the water sources. In Kabarole district this had tremendous consequences, 600 out of 2000 water sources are out of function! For this, and other reasons concerning water, sanitation and hygiene, the district government and three involved NGOs, including the two discussed in this paper, formed the WASH Alliance. This alliance proposed to introduce pay-as-you-fetch in the whole district, of which the pre-payment system is an example. Nowadays the central government demands every borehole to become pay-as-you-fetch. The district government had meetings with sub-counties and town councils on how to adopt the water sources. Previously many sub-counties would only spend their money on improving the roads, but nowadays they save money for water sources too. This includes money for water meters, as it is a new guideline from the central government that every new source has to be metered. Furthermore, the district government pushed that every committee had to form an institution and register itself at the sub-county, to be able to open a bank account. Besides working closely together with NGOs, the district government also has projects on their own.

Sub-counties have counsellors, which are representatives of all villages. They are responsible for providing information about wealth and water towards the water and sanitation board of the sub-county, who will write a report about the situation every year. Based on that, the council of the whole sub-county decides which steps have to be taken to improve the situation. They will then contact the district government (Kabarole), who will reject or approve the idea, also depending on their funds.

NGOs will always first consult the district and if they approve the ideas then go to the sub-county. NGOs and the government in Kabarole work closely together and decide together where to work. Then NGOs will write proposals to the government, who will decide which idea will can be worked out. Next to that, the NGOs and the government carry out projects together.

Speaking about relations between the different actors, one NGO mentioned they appreciate working with the government, but that they also encounter some irritations: *‘The government can be very influential, because they are affected by politics. So sometimes when a politician argues that village X needs some improvements they would improve that place. But the places they improve... we would not have chosen them.’* The sub-county council also criticises the government: *‘Well I am disappointed in them. In most cases they say ‘we are broke with finance.’*

4.2 Online Monitoring System

During the fieldwork, it became clear that many households shared tokens and that most of the socio-economic data was not entered into the system, which is thus a technical dysfunctionality of the pre-payment system. Intentionally the researcher wanted to perform a statistical analysis on the relation between the socio-economic characteristics of users and water use. However, this was not done as it would threaten the internal validity of the research, because of the missing data. Furthermore, there have been more technical dysfunctionalities; problems with the internet connection and SD cards (both needed to update the OMS) resulted in more missing data; Kibasi has not stored data for 8 months (end of December 2016 till half August 2017). Because of those data gaps, the researcher decided to do no statistical analysis on the amount of water use over a long duration for Kibasi. However, for Rwankenzi a graph could be made about the monthly volumes of water taken (see figure 4). The rainy season is included in the figure. Interviews will show whether or not those two factors are related to each other.

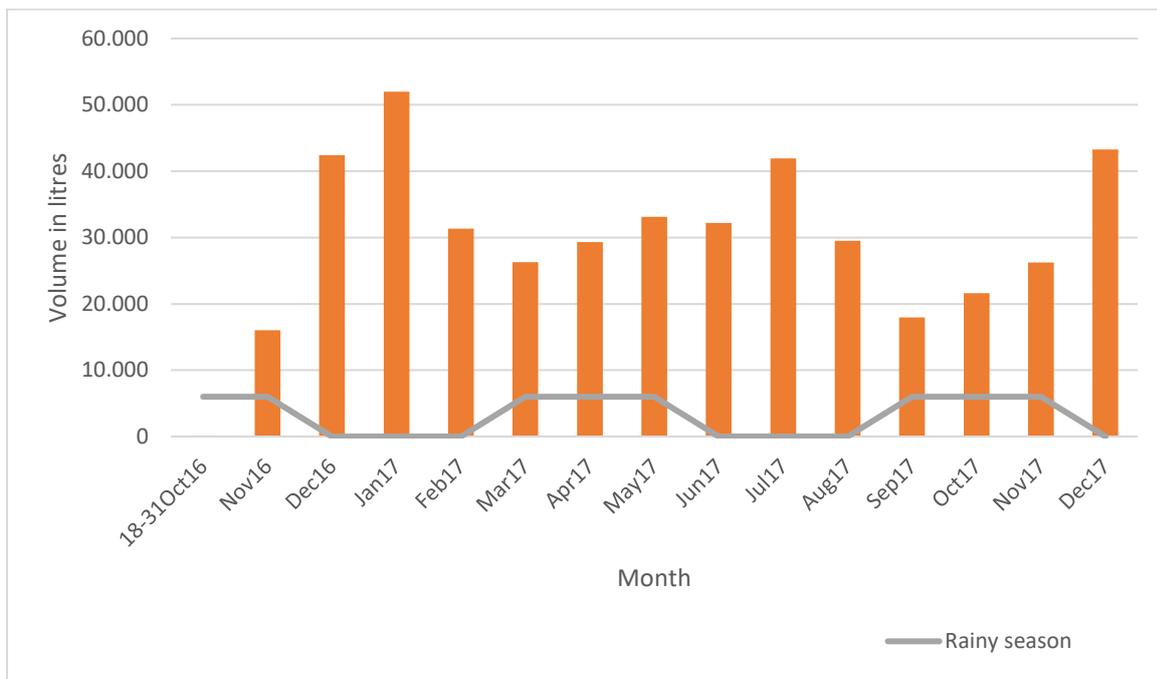


Figure 4: Monthly volumes at the pump in Rwankenzi against the rain pattern

Besides that, an interesting graph about the average volume of water taken during a day could be made, see figure 5. As can be seen, most people fetch water in the morning and early evening. Therefore, the researcher made sure to observe at these times as well. Furthermore, more water is fetched in Rwankenzi, the reasons for this were investigated during the further research. No direct link with the number of inhabitants could be made, as both villages have between 200 and 250 households.

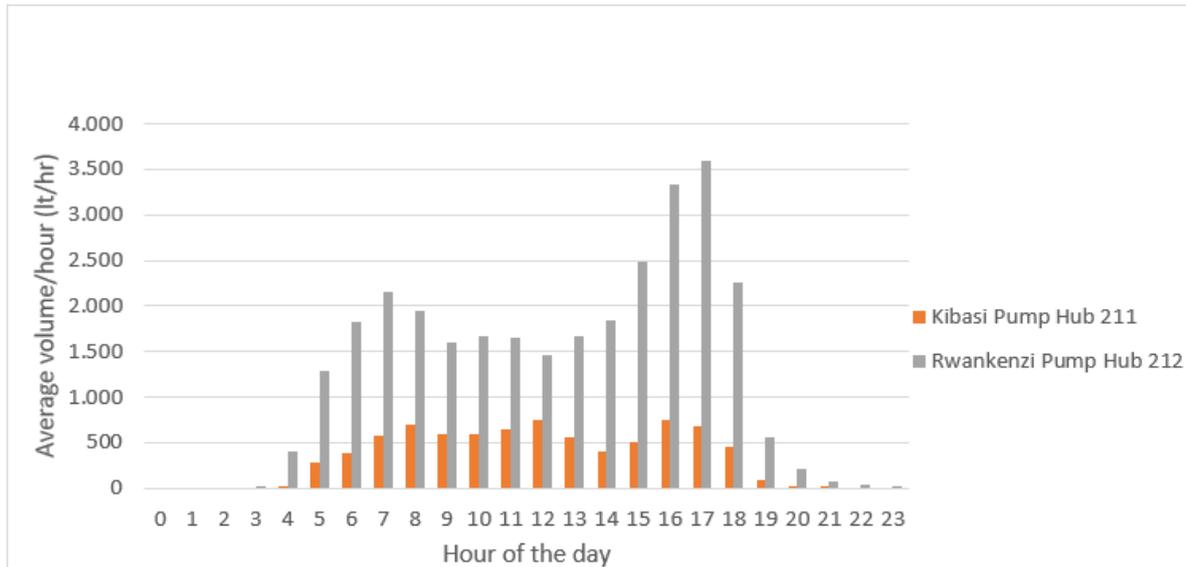


Figure 5: Hourly average volume of water during the day (period July - December 2017)

Next to that, the OMS showed that many tokens are not used at all or not used for a while. This information was used to track down specifically those people to unravel why they stopped using the borehole.

4.3 Situation before installing pre-payment system

The situation in Rwankenzi and Kibasi before installing the pre-payment system is summarized in table 1. In both villages the water pumps were out of function due to a lack of funds for maintenance. WUCs only asked for money when the pump needed reparation (going door by door), but inhabitants refused to pay, and the WUC's became passive. An inhabitant of Kibasi explains: *'Before there was a different committee. It did not work properly. They were lazy and too busy persons, and were committed to other work.'*

Furthermore, both villages did not have other water sources of good quality. Rain water would only be available in the rain season, the hand dug well (an open pit in the wetland) in Kibasi would dry up in the dry season, and crater lakes, the river and shallow wells (hand pumps, not deep) contain diseases. Besides that, when living far away from the river or shallow well, one would have to pay a water vendor ((motor)cyclists who deliver the water at your home) 400 or 500 Ugandan Shillings (UGX, local currency) per jerrycan.

	Rwankenzi	Kibasi
Water pump condition	Down for already six months	Down for a year
Other sources and costs	<ul style="list-style-type: none"> • Crater lakes – For free • River – For free or 400/500 UGX (water vendors) 	<ul style="list-style-type: none"> • Shallow wells – For free or 500 UGX (water vendors)

	<ul style="list-style-type: none"> • Rain water – For free • Previously: gravity pipe system (already down for 3 months, no progress) 	<ul style="list-style-type: none"> • Hand dug well – For free • Rain water – For free
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Table 1: Situation before installing pre-payment system

4.4 Transition period

In Rwankenzi the water pump was relatively cheap to repair, but the community did not have the money. The NGO followed the existing hierarchies and had meetings, first with the Kabarole Water District Officer, then with the sub-county Kasenda, who agreed on the system, and after that with local leaders and the community members.

In Kibasi, the NGO admits to have made one major mistake; not having a meeting with other stakeholders before installing the pre-paid system. A week after the payment system was installed the government installed national water (pipe system), which is easier to fetch as it just flows, no pumping is needed. The Kabarole Water District Officer explains it was the central government who decided to put national water, not the district government: *‘They (national government) decided to extend national water from Fort Portal to Kijura, and Kibasi is on the same road just before Kijura... They decide that once a year. They will identify trading centres (villages) in the need of water and rank them based on the population size.’* National water charges 100 shillings for a 22 litre jerrycan, while the handpump charges 100 shillings for 20 litres. The NGO then sat down with the WUC to discuss what to do: *‘The WUC told me we (the NGO) could not shift the payment system to another village. Because what if the national water breaks down?’* They together decided to change the price to 50 shillings, and to increase the amount of litres from 20 to 22. The NGO is happy with the solution: *‘At least people have the spirit of paying. Let people have a choice!’*

The NGOs both had sensitizing meetings in the villages (see table 2 appendix), organised by the NGOs and the WUC’s together. Mobilisation of inhabitants was done by the WUC’s, in different ways (see table 2 appendix). WUC members in Rwankenzi mentioned this was a challenging task: *‘People did not come. They did not want to come. We called them, all twice. But many still refused.’* A local NGO worker, living in Rwankenzi, explained: *‘It is very rare for this community to attend such thing.’* The meetings in Kibasi seemed more successful, more than twice as many people showed up there, and they held six meetings in total while Rwankenzi only held two. However, Kibasi experienced the same problem as Rwankenzi as one WUC member said: *‘Some are stubborn. Then we call them, two times, but they still won’t come.’* In the meetings, the new WUC was elected by the community and the system was explained thoroughly, including its maintenance and use.

4.5 Current situation

System

Now, both pre-paid boreholes have been functioning for a year. In both villages, the borehole is situated in the village centre on the beginning of a banana field. Water that gets accidentally spoiled flows through a drain to the banana field. In both villages the borehole is surrounded by a fence, to prevent animals dirtying the compound, and to prevent children, who often fetch water, from destroying the crops of the land owner. Nevertheless, children play on, and accidentally damage, the fences.

Users of the hand pump receive a token. After payments (tariffs Kibasi 50UGX per 22litres, Rwankenzi 100UGX per 20litres) at a kiosk in the village they gain access to water by presenting the token at the pump. Credits will be deducted according to the numbers of litres fetched. Energy needed for both systems is derived from two separate solar panels, one at the kiosk and one attached to the pump.

Kiosk owners and WUC members

The kiosk owners and WUC members, all elected by the communities, have their own tasks and responsibilities, summarized in table 3 and 4 (appendix). Interesting differences between the two villages, except for the price difference, is that the kiosk owner in Kibasi receives 20% of all micropayments while the kiosk owner in Rwankenzi receives 10%. Both kiosk owners are controlled by the WUCs. Furthermore, in Rwankenzi, the solar at the pump got damaged two times, so the chairman of the WUC decided to remove the solar panel to charge the battery at home. In Kibasi, the treasurer of the WUC removes the solar panel every evening. Next to that, the WUC in Rwankenzi opened a bank account to store the incoming money. However, the WUC in Kibasi decided not to store so far, since registering and travelling to the bank costs money and time. In both cases the WUCs look after the pump, including its hygiene, and organises WUC meetings every month, and more often if maintenance is needed. Next to that, the WUCs perform church announcements to keep the inhabitants involved and updated. However, they acknowledge not doing that often. Incoming money is used for maintenance, for paying workers to clean the pump compound (e.g. planting grass to prevent mud) and for lunch for WUC members during meetings. Interviews with WUC members separately revealed that the kiosk owner/treasurer and a general WUC member (also chairman of the village) in Kibasi are not satisfied with their chairwoman: *'She is such a greedy person you know. She doesn't even take water here. Please write these complaints down.'* One time she tried to convince the other WUC members of taking 10.000UGX each of the WUC money, for a meeting of one hour. The two complaining WUC members convinced the others to take 5.000UGX each, which still did not please the NGO employee: *'That is still a lot of money... Don't take that much please.'*

Maintenance

When the pumps need maintenance, the WUCs inform the NGOs about this as they do not have the technical skills themselves. *'If something is wrong, we call the NGO.... This happened around four times in the past, when the valve could not rotate because of dirt.'* He also mentions that they have not paid the NGO for the spare parts, only for fuel (20.000UGX each time). In Rwankenzi this is the other way around, they have only paid for the spare parts and not for fuel. Furthermore, in both villages there have been some problems with the internet connection of the kiosk device and pump (needed for the OMS to work well). When working on the internet connection problems, both NGOs mentioned the airtime and internet data which are loaded on the devices monthly are paid by the NGOs (20.000UGX each month), not by the WUC money. The problems with the internet connections were caused by miscommunication with the mobile money shop and incorrect registration of SD-cards in Kibasi and Rwankenzi respectively. Next to that, in Rwankenzi the solar panel got damaged two times (35.000UGX each).

Tokens

As could be seen in the OMS, many tokens are not used at all or not used for a while. Some of them do not need the token. For example, the local NGO worker in Rwankenzi explains that some houses in the centre of the village are rentals, and that some migrating people leave with their token: *'They then hope that the system is also in the city or village they move to, because there is still money on it (the token).'* Furthermore, he explains some people do not use their token yet, because their rain tank still has enough water. Once it will be empty they will start using their tokens.

Next to that, people lose tokens. This happens quite a lot, because most people that collect water are (unobservant) children. Sometimes people with a token do not understand the token well, and are curious, *'some destroy it to see what's in there'*. Therefore, there are *'quite many'* households who share tokens. Due to unclarity about getting a new token many households share instead of requesting new ones. The secretary of the WUC mentions the WUC told the users they can get a new token if they put at least 1.000UGX on it, however, he also mentions that many of them do not request a new one *'because they fear questions.'* When interviewing especially those with long not used or never used credit, most answers relate to the rain (*'still enough rain water'*) or to the token getting lost or stolen. Among those who lost their tokens, some got a new one (or two, for the messy ones) from the WUC, and some decided to share with neighbours since they thought there are no new tokens (not true), or they thought their money had expired (not possible).

In Kibasi people who lost their tokens share them as well. The NGO worker explains: *'It costs like 5.000 for a new token. We don't want them to just take them for granted you know.'* One of the tokens with long not used credit is a primary school, two teachers explain: *'Back then we used it. But then there came a national water tap at our school, very close... and it is free to open and you do not need to pump.'* However, they explain they would have used it when the national water is off, which happens quite some times, only they do not know where the token is. Their current backup is the shallow well (500shillings via water vendors). Furthermore, they think that the money on the token has expired. Others with unused credit mention to use the shallow well, which is for free: *'For me, the shallow well I just fetch water without paying anything. That's the difference that I see.'* One of them mentions to be in the WUC of the shallow well. Collecting money, only when maintenance is needed, seems to be hard, but not impossible and the pump is still working.

Users, non-users, alternative sources and purposes

In both Rwankenzi and Kibasi there are people who use the borehole and people who do not. According to the NGOs *'Everyone should be able to pay at least 20 litres a day. If it is the case they are too poor, then the WUC should come with a solution for them, maybe compensate'*, which is exactly what the WUC in Kibasi did. They identified two households who are too poor: a child-headed household and an old woman, alone, with aids, and decided to give them two jerrycans for free each day. Nevertheless, there are people who prefer other (free) sources over the borehole, because of the payment system. One of them mentions: *'The water was always for free. I know the borehole broke down, but I will not pay. The government, where are they?'*

Furthermore, in Kibasi national water seems to be a serious competitor: *'People use national water, because of distance issues, and because of convenience, it just flows'* (inhabitant Kibasi).

However, for some the borehole is the best second option: *'When the national water is off, then more people use it'* (treasurer WUC), and an inhabitant of Kibasi mentions *'It (the national water) is very unreliable.'* Furthermore, in both villages almost all households who live close to the pump use it. However, when living approximately 400 metres from the pump (see map 1 and map 2 appendix), almost everyone uses alternative sources (mainly national water (multiple taps), rivers and shallow wells). Still the price did not seem to be a problem: *'It's just too far away, a borehole close by would be nice. The price is fine'* (inhabitant Kibasi). Another non-user in Kibasi explains the borehole water makes him thirsty because of the saltiness, next to that he mentions: *'The shallow well is soft water, it's healthier.'* In Rwankenzi the same problem, hardness and saltiness of the water, is at stake; some people who live close to the pump prefer to buy river water from water vendors at 500UGX/jerrycan.

In both villages the amount of litres fetched at the borehole depends on the amount of rain, which corresponds to the results of the OMS: *'I use 8 jerrycans a day, but if it rains just 5.'* Next to that, no one uses the borehole water for washing clothes, as the hard and salt water requires a lot of soap. Most people who fetch water at the borehole use it for cooking, dishwashing, making porridge, making local brew, and drinking water. Bathing is often done with river water (Rwankenzi) or shallow well water (Kibasi).

4.6 Alternative management approaches

In Kakinga, a village about ten kilometres from Rwankenzi (see map 3 appendix), the borehole does not have a pre-paid system. WUC members complain that they have troubles in collecting money, which they only do when the pump breaks down, as people refuse to pay. Depending on the kind of breakdown they ask each household 500 till 1000UGX, however, they do not have a list of the pump users, which makes it hard to decide who to ask for money. The pump is still working, but seven pipes (of a total of fourteen pipes) broke down, and there is no money to buy new ones. Using only seven working pipes results in fetching unhealthier water, since the pipes do not go deep anymore, and in the dry season there is no water at all. Furthermore, a WUC member complains: *'Now it takes really long before the water comes. And there is not enough water. Many people use it. Often there is a very long line, they have to wait for around an hour (before the water level in the well has risen enough to pump water again). Of course they don't like that.'* The WUC has thought of fencing the pump, putting a lock on it, and asking 50UGX per jerrycan. They would then also employ someone to be there all the time. However, they decided to not do this yet, because they want the pump to be repaired properly first: *'If you do it now people won't agree with paying, because it doesn't work well now. They will say that they have been waiting for so long (in the queue).'* A water user in Kakinga is not satisfied with the borehole, and fetches water at a crater lake: *'For this one (the pump) I feel like they are cheating on me. We have to pay, and then it takes quite some time to be repaired. And it often breaks down. And it is very slow.'*

In Mugusu Town Council, a village about 20 kilometres from Rwankenzi (see map 3 appendix), the borehole does have a pre-paid system, but it differs from the ones in Rwankenzi and Kibasi. In Mugusu a pay-as-you-fetch system was introduced in July 2017 after noticing that there was no money to repair the pump when needed: *'It could take like 4 or 5 years to be fixed'*. The pay-as-you-fetch system means that a WUC member is present at the borehole at daytimes, asking users 100UGX per jerrycan. At night the WUC puts a lock on the pumping system, to prevent villagers from 'stealing' water. However, this system is not waterproof, as the WUC admits not having time to be there every minute from sunset till dawn. This results in people fetching water without paying at daytimes, when there is no lock at the system.

Besides that, the WUC is happy with the system, people pay and when there is a breakdown they are able to repair the pump. Nonetheless, the WUC also complains; in the dry season it is too hot to stand there all day, in the rain season it is too wet and cold, and there is no money to build a small house next to the pump. Next to that, there is no money to build a metallic fence, *'This one (wooden) is not permanent, we keep on constructing.'*

Those two villages show that collecting money is hard, and that lacking financial resources has big consequences; Kakinga fetches unhealthier water, has long queues due to slow pumping and has no water in the dry season. WUC members in Mugusu complain about the working circumstances. So far the pay-as-you-fetch system worked out well, but it only runs since July 2017, and time has to learn whether or not WUC members will continue guarding the pump. Both villages point out that their mechanisms for organizing the access to water (see the FWG, figure 2) are not sufficient. Kakinga lacks funds and the pay-as-you-fetch mechanism in Mugusu leads to a decrease in wellbeing (due to working circumstances) of the WUC members. The pre-paid system in Kibasi and Rwankenzi is not working perfectly yet either. However, all earlier discussed issues related to the pre-paid system seem solvable. Thus, the pre-paid system shows potential regarding cases like Kakinga and Mugusu.

4.7 Analysis

Concluding this chapter, we can identify multiple outcomes of the pre-payment system, related to different mechanisms, see table 5.

Mechanism	Outcome
<ul style="list-style-type: none"> - Unclear social arrangement for accessing tokens - Spare-parts come from abroad. No mechanism to solve this - Social arrangements: misuse/mismanagement of money by WUC - Payment mechanism: enough revenue? 	<p>Non-functioning system</p> <ul style="list-style-type: none"> • No access • No quick repair • No money for repair
<ul style="list-style-type: none"> - Distance to pump. No mechanism to solve this. - Water taste. No education mechanism. - More convenient sources present (national water) - Cheaper sources (rain water, shallow wells) 	<p>Use of other water sources</p>
<ul style="list-style-type: none"> - Social arrangement: compensation of the poor 	<p>The poor have access</p>

Table 5: Outcomes and mechanisms of the Handpump Implementation

First, the system is not functioning well, since not everyone has access to the water due to unclarity around tokens. Poor sensitizing meetings resulted in a lack of knowledge (non-material resource, see the FWG figure 2 chapter 2) at the side of the users; they had a poor understanding of the mechanism itself. For example, people destroyed their token to see what is in there, which resulted in having no functional token anymore and thus a lower outcome; no access to water. Next to that, people did not ask for a new token after losing it, due to wrong assumptions about getting a new one (unclarity about payment). These unclarity arose from unclear social arrangements (how to get tokens). When asking NGOs about future sensitizing meetings, they mentioned: *'We have thought about that recently. But the problem is that this is only a pilot and it's almost finished. When we want to go there more often we need more time and money.'* This means that the NGOs do not have the financial resources to organise more meetings, which may result in poor or no understanding by the potential new users of the pre-payment system.

A second reason for the non-functioning system can be identified; in case of a breakdown there is no quick repair, because spare-parts (material resource, see the FWG figure 2) are not available in the region itself. They have to come from abroad since the pump is high-tech. There is no mechanism in place to solve this problem. This takes time and time is not always there when the pump breaks down. This means that, even if the WUC has enough money, continuous operation of the pumps is not assured, resulting in temporary breakdown of the pump. This contradicts with the second hypothesis, which argues that the pre-payment system prevents, in case of a breakdown of the handpump, that the handpump remains out of function due to lack of funds for a repair. This means that more factors than just money, e.g. availability of spare parts, influence the pump's working.

A third potential reason for the non-functioning system is the lack of money for maintenance. Multiple mechanisms lie at the basis for this outcome; social arrangements and the payment mechanism itself. First, there is misuse of the incoming money by the WUC. For example, the WUC in Kibasi decided together to take 10% of the income annually, but, as earlier discussed, it is unclear whether or not there is enough funds to do that. Next to that, the kiosk owner in Kibasi is treasurer as well. He has the community's trust, but there is a mix of tasks and responsibilities present, since the treasurer normally checks the incomes and expenditures of the kiosk owner. One might wonder whether this mix is good, as it could enhance the chance of mistakes or mismanagement, and thus may influence the financial resources, which in his turn could lead to breakdown of the pump. Furthermore, the complaints about the chairwoman in Kibasi could escalate resulting in difficulties in decision-making by the WUC. Second, the payment mechanism is not researched well; the price change in Kibasi from 100shillings to 50shillings is not thought through and it is unsure whether or not 50shillings per jerrycan raises enough money for maintenance. As mentioned before, the WUC in Kibasi has not paid the NGO for the spare parts so far, but they did pay fuel. In Rwankenzi this was the other way around. In both villages the airtime and internet data were paid by the NGOs. In November 2017, the balance between income and expenditures in Kibasi was 195,450UGX and in Rwankenzi approximately 350,000UGX. Fuel costs around 20.000UGX each time, and airtime and internet data 20,000UGX each month. It is hard to calculate how often and what part of a pump is going to breakdown, as it also depends on the amount of use, but one might say both WUCs have sufficient money to pay for fuel, airtime and internet data. Furthermore, the WUC in Rwankenzi has been able to install new solar panels two times (buying and installing one panel costs 35,000UGX), and they have paid 280,000UGX half a year ago, for installing a new pumping mechanical system, which had broken down. Taking that into account, one might say that the WUC in Kibasi does not have much reserve, as they also did not spend anything yet on spare parts.

A fourth outcome is the use of other water sources. Multiple mechanisms lie at the basis for this outcome. First, there are people who choose a different water source due to the distance to the pump. The results show that people with a distance bigger than 400meters prefer different sources. There is no mechanism in place to solve this problem. Second, the taste of the water is a reason villagers go to other sources. Some just do not like the taste, others link the taste to unhealthy water, which is a result of lack of knowledge about health. This means there is no proper education mechanism in place. However, those issues could be addressed more in the sensitizing meetings at the beginning of the project. Third, national water is a serious competitor in Kibasi, since it just flows (convenient) and has multiple taps in the village (thus; close to many households). Fourth, some prefer other sources, like shallow well or rain water, because it is cheaper.

A fifth outcome is that the poor have access to water from the borehole with payment system. The first hypothesis argued that the pre-payment system decreases the water accessibility for poor villagers. We have seen that the WUC in Kibasi came up with a social arrangement, in which they compensate two poor households by providing them with two jerrycans for free each day. This mechanism ensures that those too poor to pay still have access to water from the pump, and thus shows that social arrangements are of great importance, since they impact the outcomes of a pre-paid technology implementation.

5. Results: Perceptions and recommendations of communities, NGOs and local governments

In this chapter first the perceptions of communities on paying for water will be analysed, in order to understand how and why different people have a different (flexible) interpretation on the new situation with the pre-payment system in place. Then, the advantages and disadvantages of the system named by communities, NGOs and the local government will be discussed, including the recommendations they make for improving the system. After that, the ideas on how to use the incoming money will be discussed. Lastly, the ideas about the role of the NGOs in the future will be discussed.

5.1 Perceptions on paying for water

Mainly users of the handpump are interviewed (see table 6), as they live in the centres of the villages, where most of the data is collected to study the effects of using the pump. Most of the users admit they do not mind to pay. However, one user in Rwankenzi mentioned: *'River water is for free so I prefer that one, however I do not think that 100 shillings is expensive. The borehole takes less time so I go there if I don't have much time.'* Another user in Rwankenzi mentioned the water is expensive: *'I would rather not pay for it.'* Next to that, she mentioned that she promised to go to the sensitizing meetings, but that she did not, and that she also does not understand why she must pay, as she could spend the money better. This means that people with limited financial resources consider available alternatives.

		Rwankenzi	Kibasi
Users	Expensive	1	0
	Not expensive	14	6
Non-users	Expensive	0	2
	Not expensive	5	4

Table 6: Opinions inhabitants Rwankenzi and Kibasi on paying for water

Remarkable is that all non-users in Rwankenzi mentioned the price of the water was not the reason for not using the borehole. For two of the non-users in Rwankenzi the water taste is the reason for not using the borehole: *'It is very rough water. It doesn't wash clothes properly. And the taste is very salty... If I boil the river water it's even healthier, the borehole water has no good quality.'* Both prefer to buy river water at 400 shillings per jerrycan. The other three non-users all do not use the borehole since it is simply too far away to carry a 20 or 22 litre jerrycan. They all live more than 400 metres away from the borehole (see map 1 appendix), and for them the river is closer by (they fetch themselves).

In Kibasi all users were satisfied with the price. However, for many of them the borehole was a second-best option, next to the national water taps. For two of the non-users the price was the

issue, one of them is the old lady who gets compensation from the WUC, and she mentions to be satisfied with that solution. The other one is a WUC member of the shallow well, who prefers to use that well because it is closer by, and he likes the taste better. Furthermore, he likes the shallow well because the water is for free most of the times. He only has to pay when there is a break down, but says that still feels cheaper than paying everytime a smaller amount. The other four non-users all do not use the borehole since it is too far away (see map 2 appendix). They all use national water or the shallow well, often even at a cost (water vendors).

5.2 Advantages system

The involved NGOs and the WUCs mention that an advantage of the system is the continuous flow of incoming money, needed for maintenance. Users of the pump mention the following advantages: *'It is cheap'*, *'There is no need to boil the water. That saves time and energy'*, *'You can use it for everything'*, *'Most important is that I have continuous access to the water'*, *'I can ALWAYS access it, this pump does not dry!'*, *'It is healthier. The water is of good quality'*. Next to that, both the Kabarole District Water Officer and the sub-county council of Kasenda are enthusiastic about the pre-paid system: *'I (the Kabarole District Water Officer) want to promote the solar system in Rwankenzi. I would like to install more solars and make it a powered system with a reserve tank, to pipe to other villages. I took visitors from the ministry there. We can write proposals for it!'* The Kasenda council agrees with this by mentioning *'it would be great if access for other places could be arranged using the same system.'*

5.3 Recommendations from users, NGOs and the local government

In Rwankenzi a challenge of the system is that the solar got broken twice. The chairman of the WUC suspects water vendors from damaging it because of loss of income. When asking a few water vendors, they confirmed they have less income now the pump is working again. A widely suggested solution for this problem (by the WUC chairman and other inhabitants) is to install the solar panel up on a high pole, to avoid damage.

Not a direct challenge of the payment system, but still important, is that in both villages the hard and salty water seems to be a problem. Suggestions do not go any further than *'Improving the taste'* or *'Treating the water'*. The taste also seems to be misleading, as many inhabitants suggest *'To improve the water quality'*, and thus link the taste to the quality and healthiness of the water. Furthermore, some suggest making the system automatic, without pumping, to just get it without effort. This is more suggested in Kibasi than in Rwankenzi, probably because Kibasi has better alternatives (national water, shallow wells (which are judged better since they have a better taste, and since people do not have to pay every time they fetch water)). Next to that, both villages encounter problems with tokens, there is unclarity about the rules of getting a new one. Some inhabitants ask for clear information concerning this point. Lastly, the WUC in Rwankenzi (and many inhabitants) complain one water source in the village is not enough. Therefore the WUC suggests *'To commodify the system, buy big solars and extend the system to the whole village'*. It is not clear what is technically seen exactly meant by this, but the idea and dream of extending the system and make more water points is clear.

The NGO working in Kibasi mentions that they find it hard to improve on technical things: *'I was never told about this (after explaining how she had to replace a SD card). We need training. We need assistance for everything now, for every little step that we take, it takes a lot of time man! So we have software issues, then we go to X, we have to sit down at the pump the whole day and communicate via WhatsApp. We are not trained. If we are trained we can do it,*

I am sure. Furthermore, some inhabitants in Kibasi suggest repairing the fence at the pump, to prevent it from damaging itself. The WUC promised to do this, however, six weeks later this still did not happen.

The Kasenda council wishes to be more involved in the project: *'It would be the role of the NGO to call for a meeting and share the results of the source with us. We don't know anything yet, we don't know about the accountability, and how they manage the funds.'* Concerning processes of management, the wish from the sub-county to be more involved in the project might be quite relevant. The sub-counties are situated closer to the villages, and thus it would take less time (and thus money, and fuel) if they had been the contact persons for the villages. This is valuable information related to the debate discussed in the previous chapter about the self-sustainability of the pumps; whether or not the WUCs collect enough revenue, and whether they have to pay the NGOs for consultancy in the future.

5.4 Financial management

If the money accumulates quickly, the WUC in Rwankenzi will use it to extend the system, so that more people will have access to water. They admit not knowing whether this is possible, as it requires a lot of money. If possible, the WUC would become entrepreneurs and get a certain percentage from the income of the new constructed sources.

In Kibasi, the WUC wants to start giving out loans to the villagers when they have a million shillings on their bank account, with a 5% interest. In Rwankenzi this idea was rejected because of a lack in trust in villagers to pay it back. In Kibasi the WUC decided that the loan receiver *'will have to put some security. They can give a goat or something.'* Furthermore, in Kibasi the treasurer of the WUC mentions they (the WUC and the NGO) agreed that the WUC receives 10% of the incoming money, annually. However, this year they did not take the money yet. He proposes to change it, instead of giving money giving each WUC member two jerrycans for free each day: *'If we allow the WUC to take two jerrycans for free, then it will encourage them to keep it safe (check the pump and use it responsibly). More people will use and control the pump.'* The NGO decided to sit together to discuss the issue, however, after five weeks nothing has happened and the NGO seems to have forgotten about it.

5.5 Role of the NGOs in the future

The WUC in Rwankenzi mentions they like the NGO, and that they need them for consultation in the future: *'They are the one who introduced it and they are the one who can help us enlarge it. We need them on advising and spare-parts too.'* When asking the WUC if they would pay the NGO for advice, they started laughing, saying they had not paid them anytime for advice. The NGO working in Rwankenzi wants to take a step back, train the local people (on technical and managing skills), and take the role of a consultant. This includes being paid by the WUC for consultancy (fuel and salary). The NGO mentions they are planning conversations with the WUC to talk about this but acknowledges it will take time and effort for the WUC to understand it properly.

The WUC in Kibasi mentions the NGO is very safe as a vocal point. Next to that, they do not want to be trained any further, because *'If someone of us knows how to maintain and repair the pump, then that could be a risk. If he is broke, then he might have the knowledge to manipulate the system and use it for free. So I am glad the NGO is here.'* The NGO worker agrees with this and says the technical training should be directed to them, not to the WUC. Furthermore, the NGO worker makes clear not liking the idea of being paid by the WUC: *'You know. I have*

a big heart for this community. Whenever I am free and just have time to go, I will go to the village to help them if needed. They do not need to pay me for that. They already pay me for fuel, I always ask them 20.000. And whenever I need some oil, then I will ask that too. But they don't need to pay me. I am not very busy. I can just go if I have time. It's no problem.'

5.6 Analysis

Concluding this chapter, we can identify multiple outcomes of the pre-payment system, related to different mechanisms, see table 7.

Mechanism	Outcome
<ul style="list-style-type: none"> - No mechanism for consultancy - Time consuming communication. No mechanism to train staff 	Non-functioning system <ul style="list-style-type: none"> • No future plan • No quick repair
<ul style="list-style-type: none"> - No education mechanism 	Unclearly about health and water boiling

Table 7: Outcomes and mechanisms of the perceptions and recommendations of communities, NGOs and local governments

First, the system is not functioning well, because it is unclear whether or not the pilot with the pre-paid system has finished. This means it is unclear if there is money left for the project, meaning that the two local NGOs do not know if they have budget in the future to spend time on the project. However, the WUCs still need the NGOs for consultancy and technical assistance. Consulting them means that the WUCs need money to pay the NGOs for salary and fuel. Only, the question is whether the incoming money is enough to cover these costs as well. When asking WUCs what they would think about paying the NGO as consultant (for now leaving aside questioning whether they even have the money for it), they started laughing. Furthermore, an employee from one NGO clearly did not like the idea of being paid, but also had no structural solution for this, as his NGO does not have budget for the project left. Therefore, it is hard to predict how the project will continue. This shows that the processes of management and practice should be established (what relations do stakeholders have with each other?) and that mechanisms for consultancy are missing from the beginning. The long-term vision is partly (pre-payment) visible, but still misses essential parts.

Second, repairing the system takes a lot of time. NGOs and WUCs mention they also encounter problems with some non-material resources, like technical skills. They both lack the capabilities to be able to understand and repair the pump when needed. Therefore the current communication mechanism with the technical company is very time consuming, and there is no mechanism in place to train staff. The second hypothesis states that the pre-payment system prevents breaking down of the pump, but again this hypothesis seems too straight forward. Assuming there is enough money to repair, it could still take much time to actually repair the pump, which thus could be temporarily down.

Third, there is unclarity about health. Villagers used different argumentation for explaining their choice of water resource, which included argumentation about the one resource being healthier (e.g. due to taste) than the other. Next to that, and not mentioned before in this paper, many misunderstandings were present about the issue whether the water from the borehole should be boiled before use or not. This means that a proper education mechanism is missing. Sensitizing meetings could include education about health in their program, which can increase

the use of the borehole, and thus increase the wellbeing (health) of people. Once again this shows (see the FWG in figure 2 chapter 2) that processes of management and practice, like the sensitizing meetings, can affect the outcomes directly.

6. Discussions and conclusions

6.1 Reflection on findings

As mentioned in the introduction, it is unknown what the effects of pre-payment systems are on the current management strategies in use. In both Kibasi and Rwankenzi we have seen that the same management strategy was applied; CBM with WUC's. However, one main and crucial difference is that the WUC's both did not function before implementation of the pre-paid system; WUC members had no motivation to be active, because they had troubles in collecting money for repairs and could not exclude non-payers from using the borehole. This corresponds with the findings from Van den Broek & Brown (2015), who find that freeriding is a rational choice and therefore undermines the CBM model, since citizens are aware that enforcing sanctions on water access is impossible. This results in WUCs having no authority and being unwilling and unable to uphold the system. Now, after implementing pre-paid, the CBM model with WUCs is again in place, however, WUC members show to be dedicated to their work and have authority, because there is a continuous flow of money and the payment system is waterproof, meaning freeriding is impossible. This contradicts the findings of Whittington et al. (2009) and Quin et al. (2011), who find that WUCs are not able to efficiently collect water user fees from community members. The pre-paid system shows to solve this problem. Next to that, Golooba-Mutebi (2012) states that the enforcement of sanctions for not paying causes conflicts. With this pre-payment system in place, these conflicts will not be present since non-payment is impossible. Cleaver (1999) questions whether or not Ostrom's CPR success stories are applicable to water, since water is fixed in social life. Now we can answer this question by stating that indeed CBM is tough when it concerns water, however, when combining CBM with a pre-payment system, it actually can work. This shows that Bakker (2003) is wrong about her statement about water being an uncooperative commodity; when using a mechanism that relies less on assumptions of human behaviour, like the pre-paid system, water can be a cooperative commodity.

In fact, human behaviour still shows to be of great value in CBM; the choice of the WUC in Kibasi to compensate two poor households makes sure that water is still accessible for the poor. This contradicts with the first hypothesis, which stated that the poor would have decreased water access after implementing pre-paid. This corresponds with the findings of Bruns (2005), who states that community level management of water resources is appropriate, because there is detailed local knowledge of the users and resources. If the WUC in Kibasi did not know the two poor households well, they had not chosen to compensate them, meaning those two households would not have had access to the source. On the other hand, using the FWG also showed that human behaviour (in this case; social arrangements) can negatively impact outcomes, since the WUC in Kibasi wants to take 10% of the income annually without being sure if there is enough incoming money to do so. This corresponds with the findings of Terry et al. (2015) and Quin et al. (2011), who find that WUCs are not always willing to work on a voluntary basis, and that misuse of WUC funds are very common in Uganda. They find that poor management of the WUCs is caused by mismanagement and corruption.

The second hypothesis stated that the pre-payment system prevents that, in case of a breakdown of the handpump, the handpump remains out of function due to lack of funds for a repair. We have seen that, so far, there indeed is enough incoming money for repair and maintenance. However, we also found that there are more factors influencing the pump's working, such as

availability of spare-parts and technical skills of the local people; spare-parts take time to come from abroad and learning technical skills takes time as well, thus both could result in a temporary breakdown. This is also emphasized by the study of De Laet & Mol (2000), who researched a successful handpump in Zimbabwe, the Zimbabwe Bush Pump, and found that one of its success factors is the fact that the pump is locally produced, and thus that spare parts are easy to come by.

Despite the fact that villagers admit 100shillings for a jerrycan is not expensive, quite some choose to use an alternative source; due to the distance to the pump, the water taste or cheaper or more convenient other sources. Parry-Jones et al. (2001) find that a geographical factor (distance to water sources) is indeed an important factor in deciding to use water from a paid source or not. They state that *'alternative water sources reduce people's willingness to pay for water from protected sources'*. Next to that, this research shows that shallow wells are serious competitors for the pre-paid system on the borehole, not only because of the distance to the pump, but also because of the moments at which people have to pay. At the shallow well people only need to pay when the pump breaks down, and some villagers admit to prefer that system. This corresponds with the findings of Whittington et al. (2009), who find that community members prefer to pay only when the pumps breakdown, as community members rather spend available money on other projects. An other reason villagers choose to use an alternative source is because of the water taste from the borehole. Some link this taste to health issues, and think the water from the borehole is unhealthy. De Laet & Mol (2000) point out the multiple identities of water pumps are crucial to take into account during projects. One of these identities is that of a health-promoting technology. Clearly, the boreholes in Rwankenzi and Kibasi do not show to promote health (because of the water taste), and therefore limit the amount of users. Next to that, De Laet & Mol (2000) point out that the pump's working order depends on the community, and that a pump can fail to constitute a community around it when it is too weak. This means, that in some way the pump is insufficiently attractive. When this happens, for example when the whole community starts to think that the water is unhealthy, then the community will not take care of the pump.

6.2 Conclusions and recommendations

We can conclude, despite some minor problems with WUC dynamics and the availability of spare parts, that the pre-payment system shows to ensure a continuous flow of incoming money. However, we can also conclude that the pre-payment system is not a replacement of the other water sources, but leads at most to a shift in choice of using different water sources. Multiple reasons lie at the basis for this conclusion. Some of them will be shortly discussed below, including some recommendations for improvement.

Knowledge about health

An example of this is the present knowledge of villagers about health. As mentioned before, unclarities about the quality of the borehole water resulted in wrong assumptions of the villagers; the river water would not only taste better, but would also be healthier. Examining the villager's knowledge about health clearly before implementing a pre-payment system could make a difference. When noticing false assumptions, these could be taken into account into the sensitizing meetings at the start of the implementation of the pre-paid system, for example by providing training about knowledge and understanding of safe water, sanitation and hygiene. However, many villagers refused to come to the meetings at the beginning of the project, which is a widely acknowledged problem (Quin et al., 2011). Further research is needed to investigate how people in rural areas can be coached well.

Distance to pump

Furthermore, the distance to the pump seems to be an issue. Ofcourse this is not directly related to the pre-payment system, but this is an issue all boreholes face; they just serve a limited amount of people, namely those who live close by. In the WASH&Learn meeting a discussion between different NGOs about the definition of access to water took place. Access to water was, according to them, defined as being a safe source, available throughout the year, within acceptable distance from ones home. Acceptable distance seems to be defined differently by different countries; some measure in time, others in actual distance. In Uganda the government set the guideline at 500 meters, however before this was 1000 meters. When accomplishing the 500 meters criterium in most places of the country, the NGOs expect the government will change this guideline again, for example to 250 meters, to keep on improving the walking distance. This could be taken into account when installing a pre-payment system on a borehole; when expecting more boreholes, the number of users from one borehole could drop. This would also affect the speed of breaking down of the pump. Installing a pre-payment system takes quite some money. Therefore, the amount of users could be a factor in deciding on which borehole to install the payment system.

Long term approach

Next to that, more long term thinking is needed when implementing the pre-paid system. In general more time should be taken at the beginning of the project. The sensitizing meetings should be prepared more carefully, for example including knowledge about health, as discussed earlier in this chapter. Practicalities about the tokens would then also be discussed. A clear plan about gaining a new token after losing it should be present at the start of the project. Furthermore, it is unclear how often maintenance of a pump is needed in general, and what the costs of maintenance are. Researching this would be valuable, as it relates to the price people have to pay for the water. Ofcourse maintenance relates to the amount of users of the pump, but this could be examined using the OMS, this will be discussed later in this chapter. Furthermore, a long term vision about the role of the NGOs is needed to know how to proceed with the project. When this is clear, deciding who gets training (technical and business skills) and who has to build connections with companies providing spare-parts would be easier. There is unclarity between the implementing NGOs about their role in the future. However, a predetermined plan is needed; when WUCs have to pay NGOs for consultancy in the future, this should be taken into account when calculating what price the users should pay for their water. Next to that, careful negotiations with the WUCs are needed to investigate whether or not they would like this system. Furthermore, the Dutch NGOs, who guided this project from a distance, would like to shift from a CBM approach to an entrepreneurial one, meaning one entrepreneur would earn money from the incoming funds and be responsible for multiple boreholes. However, when actually planning this, more research about the opinion of communities and WUCs on this is needed, as the study from Brown & van den Broek (2017) already shows that a single paid water operators poses risks to involved stakeholders.

Pre-payment system as redistribution mechanism

As mentioned before, the pre-payment system leads to a shift in choice of using different water sources. It is probably impossible to change the distance to the pump in a short time and water taste is also not easily improved. Next to that, it is inevitable that villagers, also after proper education, prefer other sources, because of the payment system, the payment moments or due to the presence of national water. Therefore, the pre-payment could be seen as a redistribution mechanism, in which those who are able and willing to pay fetch water at the pre-paid borehole.

The incoming money could be distributed among all water sources. More research is needed on the opinions of NGOs, governments and villagers on this idea.

6.3 Research limitations

Translator

As mentioned in the research methods, a translator was used for interviews with most of the villagers. However, due to translations and cultural differences with the translators, who both were Ugandan, information might get lost or differently interpreted.

Background researcher

Furthermore, it was noticed that villagers expected from the researcher to improve the whole system, as they link being white to being rich. Therefore, they may have amplified their concerns and complaints about the system. One time one translator even pointed out to the researcher that one villager was acting to be exhausted because of the pumping.

Rainy season

As mentioned in the methodology, the research was carried out in the rainy season only. This did not give an accurate view on the use of the handpumps in general. However, the OMS provided data on this. Furthermore, since the research was carried out in the rainy season, complications which occur during the dry season could not be observed, e.g. queues for pumping, a too low water level or technical defects due to intensive use.

Pre-measurement

Despite some gaps in data due to connection issues the OMS brought up useful information about the handpump use after installing the pre-payment system. However, the OMS could be used in an earlier stage, before putting the pre-paid system into use, to examine the difference in water use between the period before and after implementing pre-paid. This means that handpumps first have to be rehabilitated with implementation of the tokens (with socio-economic profiles), but without implementing the payment system at the same moment (this should then be done in a later stage). In this way, one is able to compare the pre- with the postsituation, which was now not possible. Furthermore, figure 5 in chapter 4.2 shows that, compared to the pump in Kibasi, two to three times more water is fetched in Rwankenzi. It is unknown how many users fetched at both boreholes before the pre-payment system, thus, this difference in water use might have existed in an earlier stage as well. However, one must realize that using the OMS for a pre-measurement can not be used to prove a direct relation between the payment system and water use, e.g. the introduction of national water in Kibasi is a factor which influenced water use of the handpump as well.

Literature

Agrawal, A. (2014). Studying the commons, governing common pool resource outcomes: some concluding thoughts. *Environ. Sci. Policy* (36), 86-91

Araral, E. (2014). Ostrom, Hardin and the commons: A critical appreciation and a revisionist view. *Environ. Sci. Policy* (36), 11-12

Bakker, K. J. (2003). An Uncooperative Commodity: Privatizing Water in England and Wales, *Oxford University Press*

Bernard, H. R. (2011). *Research methods in anthropology: Qualitative and quantitative approaches*. Rowman Altamira.

Bijker, W.E (1996). Democratization of technology, who are the experts?
<http://www.desk.nl/~acsi/WS/speakers/bijker2.htm>

Briscoe, J., and D. Ferranti., (1988). *Water for Rural Communities, Helping People Help Themselves*. Washington, United States: the International Bank for Reconstruction and Development/The World Bank

van den Broek, M., & Brown, J., (2015). Blueprint for Breakdown: Community Based Management of Rural Groundwater in Uganda. *Geoforum* (67) 51-63.

Brown, J. & van den Broek, M. (2017). Better the devil you know? A relational reading of risk and innovation in the rural water sector. *The Geographical journal*. 12215: 1-13

Bruns, B. (2005). Community-based Principles for Negotiating Water Rights: Some Conjectures on Assumptions and Priorities. Available online : <http://projects.nri.org/waterlaw/AWLworkshop/BRUNS-B.pdf> (accessed on 4 July 2018)

Bruun, H. & Hukkinen (2003). Crossing Boundaries: An Integrative Framework for Studying Technological Change. *Social Studies of Science*. 33 (1): 95-116

Cleaver, F. (1999). Paradoxes of participation: questioning participatory approaches to development. *J. Int. Dev.* 11, 597-612

Foster, T. (2013). Predictors of Sustainability for Community-Managed Handpumps in Sub-Saharan Africa: Evidence from Liberia, Sierra Leone, and Uganda. *Environmental science and technology*. 47, 12037-12046

Foster, T. & Hope, R. (2017). Evaluating waterpoint sustainability and access implications of revenue collection approaches in rural Kenya. *Water Resources Research*. 53, 1-18

Franks, T. & Cleaver, F. (2009). Analysing water governance: a tool for sustainability? *Engineering Sustainability*. 162, 207-213

Franks, T. & Cleaver, F. (2007). Water governance and poverty: a framework for analysis. *Progress in Development Studies*. 4, 291-306

Franks, T., Cleaver, F., Maganga, F. & Hall, K. (2013). Water governance and livelihoods: Outcomes for smallholders on the Usangu plains, Tanzania. *Water Resources and Rural Development*. 1-2, 1-16

Golooba-Mutebi, F. (2012). In search of the right formula: public, private and community driven provision of safe water in Rwanda and Uganda. *Public Admin. Dev.* 32 (4-5), 430-443

Harvey, P.A. & Reed, R.A. (2006). Community-managed water supplies in Africa: sustainable or dispensable? *Community Development Journal*. 42, 365-378

ILO (1995). Design, monitoring and evaluation of technical co-operation programmes and projects. A training manual.

Jiménez, A., Jawara, D., LeDeunff, H., Naylor, K.A. & Scharp, C. (2017). Sustainability in Practice: Experiences from Rural Water and Sanitation Services in West Africa. *Sustainability* 9 (403), 1-14

Jones, S. (2011). Participation as citizenship or payment? A case study of rural drinking water governance in Mali. *Water Altern.* 4 (1), 54-71

de Laet, M. & Mol, A. (2000). The Zimbabwe Bush Pump. *Social Studies of Science* 30 (2), 225-263

Mackenzie, D., & Wajcman, J. (1999). Introductory essay: the social shaping of technology. *Open University Press*, 3-27

MacNaghten, P., Davies, S. R., & Kearnes, M. (2015). Understanding public responses to emerging technologies: A narrative approach. *Journal of Environmental Policy & Planning*, 1-19

Marson, M. & Savin, I. (2015). Ensuring sustainable access to drinking water in Sub-Saharan Africa: conflict between financial and social objectives. *World Development.* 76, 26–39

Moriarty, P.; Smits, S.; Butterworth, J. and Franceys, R. 2013. Trends in rural water supply: Towards a service delivery approach. *Water Alternatives* 6 (3), 329-349

Mosse, D. (2006). Collective action, common property, and social capital in South India: an anthropological commentary. *Econ. Dev. Cult. Change* 54(3), 695-724

Mugabi, J. & Kayaga, S. (2010). Attitudinal and socio-demographic effects on willingness to pay for water services and actual payment behaviour. *Urban Water Journal.* 7:5, 287-300

Nekesa, J. & Kulanyi, R. (2012). District hand pump mechanics associations in Uganda for improved operation and maintenance of rural water-supply systems. *Waterlines.* 31, 170-183

O’Leary, Z. (2004). *The Essential Guide to Doing Research.* Sage Publications: Thousand Oaks

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press

Ostrom, E., Burger, J., Field, C.B., Norgaard, R.B. & Policansky, D. (1999). Revisiting the commons: local, lessons, global challenges. *Science’s Compass.* 284, 278-283

Parry-Jones, S., Reed, R., Skinner, H. (2001). Sustainable Handpump Projects in Africa: A Literature Review. *Water, Engineering and Development Centre, Loughborough University.*

Pinch, T.J. & Bijker, W.E. (1987). The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other, in *Bijker et al. (1997 [1987]):* 17-50

Quin, A., Balfors, B., Kjellen (2011). How to ‘walk the talk’: the perspectives of sector staff on implementation of the rural water supply programme in Uganda. *Natl. Resour. Forum* (35) 4, 269-282

Sara, J. & Katz, T. (1998). *Making Rural Water Supply Sustainable: Report on the Impact of Project Rules.* Water and Sanitation Program, World Bank, Washington, DC

Terry, A., McLaughlin, O. & Kazooba, F. (2015). Improving the effectiveness of Ugandan water user committees. *Development in Practice*, 25:5, 715-727

Uganda Bureau of Statistics (2017a). The National Population and Housing Census 2014 – Area Specific Profile Series, Kampala, Uganda

Uganda Bureau of Statistics (2017b). The National Population and Housing Census 2014 – Subcounty Reports, Kampala, Uganda

de Vaus, D.A. (2013). *Research Design in Social Research*. Sage Publication, London.

Whittington, D., Davis, J. & McClelland, E. (2009). Implementing a demand-driven approach to community water supply planning: a case study of Lugazi, Uganda. *Water International*. 23, 134-145

Whittington, D., Davis, J., Prokopy, L., Komives, K., Thorsten, R., Lukacs, H., Bakalian, A. & Wakeman, W. (2009). How well is the demand-driven, community management model for rural water supply systems doing? Evidence from Bolivia, Peru and Ghana. *Water Policy*. 11, 696-718

World Bank (2016). World Development Indicators. Available online: <http://databank.worldbank.org/data/reports.aspx?source=2&country=UGA> (accessed on 15 August 2017)

Appendixes

Topic-list semi-structured interviews

Introduction

- Researcher explains purpose of the research and introduces herself
- Start with context-questions:
 - Can you tell me something about yourself? For how long have you been living here, with whom, what is your job, etc.
 - Tell me what your day looks like. What time do you get up, what do you do after that, etc.

Topics (defined before research) to address during interview divided per research question (list served as back-up):

1. Effects of pre-paid hand pumps?

What was the situation before the pre-payment installation?

- How much water did people take at the pump? When and how often? What for (purpose)?
- What other sources did people use? How much? What for (purpose)? What were the costs?
- How long was the pump down? Why was it broken?
- Where did people get their water when the pump broke down?
- Was there a WUC in place? Who are the people in the WUC? (what do they do, what is their history and position in the village/area) Why and how were they selected? Were you satisfied with them?
- Was the WUC/others able to do maintenance at the pump? Were spare parts available?
- What were the challenges of the previous situation? Does the pre-payment system overcome these challenges? How and why?

What changed?

- Why and how did the payment system come into place? Who were involved in the decision making process? How do you feel about that?
- How much, and how often, do people fetch water now? Why that certain amount? Is that rain or season dependent? What is the time spent on collecting water? Do they know how much credits they will lose? What will they use the water for?
- How much water can they take maximum each time? Why this amount? Who determined this? Who can change it?
- What do people pay for the water? Who determined this? Who can change this?
- Are there people who do not use the pre-payment handpump? Why are they not using it? Are there people excluded because of the payment system? What then (support?)?
- Do people use multiple water sources or just one? Why? Which sources do they use for what purpose, and what are their costs? How far are these sources?
- Is there a WUC in place? How were they selected and what do they do? Do you think they are doing a good job?
- How much money has been collected?
- Who manages the money?
- How much money does the WUC receive? Are they satisfied with the money they receive?
- What is the role of the kiosk owner?

- How much money does the kiosk owner receive, and is he/she satisfied with that?
- How is money stored?
- Is the WUC/kiosk owner/others able to do maintenance at the pump? Are there spare parts available?
- Are there conflicts about the access to the water?
- Do people notice health differences compared with the situation before the pre-payment installation?
- Do people understand the system? Do they know how to use it?

2. Perceptions on system?

Views and opinions about the system.

- What do people want (goals)? Do they really demand clean water?
- What do people see as the advantages and disadvantages of the system?
- Do people mind to pay for their water? Do they think the water is expensive or cheap? What are people willing to pay for water?
- Satisfied with WUC and kiosk owner?
- What are the challenges with safe storage of funds?
- Opinions about repairing the system? Is this easy or difficult, and why?
- What do people see as the role of the local NGOs now? And what do they see as their own role?
- Do people have problems with people using the hand pumps for commercial ends? (this could be seen as an obstacle for accessing the pump, and this would mean a more intensive use and thus probably more maintenance)

3. Recommendations people make?

- What do people see as challenges of the system, and what solutions do they bring up?
- What do they see as their responsibilities in managing the pump?
- What are their capabilities?
- Do they need external support?
- Who do they want to manage the funds (do they know who now manages the fund)? Why?
- Are people able to do maintenance, if not what then?
- Would they like something to change about the WUC and kiosk owner? What?
- What do WUC and kiosk owner themselves think about managing the funds? Who should do that? Who should do maintenance?
- If storing funds is a challenge, how can this be done better?
- What do people, and the NGOs themselves, see as the role of the local NGOs in the future?
- If people have problems with people using the water for commercial ends, how would they like to deal with this? (e.g. process this in the price?)

Table 2: Sensitizing meetings

	Rwankenzi	Kibasi
Number of meetings	Three	Six
Mobilisation	<ul style="list-style-type: none"> • Phone calls • House to house • Church announcements 	<ul style="list-style-type: none"> • Phone calls • House to house • Church announcements • Written notes
Attendance	1 st : 38. 2 nd and 3 rd : below 10	Each between 20 and 60
Organisation	By NGO and WUC together	By NGO and WUC together
Content	1 st : <ul style="list-style-type: none"> • Introduce pay-as-you-fetch • WUC election 2 nd and 3 rd : <ul style="list-style-type: none"> • How to maintain water • How to keep the water source clean • How to use it (token) 	<ul style="list-style-type: none"> • WUC election • Taking care of system • Explain token • Explain price reduction

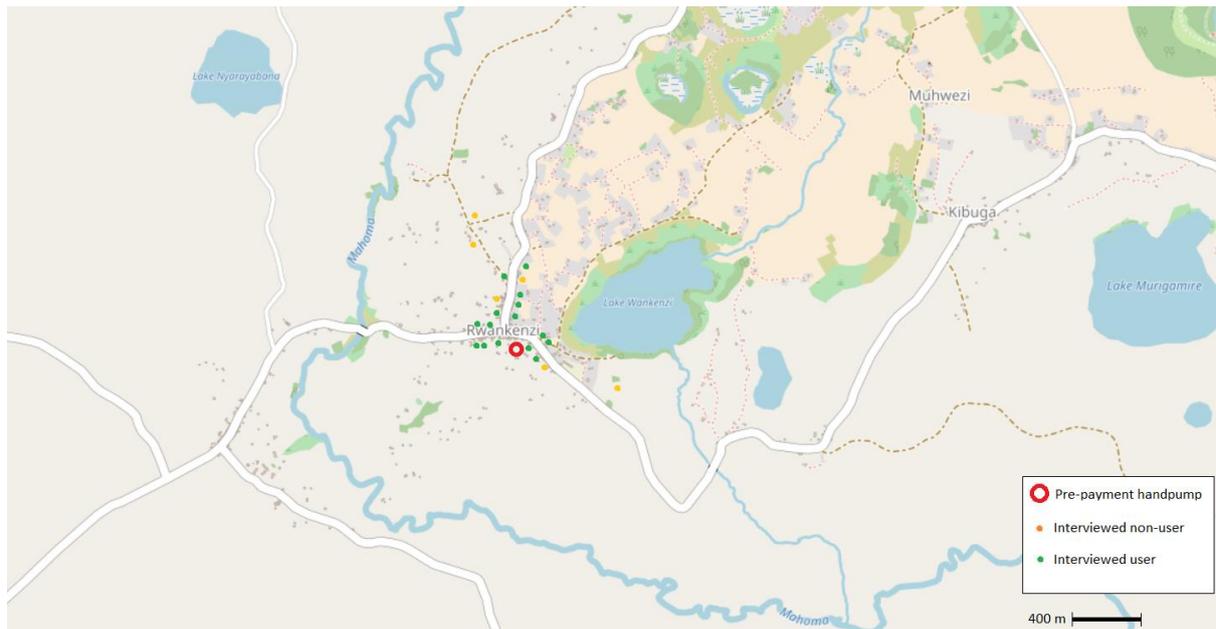
Table 3: Activities WUC members Kibasi

Roles	Kibasi
Kiosk owner and Treasurer WUC (man)	<ul style="list-style-type: none">• Puts credits on tokens• Receives 20% of income• Guards income• Removes solar panel every evening• Checks pump every day• Records incomes & expenses in book• Organises meetings
Chairwoman WUC	<ul style="list-style-type: none">• Passive
Secretary WUC (man)	<ul style="list-style-type: none">• Takes minutes during meetings• Checks books treasurer
Deputy-treasurer WUC (woman)	<ul style="list-style-type: none">• Replaces kiosk owner/treasurer when needed
Security-guy WUC	<ul style="list-style-type: none">• Advices on how to use the pump properly• Compound owner (and therefore interested in checking on security)
General WUC member (woman)	<ul style="list-style-type: none">• Collective tasks
General WUC member (man, also chairman of the village)	<ul style="list-style-type: none">• Collective tasks

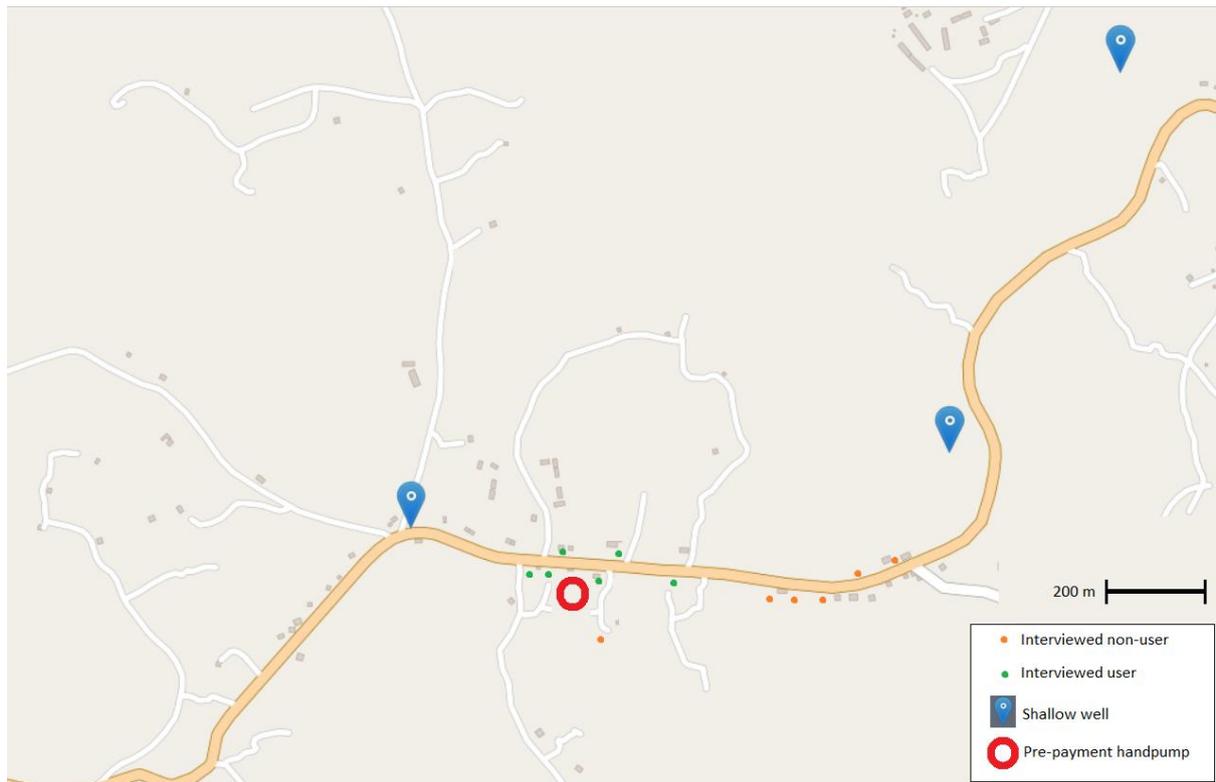
Table 4: Activities WUC members Rwankenzi

Roles	Rwankenzi
Kiosk owner (woman)	<ul style="list-style-type: none">• Puts credits on tokens• Receives 10% of income• Gives out new tokens and writes down socio-economic data, useful for online monitoring system
Chairman WUC	<ul style="list-style-type: none">• Mobilises people about system• Organises meetings WUC• Takes and gets money to/from bank with treasurer
Treasurer WUC (woman)	<ul style="list-style-type: none">• Takes and gets money to/from bank with chairman• Records incomes & expenses in book
Secretary WUC (man)	<ul style="list-style-type: none">• Checks records from kiosk owner
Caretaker WUC (woman)	<ul style="list-style-type: none">• Cleans compound
Vice-chairman WUC	<ul style="list-style-type: none">• Replaces chairman when needed
General WUC member (man)	<ul style="list-style-type: none">• Collective tasks

Map 1: Rwankenzi



Map 2: Kibasi



Map 3: All villages

