Cooperation in Social Dilemmas:
Considering sustainability options for Solar-powered Mosquito Trapping Systems (SMoTS) on Rusinga Island, western Kenya

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Summary

Rusinga Island in Kenya has been the stage for a research project called SolarMal. The aim of this project was to prove that malaria could be eradicated on Rusinga Island using Solar powered Mosquito Trapping Systems (SMoTS). These systems were constructed out of a solar panel, providing electricity, a mosquito trap with a newly developed attractant odour, two lightbulbs and a phone charging device. At the end of the research period (December 2015) the systems remain on Rusinga Island, but no plan has been made for the systems to be sustained by the inhabitants of the island. The aim of this Master thesis was to provide sustainability options to the Community Advisory Board (CAB) based on the preferences the CAB members and opinion leaders from the island display. The theory of choice for this thesis is Social Dilemma theory, as the situation of sustaining the SMoTS can be seen as a social dilemma. The main research question was: *To what extent are individual or collective options preferred by different members of the Rusinga community in organising the sustainability of SMoTS and what motivations and experiences drive these preferences?* Various interviews with CAB members and opinion leaders have been conducted, as well as six focus group discussions. The data show that most CAB members and opinion leaders prefer individual solutions instead of collective solutions for sustaining the SMoTS, their preferences can be explained by the social dilemma factors of trust, sanctioning, group identification and leadership. The recommendations depend on whether the malaria suppression function of the system works or not, which is not yet known.

Table of Contents

Chapter 1: Introduction

Background

In 2012, Wageningen University (the Netherlands) and the International Centre for Insect Physiology and Ecology (ICIPE, Kenya) launched a proof of principle study to eradicate malaria from Rusinga Island by mass trapping of mosquitoes in addition to the nationwide adopted preventative strategy of handing out bed nets and medical care (Hiscox et al. 2012). Rusinga Island is the second largest island on Lake Victoria, western Kenya. The project aims to eradicate malaria from the island using solar-powered mosquito trapping systems (SMoTS). The trap is equipped with a new type of bait which mimics human odour and has been shown under laboratory conditions to be more attractive to mosquitoes than genuine human odour (Hiscox et al. 2014). During the project free SMoTS are installed by temporarily hired and trained local technicians in every household on Rusinga Island. In addition to powering the trap, the solar panel also powers two light bulbs and a USB-socket to charge a mobile phone. During weekly community workshops, representatives of a cluster of homesteads (consisting of 50-60 homesteads) are instructed by the project staff in the use and daily maintenance of the SMoTS. When something breaks down project technicians can be called to arrange for repairs free of charge (Hiscox 2014).

The research project will finish by the end of 2015. There will be no more funding from the project and SMoTS parts and repairs will no longer be available to residents free of charge. However, the community can come up with a plan to keep the system working and this process is already underway spearheaded by the project Community Advisory Board (CAB). The CAB, created during the first year of the project, is the main link between the community and the project. CAB members have been collecting views of community members about what the community would want to sustain, sources of resources for the sustainability, what the perceived difficulties in sustainability could be and how to overcome these difficulties (C.A.B. 2014a). In addition to maintenance of SMoTS, the availability of spare parts or complete new systems, the question of ownership of the system, how the systems will be financed, how technicians will be paid and by whom, etc. must all be addressed and implemented to effectively sustain SMoTS.

For each of these issues the community has to decide upon, there are basically two options: an individual option, or a collective option. If the individual option is selected for one issue, this doesn't necessarily mean that everything else will be on individual base as well. For example: if it is decided by the community that ownership of the system should be individual, this does not necessarily mean that the paying of technicians is an individual thing as well. It is possible that every household will contribute monthly to a collective fund out of which technicians are paid. Table 1 shows a hypothetical outcome of a decision making process regarding sustaining the SMoTS.

Table 1: example outcome of decision making process

	Individual	***Group***		
Issues		*village*	*entire community*	*other group*
Ownership	x			
Maintenance/ repairs				x
Spare parts		x		
New systems			x	
Financing			x	
Upgrading	x			
Storage			x	

A literature review shows that there are two dominant models which are currently implemented in this kind of sustainability projects: the Dealer- Sales model and the Energy Service Company or fee-for-service model (Martinot et al. 2001). The outline of the two standard models is described below, variation within these models is possible.

In the Dealer-Sales model solar systems and/or parts of solar systems are sold to rural customers. The customers become the owners of the system and bear the costs of eventual repairs (Martinot et al. 2000). Because the systems are often too expensive for the, mostly poor, rural customers the dealer tends to extend credit to the customers. It also occurs that if the dealer doesn't want or isn't able to extend credit, this is done by micro finance organisations or development finance institutions (Martinot et al. 2000).

According to Urmee et al. (Urmee et al. 2009) the private ownership involved in this model ensures that people will take good care of their system and in this way maintenance costs are reduced, tampering with the system is minimised, overuse of the system is reduced and the benefits are therefore maximised. Problems with this model that are often encountered are: the risk of extending credit, collecting the credit is costly and systems might still be too expensive and therefore demand is low (Martinot et al. 2000).

The second model is the Energy Service Company model, also named fee-for-service model (Ellegård et al. 2004). In this case customers do not get to own a system, but they pay a monthly fee to the company for its use instead. The company then makes sure that the system is installed and keeps working (Ellegård et al. 2004). Advantages of this model are that it is more affordable to rural households, there is regular maintenance of the product which will increase the lifetime of the system leading to higher confidence levels of the system amongst users (Urmee et al. 2009). The lower price will also make the system available to more people as more people are then able to purchase a system (Lemaire 2009). Problems encountered in this model are *e.g.*: difficulties in collecting monthly fees or high costs in doing so, difficulties in actually providing the service to the customers due to a wide spatial distribution of customers and the high regulatory capacities the model requires (Martinot et al. 2001).

The two models have a couple of variations depending on which financing scheme is used (see fig. 1.). The Dealer Sales model is more applicable when the CAB members mostly choose for the individual options and the fee-for-service model is more applicable when they mostly choose the collective options.

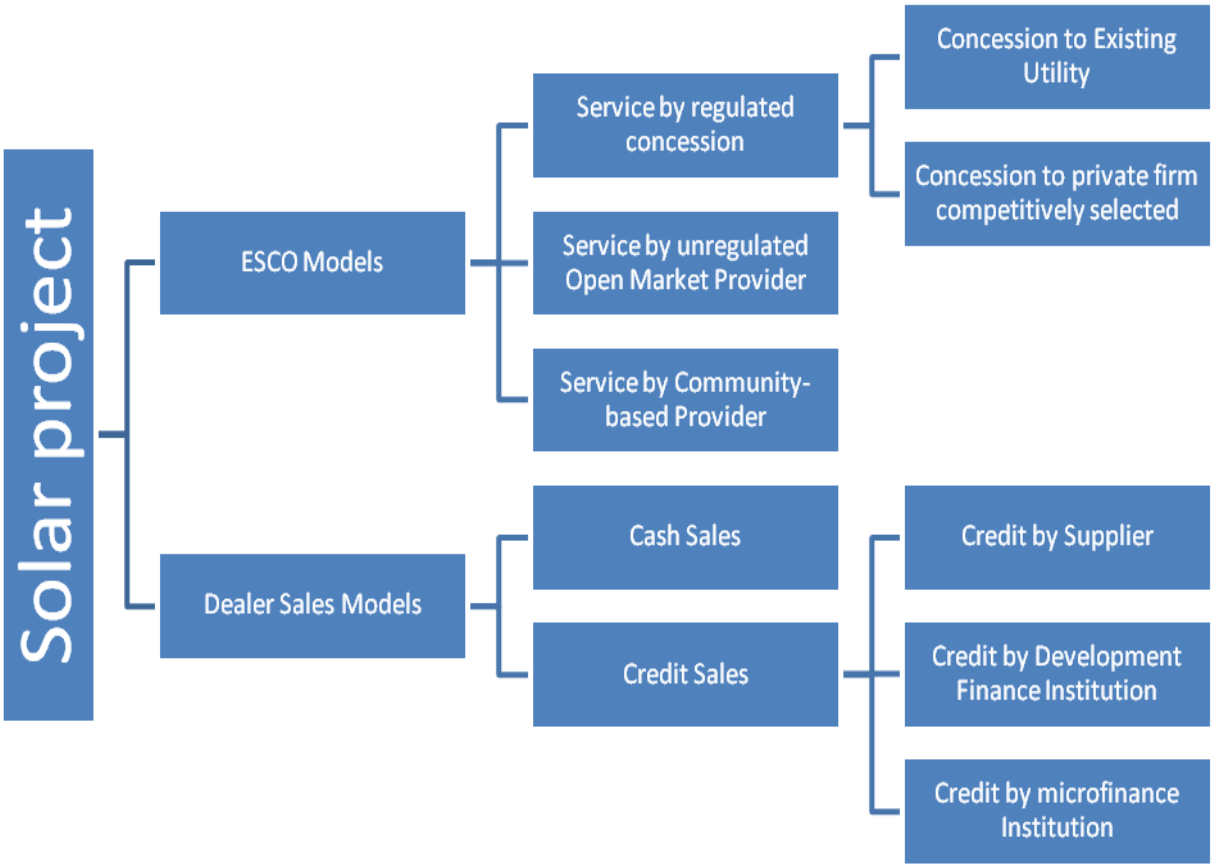

Figure 1: Business model options adapted from Martinot et al. (Martinot et al. 2000)

These models have been implemented with differing outcomes across the world. In Sub Saharan Africa, the ESCOs of Zambia are a good example of a fee-for-service model that works. The ESCOs have been running for more than a decade now and are able to cover their costs with the monthly fees of the people they serve (Lemaire 2009). The problems they have encountered are mainly due to inflation, problems with people not paying the fees and faulty batteries. The batteries have been replaced by better ones and the ESCOs now reclaim the system if the user does not pay the monthly fee (Lemaire 2009). The ESCOs were granted a long term loan from the government to start their businesses and in this way were able to reduce the costs charged to customers of installing the system, in addition to this the solar systems were

provided by the government as a loan as well. For the initial investment a donation of the Swedish International Donor Agency was used (Lemaire 2009).

In South Africa a government project using the fee-for-sales concession model was implemented in 1999 (Lemaire 2011). In 2011 3 of the original 5 companies were still working and were cost effective or almost cost effective. However, for the ESCOs to sell new systems they are still dependent on the government to provide subsidies (Lemaire 2011).

In Zimbabwe a project by the Global Electrification Fund was set out in 1993 to try to improve the dealer-sales based market for solar Photo Voltaic (PV) systems there (Mulugetta et al. 2000). The project funded many small solar PV businesses, many of which could only survive due to the financial backing by the project. When the Zimbabwe project ended less than 15 of the original 60 companies were unable to continue their operations. The reasons for this are that many businesses had no vision on how to become independent of the funding provided by the company and the economic conditions in the country became unfavourable by the end of the project with high inflation and devaluation of the currency (Mulugetta et al. 2000).

Choosing the collective option means that every household will have to make a contribution to sustain the systems, which means a loss of assets for each household, while it is not immediately evident that they profit from this contribution. The problem is that each household can decide not to contribute to the collective, as this might be more profitable on the short term. If every household would do this, there would be no collective action taken. As the people on Rusinga Island in general have a low income, although the SMoTS do save them some money on the use of kerosene and phone charging costs, it would be necessary to save this money individually for repairs to the system and to buy spare parts. As it is unknown when the system or a part of the system will break down, there may not yet be enough money saved to pay for the repairs or spare parts. This could mean that the systems will not be repaired and eventually be discarded. However, reports of the regular meetings of the Community Advisory Board show there is a high motivation among the Rusinga people to sustain the systems (C.A.B. 2014b). The problem can be considered to be a social dilemma, and more specifically: a public goods dilemma (see theoretical framework below). When considering the frequency at which components will need replacement the composition of the SMoTS must be taken in to account. The system consists of two parts: a domestic electrification part: lights and a phone charging device, and a malaria control part: the mosquito trap. While the malaria control part can indeed be considered to be a public good, as everyone benefits from the prevention of malaria, the electrification part is more of an individual benefit, although it may create an incentive for sustaining the system and in that way it would be in everyone's interest to keep it and thus also be considered a public good.

Rusinga Island has been the setting for a number of projects before SolarMal, some of which are still going on such as the "Island of Hope" project which was started by a Czech Developmental aid organisation called Center narovinu (narovinu 2014). Two other projects have taken place on Rusinga Island, one by Care Kenya which provided water tanks and latrines and one by CCF which focussed on improving farming, small scale businesses and fisheries by providing boats. Both of these projects were unable to effectively sustain part or all of the goals that were set. The reasons for these failures can prove to be very valuable when trying to determine what would work for the SolarMal project concerning sustainability.

Research Objectives

The objectives of this research were:

1. Monitor and understand the arguments for the preferences that CAB members/community opinion leaders have regarding sustainability options in social dilemma concepts and theories.

2. Find possibilities to achieve cooperation between CAB members and possibly other actors involved, by analysing the characteristics of social dilemmas that are found in the first objective and using proposed solutions found in literature to understand and help solving the issues.

3. Present the Community Advisory Board with a set of options to achieve sustainability for the solar powered mosquito traps during a meeting.

Theoretical Framework

Social dilemmas are situations in which collective interests are at odds with private interests (Kerr 1983). Kollock (Kollock 1998) defines them as: "...situations in which individual rationality leads to collective irrationality.". An example of this could be the choice of going to work by car instead of going by public transport. Going by car may have the advantages of getting to work faster, being cheaper than public transport and being independent of public transport travel schedules. The disadvantage is that if everyone would choose to go by car instead of public transport, this would result in huge traffic jams causing everyone to be late for work, spend more money on fuel and, on top of that, cause the air to become heavily polluted so everyone will be worse off. So for the individual it makes perfect sense to choose to go by car, but for the collective this is not advantageous and therefore considered irrational.

Kollock (1998) recognises that there are two broad categories of social dilemmas: two person dilemmas and multiple person dilemmas. Two person dilemmas are the well-known prisoners dilemma, the assurance dilemma and the chicken dilemma (Kollock 1998). The prisoners dilemma involves the story of two prisoners who both get the same two options: either betray their partner in crime or keep silent. If both keep silent, then they have to serve 1 year in jail. If both betray each other they will both serve 2 years. If the first betrays the other and the other remains silent, the first will go free while the other serves 3 years in prison, the same happens the other way around. In this dilemma it is always better to betray because if you betray the other person while he or she keeps silent, you will go free while the other has to serve for three years. When you betray the other and the other betrays you in turn this is still better than if you had cooperated while the other had betrayed you as you would then have to serve for three years instead of just two. Kollock (1998) sums this up by ranking the possibilities from best to worst: (D is defect (betray), C is cooperate) DC>CC>DD>CD (Kollock 1998).

The assurance dilemma is a variation of the prisoners dilemma (Kollock 1998). In this dilemma the point is that mutual cooperation (trust) will give the best outcome, however if one of the two defects then it is best for the other to defect as well. The ranking in this dilemma is then: CC>DC>DD>CD (Kollock 1998). The last two person dilemma is the chicken dilemma. In this dilemma it is better if one of two parties defects than when both defect: DC>CC>CD>DD. This dilemma is visualised using a game of dare featuring two cars which are driving towards each other. The first one to move away is the "chicken". This explains why the worst outcome is when neither of the two cars move away. The reason for mutual cooperation to be ranked second best option is that if both move away the shame is not all that bad (Kollock 1998).

Multiple person dilemmas are divided in to commons dilemmas and provision of public goods problems (Brewer and Kramer 1986). Commons dilemmas are named after Hardin's article: the Tragedy of the commons (Hardin 1968). The tragedy of the commons entails the social dilemma of taking a resource which gives the individual an immediate gain while the costs are shared by multiple persons. This immediate advantage applies to all individuals of course, causing them to choose individually as well, which leads to a depletion of the resource in the end (Kollock 1998). Provision of goods dilemmas, also called social fence dilemmas (Kollock 1998), are problems where the individual has to decide whether or not to contribute to a collective good. If the individual does not contribute to the collective good, this does not exclude him from using it. This constitutes a gain for the individual as he can profit from the common good without contributing anything from his part, this is called free-riding (Kollock 1998). If everyone would do the same however, there would be no means to establish or sustain the common resource (Brewer and Kramer 1986).

The different types of social dilemmas have been (and still are) tested using simulations of social dilemmas with real volunteers. It has been shown that people do not always choose what would be best for themselves in the short term but rather choose to cooperate for a number of reasons (Dawes 1980). Reasons can be social control (Kerr 1999), the possibility to reward cooperative people or punish non cooperative people or be rewarded or punished (Sutter et al. 2010), the size of the group involved (Brewer and Kramer 1986), conformity to the rest of the group (Schroeder et al. 1983, Carpenter 2004) and identification with a group and the presence of a leader (Van Vugt and De Cremer 1999). Trust is also an important factor in determining whether people will contribute to a collective good or not (Messick et al. 1983, Fleishman 1988, Van Lange et al. 2013).

Social control is only effective in promoting cooperative behaviour if a number of conditions are met (Kerr 1999): It should be clear that there is a cooperative norm, that is: it is expected that one cooperates and that group members care about others actions. It has to be certain that any sanctions will actually be

delivered to non-co-operators. Behaviour should be monitored by all group members, the choices made are public. The sanctions that are possible should be severe enough for members to avoid being sanctioned. An experiment performed by Kerr (Kerr 1999)shows that people care most about sanctions that exclude them from the group.

Sanctioning appears to be an effective method for promoting cooperative behaviour in social dilemmas (Kerr 1999), this is confirmed by Sutter et al. (Sutter et al. 2010). In their article Sutter et al. (2010) also find that when groups are given the choice for installing an institution of punishment for defecting or one rewarding cooperation, they tend to choose the institution that rewards them if they cooperate. Another finding in this article is that cooperative behaviour is increased in both the punishing and the rewarding institution as long as the group can choose which one they would like.

The effect of group size has been disputed. According to some authors (Brewer and Kramer 1986, De Cremer and Leonardelli 2003) smaller group sizes (8 people in Cremer and Leonardelli's research) lead to higher cooperation than larger group sizes (32 people in their experiment) especially when choices are public because the social pressure will be higher. But in an experiment done by Isaac et al (Isaac et al. 1994) it was found that in large groups (40 and 100 people)cooperation was equally high as in small groups (4 and 10 people). The authors of this article state that the effect of group size on cooperation for a public good depends on an interaction between the group size and the marginal returns per capita (Isaac et al. 1994). In their research Isaac et al (1994) altered the marginal returns per capita, in field situations this might not be possible though.

Conformity is the phenomenon in which people copy the behaviour that is most prevalent in a group (Carpenter 2004). This behaviour could stem from the desire to belong to the group (De Cremer and Leonardelli 2003). This could lead to both higher and lower cooperation, depending on how many people defect or cooperate in the beginning (Carpenter 2004).

Group identification can have positive effects on the willingness of people to contribute to a collective fund, because their trust in others to do the same is high, or because they value the goods more (Brewer and Kramer 1986, Van Vugt and De Cremer 1999).

Leaders can have a positive effect on how much is contributed by group members. There are two types of leaders according to Van Vugt and De Cremer (Van Vugt and De Cremer 1999): Instrumental and relational leaders. Instrumental leaders can impose punishments to group members if they do not cooperate while relational leaders can only encourage members to cooperate. It was found by Van Vugt and De Cremer (1999) that in groups where group identification was high, both types of leaders raised the contributions to the public goods. In groups with low group identification the instrumental leader was able to raise contributions while the effect of the relational leader was much less.

Trust can have a great influence on how cooperative people are (Van Lange et al. 2013). Trust means to be willing to be vulnerable because of positive expectations of the actions of others. It has been shown that high trust leads people to contribute more to a collective good. When people do not have such high levels of trust this does not mean they are truly non-cooperative, it means they do not trust other to contribute so they won't either. When an institute of sanctioning is installed people with low levels of trust can still cooperate (Van Lange et al. 2013).

Research Questions

Main research question

To what extent are individual or collective options preferred by different members of the Rusinga community in organising the sustainability of SMoTS and what motivations and experiences drive these preferences?

Sub research questions

- What do the CAB members/community opinion leaders prefer concerning organizing sustainability of SMoTS in a collective, individual or other manner ?

- Is the system regarded as a whole or as two or more distinct components by the CAB members/community opinion leaders?

- What are the arguments CAB members/community opinion leaders give for their preferences?

- Does the sustainability of SMoTS issue have the characteristics of a social dilemma?

- Are the arguments given related to the factors which are important for cooperation in social dilemmas?

Chapter 2: Methods

Interviews

During the fieldwork 16 semi structured interviews were undertaken. The choice for semi structured interviews was made because this type of interview left enough room to diverge from the prepared questions when the interviewee came up with interesting topics not previously considered. All interviews were recorded, with oral informed consent, using a voice recorder. The recorder was turned on after the interviewees introduced themselves, hence the names were not recorded on the device with a few exceptions. In the transcripts the names which were accidentally recorded are removed. Transcription was done by the interviewer in a word to word fashion, unless the interviewee repeated information already given before or gave irrelevant (off-topic) information. In these cases the information given by the interviewee was summed up in a few lines, the same applied to some very elaborate examples given by a few of the interviewees. All interviews took place at the interviewees homes or at a location of their choosing.

Nine out of 16 interviews were conducted with CAB members. The other seven were conducted with opinion leaders. The CAB members were selected from a total group of sixteen members. They were selected on a few criteria, most importantly that they should be living on Rusinga Island. In the selection of interviewees regard for local politics was taken in the sense that both the chief of Rusinga West and the chief of Rusinga East were selected, as not interviewing them would be taken up as a sign of disrespect. In the end the chief of Rusinga West sent an assistant chief in his place though.

For the selection of opinion leaders, a type of snowball sampling was used. After each interview with a CAB member, they were asked who they perceived to be an opinion leader on the matter of SMoTS sustainability in their immediate surroundings. The list obtained in this way was edited to add more of a balance in male/female interviewees, as more males were mentioned as opinion leaders. Additional opinion leaders were chosen from a list of opinion leaders compiled by the SolarMal staff earlier on. For the complete list of questions for the interview see appendix I.

Focus group discussions

Six focus group discussions were done to acquire some insights in to how the ideas that were proposed by CAB members and opinion leaders during the interviews would work out in the community. Therefore, four preliminary models for sustainability were created from the data of the interviews. The FGD participants were asked what they thought of each model and what they perceived to be the challenges and advantages. For the complete question list see appendix II. The FGDs were conducted mainly in DhoLuo as many of the participants did not speak English well enough. The FGD were moderated by a bi-lingual project staff and there was a note-taker. A translator was present at all times to translate the ongoing discussions into English for the research student. The discussion was audio recorded with permission of all participants. These recordings were transcribed by the bi-lingual project staff afterwards. In addition the complete discussion was recorded on a voice recorder after informed consent of all participants present. These recordings were transcribed by the bi-lingual project staff afterwards.

Six FGDs were conducted, four of which were conducted with people from villages and the remaining two were conducted with people from fishing beaches. The distinction between beaches and villages was made because it was expected that the high migratory character of beaches would influence the outcome. To ensure an equal distribution of men and women in the FGDs, two of four village discussions were conducted with women and two with men. For the beaches the same concept applied. To avoid male domination during the discussions the choice was made to hold separate discussions for men and women. There were a few criteria the people had to meet before they could be selected. First of all the participants needed to live in a metacluster in which the SMoTS were already installed (at that time metaclusters 1-7) and they needed to be 18 years or older, for the beach FGDs an added criterion was that they should be living on the beach. The aim was to recruit around 8 people per FGD. Because there are always people who at first confirm to come but due to circumstances do not show up, 12 people per FGD were invited. How many participants really turned up varied much between the different FGDs, a number of four participants was taken as a threshold for the FGD to start. One FGD had to be rescheduled because only three participants came, this was probably due to an action from a political party which was handing out funds for women's group activities.

Village

The people for the village FGDs were selected through stratified random sampling, as much evenly distributed over the metaclusters as possible. This meant that three people were chosen randomly from each metacluster, with the remaining three randomly chosen from all seven metaclusters, this was done for men as well as for women. To select participants the baseline demographic survey document including much personal data from all the people involved on Rusinga Island during the onset of the project was used. This document was adapted to show only the necessary information, *i.e.*: name, age, gender and phone numbers per metacluster number and cluster number. The randomization was done with excel using the RANDBETWEEN option, taking as the maximum the number of people in a certain metacluster. If a certain person randomly generated did not meet the criteria, because of his or her age for example, the person above that one was selected if this one did meet the requirements. If this person did not meet the requirements either, another number was randomly generated. The selected people were then contacted by phone by the SolarMal social staff. The use of the baseline demographic survey document had some downsides. Many of the people on the list had migrated in the years after it was created or their phone numbers had changed. It therefore happened often that a new list had to be generated, because many people could not be reached or had moved.

Beach

The participants from the beaches were selected in a slightly different way. There were 10 beaches located in metaclusters which already had SMoTS installed. So for every beach at least one male and one female participant was selected. Through random selection each of the remaining four was allocated to one of the ten beaches. The project had decided that everyone who received a SMoTS on the beaches should sign an agreement for taking good care of the system. These forms were kept by the SolarMal project, and a copy was given to the household. The forms were used to select participants as these people had received a SMoTS and certainly lived on a beach. The number of forms was counted and then a number was randomly generated using the RANDBETWEEN function in excel. However, the forms were not present for all beaches which led to a more difficult sampling method for a part of the beaches. For these beaches (three in total) a specific list was created with the clusters in which these beaches were located. People from these lists were chosen in the same way as was done for the villages. The precise location of the selected peoples' homes had to be checked though, as some of the clusters included non-beach areas as well. This was done with a Google Earth application and Global Positioning System coordinates from the file. If one of the selected participants appeared not to live on the beach, another sample was taken randomly. The selected persons were contacted by phone by the SolarMal social science team. Again it proved hard to locate people as migration levels are high on beaches. It would also have been better to take samples of households instead of persons. This would have made inviting people much easier as any member of that household with the right sex and age could have participated. Due to the difficulties in locating people for the FGDs which resulted in time pressure, the beach management was asked for help to locate and invite some people living on the beach under their supervision.

Chapter 3: Views of CAB members and opinion leaders on sustaining the SMoTS

Time since installation of SMoTS

A total of 16 people were interviewed; Nine CAB members and seven opinion leaders. The CAB members numbered six men and three women, the opinion leaders numbered four men against three women. All CAB members, except for one, already received the SMoTS. The same applied to the opinion leaders. The time the interviewees had the systems installed ranged from one year and three months to three months before the interviews were conducted.

Views on the purpose of the system

Almost all CAB members (eight out of nine) mentioned mosquito trapping as a benefit of the system alongside the house lighting and phone charging. Of the opinion leaders however only two out of seven mentioned the mosquito trapping as something that benefits them.

Ownership

On the question of who should be the owner of the installed systems after the research phase ends, many interviewees answered the people who currently have the systems installed on their houses should become the owners of the system. Six CAB members gave this answer and five opinion leaders did the same. One of the most common reasons given for the households owning the system after the project leaves is that the person who currently has a SMoTS knows how to take care of it, while some other people might not have this knowledge, therefore the system will be broken or misused by these people if the system is owned as a collective, that is: other people have access to it. This concern is illustrated by a quote of one CAB member:

"It is not very easy for someone to be assigned who is not staying in that house. He may not be concerned, things cannot go well at times. He may even take the cables. Because not everyone got the system. He may even be tempted to use my battery putting a radio on it or a computer."

Another reason often heard was simply:

"The owner of the house should own it as this is the person given the system by ICIPE."

One opinion leader did not want an island wide organisation to own the systems because of a previous experience with the RMP (see box 1):

"Because Rusinga is big. You know when this thing was started it was managed by the malaria people. (...) There were a lot of squabbles. Money. Involving money and so on."

Communal ownership was considered an option for five out of nine CAB members (one person said both communal ownership and individual ownership was possible). For the opinion leaders this number was much less with communal ownership being named only once. The exact meaning of communal ownership was left to the interviewees to define, they defined it as either a group of people that would own the system or as the whole community through a board representing the community.

One CAB member had a specific reason for preferring a CBO to own the systems instead of individual ownership:

"Some were benefitted even though they were not residents of this area. If we allow them to own the system, when the project ends definitely they will leave with the system. But according to the way I am seeing this thing, this thing should remain with us."

Box 1: The Ksh 500,- issue

At the beginning of the SolarMal project there was a local CBO present on Rusinga Island concerned, among other things, with malaria prevention. This Rusinga Malaria Project (RMP) presented itself to one of the leading persons of SolarMal as a very valuable partner as they had the support and knowledge of the whole community of Rusinga. The RMP was welcomed at an early stage to assist in the SolarMal project (Oria et al. 2014). However the RMP started to collect money from the residents of Rusinga, without informing the SolarMal management and without their consent. The money collected was allegedly for sustainability of the systems, although some residents claim the RMP members said the money was a subscription to get a SMoTS. The amount collected for one SMoTS was 500 Kenyan Shillings (Ksh). When eventually the actions of the RMP were revealed, they were asked by the SolarMal management to stop their collection of money immediately. Many efforts have been undertaken to get the RMP to refund the money to the community, but without success since the RMP members are very vague about its whereabouts. The exact amount of money that is collected is unknown, but based on how often this issue is mentioned by different people it could be quite substantial. Adding to the difficulty is that some former RMP members are now working for SolarMal, the community knows this and therefore community members often think that SolarMal keeps the community's money and is responsible for the collection of the 500 Ksh. Informal discussions with the SolarMal staff revealed that some members of the RMP might still be collecting money in name of the RMP. Even though many community members are angry at what they feel is theft, no one has been arrested or persecuted as of yet. According to one staff member this has to do with the strong family ties present on Rusinga Island. The Rusinga people are not eager to report family members to the authorities. Another staff member suspects that the authorities do not respond to the matter because they are paid by some of the (former) RMP members to accept their actions. Whatever the truth may be, the 500 Ksh issue remains an important topic for the people of Rusinga, as the issue is brought up in many instances, until it is solved.

Interestingly some CAB members named the CAB as the right group to take up the responsibility of a governing body and own the systems, while none of the opinion leaders seemed to consider this option. Both CAB members and opinion leaders mentioned that a new CBO should be formed to own the systems. One CAB member mentioned the RMP to be the best CBO to own the systems after the project has left:

"I think we can have one body governing the whole community, and they get representation from the whole island. (...)the CAB should be realigned or we mandate the RMP who has the whole of Rusinga."

One opinion leader proposed a model that follows the fee-for-service model closely:

"What I am trying to bring home is that there should be this board that makes sure the thing is sustained. Not the beneficiary. The beneficiary should own it as a result of paying a small fee. For example we have Kenya Power. You pay something, they bring the light. I am the beneficiary, but that project is not mine. We own it."

Another opinion leader preferred the collective effort, the collective being a group of people this time, to be in regulating proper maintenance of the systems:

"Everyone who has the solar and the light to come in the group compulsory. No question about it. As long as you have the solar you are a member of this group. And as long as you are a member of this group you have to comply with the rules and regulations governing this. And these rules and regulations should be uniform."

Some who considered owning the system as a collective to be a viable option, acknowledged the risks of trusting others, but held the opinion that with proper rules and regulations this could all be solved.

Analysis of Ownership: History matters

The doubts about others' abilities to take good care of their system, possible misuse by others, when the system would be owned and maintained by a group and the distrust expressed about groups or governing bodies, sometimes in relation to the Ksh 500 issue (box 1) show that *Trust* is an important factor influencing the opinion of CAB members and opinion leaders on ownership.

Some interviewees said that the SMoTS will belong to them after the project is over. This idea has a history. At the beginning of the project it was indeed communicated to the community that the systems would be handed over to them when the project was over. However, the systems were imported for research which meant that the import taxes on the systems were reduced. If the systems were to be donated, the difference in tax would have to be paid as the systems would no longer be part of a research. At the moment the solution seems to be that the systems remain legally property of ICIPE, but the community is free to use the systems. This however still leads to uncertainties in ownership and the exact rights the community will have to the systems. Still the initial promise made by SolarMal towards the community remains in the memory of at least part of the community. This shows that small things that are said or decided at one point can have quite a large influence later on. It is therefore important to take history into account.

During their meetings the CAB members had been discussing the sustainability of SMoTS before this research started. During one of these meetings there was talk of the CAB becoming a governing body for all SMoTS-related issues. Some CAB members repeated this idea during the interview, others seemed to remember only parts of it or merged it with their own ideas. The diversity in the answers given by the CAB members show that they are not unanimously behind the idea of the CAB as governing body owning the systems. Overall the CAB members did show more readiness to consider ownership as a collective than the opinion leaders.

The opinion leaders seem to prefer smaller institutions as the last quote shows. This quote further shows that rules and regulations within groups are viewed as a way to deal with trust issues.

Repairs

On the question of how the systems should be repaired, most interviewees answered that repairs should be done either by local technicians or those trained by the project. Only one opinion leader seemed to be confident he could repair the system by himself. Another opinion leader was convinced that only those technicians who were trained by the project should be allowed to repair the system:

"They should be the only people allowed to touch the things.(...)If you use random experts to repair this equipment, then you are very likely to find an error."

The opinions were diverse on the question of how the technicians should be paid if they are hired. Roughly three types of answers came up. 1. the technicians would be paid per service by the household which requested the repair. 2. A monthly fee would be paid to a certain governing body and this would cover all costs for repairs made by technicians. 3. A group would be formed to save money for any future repairs, the group would then have a pool from which the repairs are paid. Interestingly the CAB members were more reluctant to save in groups to pay for repairs, as six out of nine of them preferred to pay for the technicians individually. However, very few of them mentioned at this point why they would not save in groups. One CAB member noted that:

"The household will pay the technician and it will be very cheap for the household, because the technicians come from around. They are our sons, we know them (...)*"*

The opinion leaders on the other hand did mention quite often (four out of seven) that they would help each other out if their system would break down, by forming special groups that would save for this purpose. One opinion leader said that she had already started such a group. A comment was made by another opinion leader concerning the willingness to join groups to save:

"All of them will not agree, but some are going to agree. A quarter or three quarters will agree. And if three quarters agree then we are going to do it, because we are a majority. (...) a quarter of them, these are the people who have refused. Then they will suffer. If you have refused to accompany me, isn't it, the two are together. So that person, if the thing is broken, he will suffer. Unless he says: 'now I will join you.' Then we are going to maintain them together."

None of the CAB members and opinion leaders thought it was a good idea to permanently employ technicians to do their job:

"we cannot employ them, we cannot sustain them. After they have done their job, then we pay them and we finish with them."

One CAB member had a different reason to prefer paying technicians per service rendered:

"Yes, but you know we cannot employ them, sincerely we cannot. Why do I say this, you know employing somebody in Kenya you need to pay them and in case of any eventuality they will definitely end up in labour court."

When asked if the technicians are able to make a living when they are only paid per service, one CAB member answered:

"Yes, because they will do other things as well. Some are fishermen, others are businessmen..."

The request to linking up the community with the technicians so they would be available to them was made very often by both CAB members and opinion leaders.

Analysis of Repairs: to employ or not to employ

Apparently the systems are viewed by most of the interviewees as something one needs specific technical knowledge about. The great majority of the interviewees were willing to pay a technician to repair the system. If the notion one of the CAB members has about the costs for the repairs is shared among the CAB members it could explain their preference for paying the technicians individually. Indeed one other CAB member made a similar comment, but pointed out that the low costs were due to the fact that the technicians are trained per cluster and therefore no travelling costs would be incurred nor any extra costs for the time spent travelling.

The opinion leaders are more inclined to save collectively for paying the technicians. The opinion leader's quote about the willingness to join a group shows that even though some people initially do not want to join a group, they probably will later on, according to this opinion leader. This could be seen as *conformity* to the rest of the (local) community, as those who do not join are a minority, although it is suggested here that households who do not join the group will not be able to cover the costs of repairs on their own and therefore do not have any other choice than to join.

Employment of technicians is not viewed to be an option for any of the interviewees. For the interviewees who oppose a governing body this is logical as there would be no institution to employ the technicians. Those who do favour a governing body still do not think employment is suitable. The quotes concerning this point give some insight into why that is. It appears that there is a fear that the costs of employing a technician will be much higher than if they are paid per service. Also a SolarMal staff member explained that when someone would be employed, that person might not do the job he was hired for at all, instead doing some other job to double their income. This view was found again during the FGDs. The other quote shows that there is a fear of a risk of being taken to court by the employee, in this case the CAB member is sure that will happen. Presumably the idea is that the labour court will force the employer to pay the employee a large amount of money. Another CAB member, who himself is an employee, suggests that employing someone is not something to be undertaken lightly. It seems employment is not a common practice on Rusinga Island, as the last quote illustrates as well. People on the island appear to have different part time occupations to earn an income.

Buying and selling of parts and systems

On how spare parts and eventually new systems should be obtained, the respondents could be divided in two groups. The largest group thought that a shop in Mbita, specialised in selling the spare parts and systems would be most convenient. The other group thought it would be better if the original donor or ICIPE would take the responsibility of selling the parts and systems. Although all respondents of the first group prefer a shop in Mbita, the way this shop should be managed is not unanimously agreed upon. Most of the respondents opting for the shop prefer a businessman with sufficient amounts of money to run it. There was no preference among the respondents as to who this businessman should be, although one respondent suggested that someone like the owner of Rusinga Island Lodge and the Mbita Ferry company could be approached to do the job. This would have to be done by the project, according to one CAB member:

"because the community would talk nonsense. (...) The project will approach him because me I will talk for my benefit, you will talk of yours so the project will talk to him without a direct need."

Another suggestion for how the shop should be run was that it should be managed by the CAB. This suggestion came back a few times but only among CAB members:

CAB member: "We will have a shop somewhere."
Interviewer: "A shop owned by the CAB?"
CAB member: "Yeah."

And another CAB member:

"After we see that it is working we shall pair with ICIPE and they shall tell which parts we should buy. After that we will employ at least two or three people, we can manage to pay, at our warehouses to sell."

A similar suggestion was that a governing body elected by the community should take the matter of governing a shop on itself. The idea with either a shop managed by the CAB or a governing body is that people will pay a monthly fee to the organization, this money is then used to buy spare parts or systems from the producer and place them in a shop so the Rusinga people can buy the spare parts themselves as illustrated by one opinion leaders quote:

"One you pay a fee for installation after that, after using electricity you pay a fee for consumption. So if I pay a fee let's say annually, for example, that fee is put in a pool. They will purchase the bulbs, batteries and any other. The fee from the pool will pay for the technicians and the parts. They bring it here and instead of paying 100 for a bulb you can reduce it to 50 shillings for one bulb and I buy it."

Analysis of buying and selling parts and systems: A shop in Mbita

It is clear that the great majority of the interviewees prefer to have some sort of shop where the spare parts are available. Who should run the shop is determined by the person's view on whether or not there should be a governing body. Those who do not prefer such a governing body logically prefer a businessman to run the shop, although some interviewees who do prefer a governing body still prefer a businessman to run the shop, in that case the governing body would oversee the business. Interestingly the CAB member who states that technicians should not be employed, in this case does not have any problems with shopkeepers to be employed. This might have to do with the nature of the job, as shopkeepers can be easily checked in their work.

It is also interesting to note that as illustrated by the first quote in this section the people of Rusinga do not seem to trust each other very much when matters of money are involved. Another matter of interest can be found in the last quote. The person here mentions a fee that is paid by a person to a governing body which uses the money to procure the spare parts from elsewhere and then place them in a shop so the people who paid the fee can buy the parts at a discount. This system of paying double was encountered before, but the interviewees did not seem to think this would be a problem to the community. In the FGDs more attention was given to this idea.

Financing

In addition to paying the technicians, money is also needed to buy spare parts or sometimes complete systems. This point was often intertwined with the previous two subjects. There are many different opinions in this category. The responses to the question of how the spare parts could be afforded can be ordered in three types: 1) through group saving, 2) through individual means, and 3) through donor intervention. In this case people who previously stated that there should be a governing body that takes care of repairing the systems and procuring new systems and parts, suggested that saving for the monthly fee could be done within a group. The larger proportion of those who did not mention a governing body in their previous answers suggested that group savings would be the best option to make sure there would be enough money in case repairs were needed or replacements needed to be bought for various reasons but often because they thought they would not be able to cover the costs by themselves:

"No, because the group...how can I explain it...because this thing is mine now everybody is having it and somehow...or there will be a time when I cannot afford it, through myself, but in a group we can afford everything through the contribution we are going to do. We are going to say that "alright, there is a problem somewhere so can we go to the bank and withdraw some money so that we maintain what?"

One opinion leader gave an interesting different reason for preferring small groups as a way to finance the SMoTS:

"Yeah. If it is like, you know, people must have monthly subscriptions of x amount of money, then it's the community, just that group may have the power, not someone from ICIPE, not a white man from the Netherlands, just the people there may have the power to go and remove that solar and the light from your own house, because you're not doing as a community, because it is a community effort and you're not playing in the league!"

The smallest group saw the greatest chance for success of the intervention if a donor agency would procure the necessary parts for them. As an alternative they suggested that people should struggle for themselves to make the payments and if they were not able to do so, they could call for a *Harambee* (see box 2) or for relatives to help out:

"They can call Harambee or what. Let me say when we have these old men or old women. They can join and call a Harambee because they have their MCA's (Member of County Assembly, a local political leader) *and they can go to them to ask if it is possible to do a Harambee for spare parts."*

Box 2: *Harambee*

When there is a need for something like a health clinic or a school in a community, the community can call for a *harambee*. *Harambee* is a traditional Kenyan way of realising a collective project. Usually some prominent members of the community are chosen by the community as the leaders for that specific project and they have the task to organise fund raising events and, if necessary, organise the labour necessary for construction activities.

Some interviewees were not directly against the idea of group saving but foresaw problems with it for some people, and therefore preferred the above mentioned solutions:

"Income, some people do not have income, especially the old. Joining a group calls for contributions and some people may not be able to contribute."

In this last group some members had some reservations about the idea of saving in groups or putting money in a communal pool:

"No! I got an experience in things being done like this. They don't succeed. The reason I cannot tell but I know things in group are not working in the correct way. Because you can put money together and then you would find the money is not there."

Later on in the interview this person directly mentioned the reason for distrusting groups:

"Before this thing started, we were told to contribute 500 shillings each and that 500 up to now we don't know where it is and even if we ask the people who collected it they don't tell us the truth. So that is why I am against things being done in a group"

A similar reason for the distrust is given by another opinion leader:

"I can also remember when these things (the project) *were starting we were told to pay 500 shillings for the maintenance of this. But again I don't want to get involved so much of that because there were a lot of things coming in. There were a lot of things like the misappropriation of funds and it was disgusting."*

Analysis of financing: Distrust and *harambee*

It appears that group saving is seen as a valid way of generating enough money to pay for spare parts and repairs. However, at the same time there is much distrust among the interviewees about these group efforts. Some interviewees point directly to the 500 Ksh issue as a reason for the distrust, but in other cases, interviewees remain vague about why they think group work is not preferable. Interestingly those who oppose group work the most are also the ones who point at *harambee* to be a solution, which in itself is a collective activity. It could be that the form in which the group work is done matters to them, or it may be that *harambee* is such an integrated part of society it is not viewed as a collective effort one could

doubt, lastly it might be a reflection of their earlier statements that each person should care for him or herself, as *harambee* contrary to group work is something that not necessarily involves the interviewee.

Storage

The issue of storage did not turn out to be something the interviewees had a strong opinion on, and in most cases just followed logically out of what they had mentioned before about where to get the spare parts, *i.e.*: the shops. There has, however, been one interesting mention by a CAB member who stated that there were already some agreements between the chief and the CAB that the location previously rented by CCF (Christian Children's Fund) would be available for a CAB-run shop without them having to pay rent.

Upgrading

Upgrading means that community members alter the system to allow more uses than the project currently permits, for example if they want to connect a TV to the system they are allowed to do so. This topic also went into the financing of the parts, for example a bigger solar panel or a stronger battery, which would be necessary to carry the extra burden on the system. There were roughly two responses to the issue of upgrading along the lines of *"if the donor can pay for it we will be very pleased"* and *"do not allow it".* It was mentioned often that many people already had big solar panels installed[1] to generate energy for appliances such as TV's or refrigerators. One CAB member noted that many of these solar panels are not working due to a lack of technical knowledge on the proprietor's part. One opinion leader expressed his opinion on allowing upgrades to be made to the system in the following way:

"I think, and I am telling you this from lots of experience, I was born and raised here and have been working here my whole life. That project should be as specific as it is. It is for charging small appliances and for just light. If you open a room for expanding that system I am telling you, people will explore and that thing will break. For those who want to expand it for different things, it sounds like you have money. If you have a TV then you should know that it uses power. If you are away from the main electricity then the honourable thing you should do is buy a bigger solar system, buy a battery and connect it."

A CAB member was worried that allowing people to alter the system would threaten the main purpose of the system:

"If we go in that way then the original purpose of the thing will be beaten off. You know we have the trap the SMoTS. And to me that is the engine of it all the main thing. The charging and lights are supplementary. So the main purpose of this was to drive malaria out of Rusinga. So if we start bringing a larger panel that can...and I know how our people use the power. (the interviewee gives an example of his children watching so much TV that the battery was down at 11 p.m.) *So this will automatically beat the intended purpose of malaria eradication in Rusinga."*

Analysis of upgrading: A matter of expertise

Several interviewees mentioned that solar panels can be bought or already found around the island, so apparently there already is a trade in solar equipment in the area. It is known that other parts used in the system, like the battery, light bulbs and cables are also available on the island although these parts are different than the ones that are currently used and of lower quality. When it comes to financing the necessary parts however, very few interviewees seem to be willing to pay for it. Furthermore there are quite some interviewees, both opinion leaders and CAB members, who think their fellow community members will break the system if they are allowed to alter it and by doing so halt the malaria eradication effort. It is surprising that the opinion leaders would name this as they did not seem to think about the mosquito trap as an important part of the system earlier on in the interview.

Challenges for collective efforts

The interviewees mentioned what they perceived to be challenges for collective efforts in sustaining the system. The word group in this section has two meanings: on one hand it is used by the interviewees to indicate a possible governing body and on the other it is used to indicate groups intended to save money for sustainability. The way they used it depended on their answers given in the preceding questions.

[1] Although this was mentioned multiple times, few solar panels were actually observed on the island.

Two CAB members gave interesting opinions of challenges they saw for a collective effort in the sense of a governing body:

"You know the problem of fear and lack of confidence that we are having, is lack of...the people who are actually elected cannot be accounted in terms of money. You can remember I mentioned something about the Rusinga Malaria Project, yes the RMP. The RMP was there but even now there are still some challenges because of transparency."

"As much as ICIPE is not keeping the money, the people know that the SolarMal project is from ICIPE. But when the money was collected they knew it was for the SolarMal project. So you know when the project is now phased out and the people are asked to contribute some money and they do not know where the 500 shillings are, imagine...how would you feel? Would you want to contribute again?"

In line with this, as an answer to what should change to make the group effort more successful, accountability of the group leaders and transparency of the financial side are mentioned:

"(...) these people should cooperate, be transparent and should be able to account for any finances. Because that one will determine the failure or the success of this. You collect money for a certain purpose and if you do not use this money properly that can lead to failure. If money is accounted for properly that one can bring success."

Interestingly this is said by four out of nine CAB members against only one opinion leader. The same CAB member who gave the first quote in this section has a rather fatalistic view on the issue of accountability though, he answered when asked if he doesn't think the same corruption will take place as before:

"Yes yes...No! Aiaiai. That one not for now. You know there is one thing I mention almost every time: we are all human beings. You cannot trust a human being. You can elect someone today and the following day what will happen we cannot know. So this element of lack of trust, lack of accountability may actually happen again. (...) Yes. That one you cannot tell."

Five CAB members also name community sensitisation as something that is vital for a group effort to succeed, against three opinion leaders. On this matter one CAB member noted:

"It might be difficult for the community to understand. We would like every member in Rusinga to benefit. But some will not understand. There are people in the community who just oppose things for no particular reason, the hard-core people. They are also in the community. We have challenges talking to them and convincing them. Even community contribution. We do not anticipate 100% but if we work really hard we hope to get 70-80%."

An opinion leader thought sensitisation was important as well but for a different purpose:

"Groups need to be sensitised to the objective. So they know that the groups need to take care of the system because the project will leave."

To meet the challenge of corruption, the CAB members as well as the opinion leaders state that rules and regulations should be in place. The rules then would need to be enforced by the two chiefs. The preceding part mostly dealt with group effort as meant in a large governing body, for smaller groups some interesting observations can be made as well. Comments like:

"you find people who are not committed, people who are only interested in stealing money from the group, money that people have put together."

are common among both CAB members and opinion leaders. Often they say these things out of personal experience. Their solution for this challenge is often punishment for those who do not follow the rules of the group.

One CAB member added to this that it is very important that group members feel that they belong to a group:

"The people should own the group, they should feel they're part of it. (...) They have to own to group because a group effort helps, you can't sustain the system individually."

Also comments about group size were common, one opinion leader prefers groups to be small, an opinion that is shared by many interviewees:

"This small group is easy to manage. Management of the group becomes easy. Just as I said when it becomes a large group it is not easy to manage. And that is why we had a problem when it was Rusinga, then you had a problem with financial matters. Because the group was so (...) it was just too big. And few people made decisions and the rest was just left just like that."

When numbers were given for group sizes, they varied from 10 to around 30 people per group, but most interviewees said the ideal group size would be between 15 and 20 as this ensured the manageability of the group while it also made sure the group would have sufficient income.

The interviewees who did not trust group work to succeed depended in many cases on first hand experiences. It is possible though that second hand experiences were also of influence in the formation of their opinion as illustrated by the following quote of a CAB member:

"sometimes individual responsibility is better than in a group. Because... there is a group that normally sits here. A women's loaning system, that is funded through a trust: Kenya women finance trust. The women were put in a collective...like a pool where they can guarantee their members to take a loan. So if someone defaults then the whole group takes responsibility. But sometimes I see the group has difficulties, they have to go around and look for people...someone has disappeared."

Analysis of challenges for collective efforts: More trust issues

It is clear that trust is an issue for both governing bodies and smaller groups. The trust issues are caused because the interviewees had experiences with dishonesty and corruption in both types of groups. Again the RMP is sometimes named explicitly, but not by everyone, and can therefore not be considered to be the sole culprit for the lack of trust many interviewees are experiencing. It seems that trust is an issue not only between people and larger institutes but also on a lower level between people and their fellow group members or leaders of their groups whom they elected themselves. Interestingly almost all interviewees who brought up the trust issues, be it about a governing body or a saving group, said it can be solved by having rules and regulations and proper accountability of the leaders. It raises the question though why these rules and regulations were not already in place, or enforced, if corruption and dishonesty is often such a problem in groups.

The CAB members seem to be more positive towards working through governing bodies than the opinion leaders, as could have been expected from the previous topics, even though both mention the distrust of larger organisations.

The remark that community members should "own" the group points towards group identification as an important factor preventing people to default from groups, or encouraging them to join it.

It is interesting to note that the ideas the interviewees have on group sizes match with the theory as described in the theoretical framework.

Experiences from working with other community members

All interviewees had some experience with working as a group, be it fishing or saving or some community-based service. By asking directly about the personal experiences of the CAB members and opinion leaders some additional insights in the reasons for preferring or disliking collective efforts were gained.

According to one CAB member the people of Rusinga are very well able to take on any project, as long as they feel they own it and buy the idea. He gave an example of a school that needed to be supported, some community representatives looked at the plans he presented and after asking some critical questions they agreed to the plan, they "bought" the idea. After that the community itself came up with the idea to form a body to which they would contribute 100 shillings each month and do a fundraising to support the school. The CAB member emphasised that it is important to involve the community right from the start and agree on the way the project will be executed. The CAB member added that it is important that the initiator of the idea only supervises the progress made without bringing in additional interests as this will conflict with the way the community works. Directly after he said this he made an interesting comment:

"*And some employees of SolarMal should also not interfere with the program. Some of the employees, some of your employees are interfering. They are putting in their interests."*

When asked what these interests were, the CAB member apparently told the note-taker present to keep the next things off-record and he stopped writing for a while.

"Like the inception of this CAB I don't think it came from the community and two..."

The CAB member did not further specify what he exactly meant with the interest, but instead repeated that the SolarMal bosses should not put in their own interests, and changed the subject.

An opinion leader stated that in his experience the community has problems undertaking projects which do not yield immediate results. He thinks this short-term thinking is caused by the high levels of poverty which leads people to be focussed on alleviating immediate needs. He gave an example of this:

"That is another reason why you might have heard or read that the prevalence of HIV is high here. It is not high because people are stupid. It is not high because people are not educated. People know exactly what causes HIV and they know it very well, they can teach you they can teach me. But if my children are suffering and cannot go to school they are crying or one is very sick or angry. And some random men here offer to give me 500 shillings which I can use to buy food and they will settle, and the only thing this man wants is sex, and I have my organs here whatever I can use to do that sex. What do I do? I may get AIDS, it will not kill me today, it may kill me in 5 to 10 years. But this is an immediate problem."

What the interviewees found positive about group work was that in a group you have access to more contacts, so if something needs to be done outside of the expertise available within the group, it is more likely one person within the group knows someone who is able to do it. Many mentions are made about groups creating togetherness as in the following quotes by two opinion leaders:

"The group has brought togetherness and we work together. We give each other advice and we have grown and we help each other grow."

"Yeah, group work brings people together, it is...you become a family because most of the things you do you do by consensus. If there is any member who has got a different view it can be sorted out and then the group can just continue. Small matters that crop in you sort them out and you continue."

This togetherness helps people to work together better and create more willingness to contribute to the group.

Many interviewees mentioned that they disliked people who do not or barely contribute to a group but they do want the profits.

"I dislike people who do not want to participate. I usually call them joy riders. They say they are part of a group but there is not really something they do to be part of the group."

"What I dislike in groups is that there are sometimes people who are depending on the others. They don't pay the way they should pay. I may have, but I may be a miser I am not very willing to pay the way I should pay."

The interviewees are sure that through group rules these people can be forced to cooperate, as one CAB member states:

"At group level this regulation really helps.(...) But of course there are very stringent rules. If the rules are not strong people will bend them. There are women's groups who have very nice rules. People there know that the rules are the rules and if you break them for a time, you are expelled."

Another common problem within groups is said to be gossiping. Interestingly especially the CAB members in leading positions named this as a big problem.

"That is a serious issue a very serious one. When you see I am doing good, you must talk bad. Why they do even you cannot tell! But when you are a leader you need to accept a healthy criticism. You need to accept, because for you to change you need to understand those who oppose. But many of us they are just gossiping."

"What I dislike most is when people, like in a group there can be gossips. Gossips can spoil a lot of things."

A mechanism for dividing groups and bringing down morale is what many interviewees call "politics". Politics is described as some people within groups start to spread doubt among members about their

current course and about the leadership of the group. It is often seen as an attempt to take over the group for one's own benefits:

"Yeah when they come to a group the first year they are good, the second year they can listen to you, the third year...they are now clever. So now politics started. But what I do when someone is doing politics I just make that person leave the group. Because one politician can even spoil twenty. Yeah like: This cannot be done in this way, like you want to save in the bank and you tell us my money cannot be taken in the bank, and you came just last year, and you say this and that will happen, it cannot be done, the bank will eat my money...that is the politics I am talking about."

"some people may start a very bad propaganda: "Oh these thing were given to us, now the project has collapsed, they are now ours. I am not becoming..." Somebody will just say that propaganda(...)"

One opinion leader thought more of "politics" as involving real politicians searching for votes:

"They will divide the group. They will come very silently, because where there are people, the politicians like the crowd they like people just simply where they can get their votes. It may not happen but I've got cases, very few cases where politicians have disrupted the group activities. That can bring the group down."

Analysis of experiences with groups: the free-riding problem and politics

The CAB member who insists that the SolarMal staff is putting in their interest may be referring to something that happened at the very beginning of the project: the installation of the CAB and the decreased importance of the RMP as a main link to the community. This CAB member is consistently recommending that the RMP should be reinstalled to carry out the sustainability of the SMoTS. The example he gave bears a lot of similarity to a common *harambee*, confirming that *harambee* is an integrated part of society on Rusinga Island.

The example about HIV and short term thinking given by one of the opinion leaders is an interesting one as it could have an effect on how well the sustainability efforts will go. It appears to be very useful to have the lights and mobile phone charger on the system as this is a very tangible immediate result of the system, however it is not certain that the people are willing to sustain the mosquito trap should they not notice any effects in malaria reduction. If the community members do perceive an effect already in malaria reduction, the short term thinking will likely be less of a problem.

People who profit from a group's activities, but do not participate in it are called free riders. These free riders seem to be common in small groups, even though the interviewees say that it can be easily countered when there are clear rules installed. The interviewees depend on rules in groups much to take care of any unwanted behaviour, such as freeriding but also politics as mentioned later on. Each time rules are mentioned, it is striking that they are mentioned in a context of sanctioning, and not even once in a rewarding sense, for example rewarding those who do cooperate in group activities. This is contrary to the findings by Sutter et al.(Sutter et al. 2010) (see theoretical framework).

Preferred choice tables

Below the filled-in preferred choice tables can be found for the CAB members (table 2) and the opinion leaders (table 3). It appears that there are many possibilities for how each of the issues can be dealt with, both individually as collective. The tables are divided into three parts: a part which points toward an individual preference (green), a part which point towards a collective effort preference (orange), and a part that falls outside of these two categories (yellow). Both the table for the CAB members as the one for the opinion leaders shows that most answers pointed towards preferences in the individual part. Striking differences between the two tables are an absence of the CAB, RMP or surprisingly *Harambee* as collective answers to the issues for the opinion leaders, while they are given as answers by the CAB members. The opinion leaders also seemed to be more inclined than the CAB members to expect a donor or the project to come in with a donation to help with sustaining the SMoTS.

Table 2: Preferred choices of CAB members, all answers have been inserted. Multiple answers per issue are possible

CAB													
	Individual							Collective Effort					Other
Issue \ Answer	Household	Relatives	Project trained technicians	Businessman/businessmen	SMoTS owners	CBO	CAB	Rusinga wide body	small group (women/youth...)	RMP	Harambe	Project(SolarMal)	(Other) donor/NGO
ownership	6					2	2			1			
repairs	1		6			1				1			
payment for repairs	6	1				1			1	1			
procurement of spare parts and new systems				6			2	1		1	1		2
financing of spare parts	4					1	1	1	3	1	2		
upgrading	4				1		1						
Total	21	1	6	6	1	5	6	2	4	5	3	0	2
Grand Total				34							26		2
Percentage of answers given				55							42		3

Table 3: Preferred choices of opinion leaders, all answers have been inserted. Multiple answers per issue are possible

Opinion Leaders													
	Individual							Collective Effort					Other
Issue \ Answer	Household	Relatives	Project trained technicians	Businessman/Businessmen	SMoTS owners	CBO	CAB	Rusinga wide body	small group (women/youth...)	RMP	Harambe	Project(SolarMal)	(Other) donor/NGO
ownership	5					1						1	
repairs	1		4					1	1				
payment for repairs	3	1						2	2				
procurement of spare parts and new systems				2				2	2			1	1
financing of spare parts	2	1						1	2				
upgrading	4				2								2
Total	15	2	4	2	2	1	0	6	7	0	0	2	3
Grand Total				23							16		5
Percentage of answers given				52							36		11

Qualitative preference table

The qualitative preference table (table 4) lists the key words and phrases that were used most often by CAB members and opinion leaders on each subject.

Table 4: Qualitative preference table of CAB members and opinion leaders

	CAB member preference	*Opinion Leader Preference*	*Other ideas*
Ownership	Individual ownership, CBO owns the systems, CAB owns the systems	Individual ownership	SolarMal should own them
Repairs	The technicians trained by the project should repair the systems	The technicians trained by the project should repair the systems	-
Payment for repairs	Each household should pay for the repairs themselves, monthly fee to a governing body	Each household should pay their own repairs, save with a small group, pay a fee to a governing body	-
Procurement of spare parts and new systems	Businessman using own capital, CAB/CBO using monthly fee from community	Businessman with enough own capital, Some sort of governing organisation, save for it with small groups	A donor should bring them here
Financing of spare parts	Households themselves, should be included in the monthly fee to CAB/CBO, groups can save for them, people can call for a *Harambee*	The households themselves, small groups can save for the parts, relatives could help	-
Upgrading	Households themselves should pay for that, groups of SMoTS owners could save for that	Households themselves should pay for that, groups of SMoTS owners could save for that	A donor should come in to pay for upgrades

Chapter 4: Views of community members on constructed models

After a short first analysis of the interviews, four models were constructed:

Model 1: *The system is owned by the person who currently has it. Parts are paid by the owner and repairs are paid by the owner. Repairs are either done by the owner or by a contracted technician. There is a shop in Mbita that sells the parts for cash or on credit.*

The first model is a reflection of the most individualistic views encountered during the interviews, in which each SMoTS owner has to take care of everything by him/herself. In this model it is possible to buy parts on credit, this suggestion passed in one interview where it was stated to be a common practice among shop owners. In this model that suggestion is tested.

Model 2: *The system is owned by the person who currently has it. SMoTS owners form groups to which they pay a monthly fee. Parts and repairs are paid by groups. Repairs are done by technicians. Joining a group is not compulsory. There is a shop in Mbita that sells the parts.*

The second model still starts with individual ownership as this was the preferred option for many interviewees. However, there is more room for collectiveness. The main point of this model was to find out how the participants related to it in comparison with the first model and to examine their opinion on working together. This model is still quite non-committal.

Model 3: *The systems are owned by a governing body for all of Rusinga (CAB, CBO ...). People are still responsible for the system. Those who have SMoTS form compulsory groups. The governing body collects a standard amount of money from the groups. The money is used to buy spare parts that will be placed in a shop in Mbita. The shop is governed by the governing body. People with SMoTS buy spare parts in the shop and pay for repairs done by technicians.*

The third model is actually directly copied from a few interviewees who shared the same thoughts. The seemingly odd double payment involved in this model was a main reason to take it up in the FGDs. None of the interviewees who mentioned it seemed to think of it as a problem, so to find out what other community members felt about the apparent double payment, this model was proposed. Another use for this model was to find out what the community thought about a governing body owning the systems.

Model 4: *There is a governing Body. SMoTS are owned by this governing body. New systems are acquired through seed funding from donors. Technicians will install systems for customers and do repairs and monitoring. Technicians are paid by the governing body per service rendered. People who have a SMoTS installed pay a monthly fee which covers everything. People can join a group when they have a SMoTS, this group saves or finds a way of income generating to pay the monthly fee to the governing body. Added to this are specific regulations for those not able to pay (because of specific reasons like age) groups or relatives pay their bills.*

The last model is based mostly on the fee-for-service standard model. It is also based on those interviewees who saw the greatest potential in collective efforts. The last line is derived from one interview but backed by a few others. The interviewees often pointed towards relatives or neighbours to help out others who were not able to pay, this model was used to examine if that would really happen. An overview of the subjects included in each model can be found in table 5.

Table 5: overview of the four preliminary models

	Model 1	*Model 2*	*Model 3*	*Model 4*
Governing body	no	no	yes	yes
Ownership	individual	individual	governing body	governing body
Repairs	self/technician	technician	technician	technician
Shop in Mbita	yes	yes	yes	no
Monthly fee to governing body	no	no	yes	yes
Saving in groups	no	optional	yes	optional

Model 1

The system is owned by the person who currently has it. Parts are paid by the owner and repairs are paid by the owner. Repairs are either done by the owner or by a contracted technician. There is a shop in Mbita that sells the parts for cash or on credit.

Village participants: The male participants in this group generally think this model could work, but they mention a few challenges that could frustrate the sustainability effort, one of them sums up the concerns:

"It can work yes but it will depend with the homestead the system is installed i.e. whether the household owner has enough knowledge on the system since maybe he or she was trained but cannot remember everything that was taught at the workshop on how to care for the system, it will also depend on whether one has money to sustain the system, some are also very old such that they may not even know when the system has got a problem, also finding the technicians can be a very big challenge to them too."

One of them mentions that whether or not it is sustained depends on the effectiveness of the system and the availability of grid power:

"Yes it can work depending on the need of electricity among the community members, so it will depend on how people perceive the importance; is it for light or malaria prevention? So if it will prevent malaria then I will have to maintain it. And if where I come from there is grid power and the panel that we were given cannot serve our homes then some people will rather go for electricity."

Interestingly this same person then continues to say that the model might *not* work because:

"If you look at this project one thing has superseded the other, light is more important to the community than the intended purpose. The idea might not work because we are going to have quacks, and it will be subject to a lot of abuse."

The quacks in this case may be referring to untrustworthy technicians. The concern that the technicians may not be capable of repairing the systems was also mentioned as a challenge by the women in the village participants group:

"Untrusted technicians that can destroy the system further"

Or:

"(...)lack of trust and honesty among technicians when handling the repairs(...)"

The women did see this model as one that could work:

"It can work since the project has ended and it is now mine in addition it's me who uses it so when it gets damaged it's me to look for a technician to come and repair it for me and it's also good that the project trained some that can assist."

It is interesting to note that the women apparently do appreciate the technicians that are being trained, but are concerned they cannot be trusted.

Concerning neglect or selling of the system both men and women mention that it will happen when the maintenance costs are too high for the person who has the SMoTS, or when there is no place or person the SMoTS owners can turn to when the system breaks down. One male participant makes an interesting remark about what will happen if the system is left to the community:

"A human being by nature is a very curious animal and out of that curiosity, people will do unimaginable things with that system that will render it useless after some short time. That is when it left in the hands of the community."

The great majority of both men and women in the village participant group think that the dealer should be selected by the SolarMal project or should be someone from the SolarMal staff as they have knowledge of the systems:

"The dealer should be one of the project staff that know and understand the system very well and they also have experience with the system."

It was also suggested that the SolarMal project should make a Rusinga wide announcement for this opportunity, so interested people could come themselves. None of the participants provided a name of a possible dealer.

Most village participants thought the dealer should use his own capital to finance the shop. However, one male participant had a different opinion:

"The Rusinga people can still come up together and pay some little fees to bring these things from wherever they are brought from and stock them within Rusinga here and that will be the shop for the Rusinga people, then we call it SolarMal shop. Anything we need for the maintenance or repair of the systems can be got from the shop."

Buying parts on credit is not viewed to be desirable by the village participants, mainly because of the following reason mentioned by a female participant:

"The system should just be bought on cash since some people do not pay debts after receiving spares on credit."

Furthermore, buying on credit is seen as a sign of irresponsibility:

"No since some people will not be able to pay back thus the shop may collapse since there is no money to go and bring new spares. People should become responsible and buy the spares on their own in cash."

During all FGDs with the village participants it was mentioned that neighbours or relatives should help those who are not able to pay for spares or repairs:

"Since the system is helping us a lot we have to take every responsibility that comes with the system, Relatives and neighbours will have to come in and assist those who cannot afford i.e. the old men and women."

Beach participants:

Most beach participants agree that the model could work, because the people who have the SMoTS now will be forced to maintain the system if they want to keep enjoying its benefits. However, during the FGDs some beach-specific challenges emerged. First of all, there was a long discussion with the male participants about who would be the owner of the SMoTS, the landlord or the tenants. The participants had some objections against the idea that the tenant would become the owner:

"The model cannot work if its left to the tenants and especially when they are aware that the project is over and you as the landlord is not staying with them, this tenant can migrate with the system, because most of the tenants at the beach vacate the house even without notifying the landlords, so system should be handed over to landlords"

Another participant made a comment about what he thinks would happen if the landlords would own the system:

"The landlord can sell the system, the reason why he can sell the system, when the system was brought, the household owners signed the form and now the SMoTS will remain the property of the landlords and they will do whatever they like with the system. They can even migrate the systems to their homes if they don't have the system. Some are even saying that what they will definitely do."

One male participant did not think the model would work, because the presence of a system would mean that either the rent of a house would be increased or there would be extra costs for the tenant if he has to maintain the system:

"According to me the model cannot work because an example: I am renting a house at Ksh 400 and system maintenance at one point might take Ksh 3000, I might consider doing my math: do I take Ksh 3000 which might pay my rent for some few months in a house of the same rent and was not installed, or do I use the all amount in repairing the system? Definitely I will migrate in the other house which is not installed to survive more months. So the model cannot work at the beach and people will abandon the houses. So the tenants will not take care of the SMoTS."

Then there is another challenge for sustainability at the beaches pointed out as some rental houses occupied by multiple people share one SMoTS, this means that one tenant may only have one lightbulb, while another has the rest of the system in their compartment:

"Those who share at the beaches may have challenges of maintaining the system jointly especially those who were given the bulb only."

Just as with the village participants a concern was expressed by one female participant about some technicians, in this case however it is clear that the technicians trained by the project are trusted:

"Local technicians might exploit the household members when repairing the SMoTS, so trained technicians who are known to the community should take charge after the project."

According to most beach participants the technicians who were trained by the project should become the dealer as they have knowledge of the system. There were a few divergent opinions on this matter though. One male participant suggested that the project should identify a dealer from an already existing shop in Mbita or Kisii:

"Then the project to identify one of the big electric shop from Mbita or Kisii to be selling these components to the community, because I don't think it will be easy to identify an individual who is interested in the business."

One of the female participants had the following idea:

"Women can form groups or SolarMal groups to take up this business"

Then there was one male participant who thought there was some kind of hidden agenda behind the question:

"Madam that question has a hidden agenda, one you want us to give an individual name, and then you call that person. I think this should be left open because it's a good business and now we know that you require a dealer, let anybody who is interested approach you."

Possibly the participant feared that the person he would mention would not appreciate the offer and in this way the relation between the participant and the mentioned person would be damaged.

The money necessary for the shop should be found by the shopkeepers themselves or, as one female participant suggested, it should be obtained through a small monthly fee paid by households with SMoTS.

The participants gave a variety of answers to the question how those who would not be able to pay for repairs or spare parts could still get them:

"The project to develop a list of those who cannot afford and see a way they can be helped by the dealer."

"They can get support from their relatives."

One female participant thought it would be better to avoid this issue:

"Landlords to have tenants who are willing to maintain the SMoTS, because some tenants are so lazy to maintain the system."

One male participant did not see any option for those who could not afford the costs:

"We should not pretend that people are able and if those who are not able are faced with challenges they will likely sell the system or neglect them."

Model 2

The system is owned by the person who currently has it. SMoTS owners form groups to which they pay a monthly fee. Parts and repairs are paid by groups. Repairs are done by technicians. Joining a group is not compulsory. There is a shop in Mbita that sells the parts.

Village participants: Most village participants agreed that this model would work as it solved the challenge of maintenance for people with little or no income. The participants, male and female, were quite enthusiastic about group work:

"It can work since group work is inclusive of the old who do not have enough knowledge about the system and from the group they will get assistance and those that lack enough money too will get assistance from the group savings, group work is also very good since people share ideas and they also have reasons for starting up the given group also working in a group can enable them face credit as a group thus making work easier, also with group work it opens ways for other developments"

Together with the positive sides of group efforts, there were many concerns and challenges mentioned. One of the most prevalent concern is phrased in the following quote by one male participant:

"(...) if there is this careless person in a group that his device keeps on getting damaged every time meaning that the rest of the group is collecting money for an individual"

Another challenge mentioned by a few male participants:

"bad group leadership leading to misappropriation of group resources"

One participant links this to specific areas on Rusinga Island:

"There are areas in Rusinga where groups can succeed and areas where they cannot succeed, people might contribute money and when I need some repairs to be done then there is no money."

Multiple references are made by female participants towards group members who refuse to cooperate:

"Some members may contribute while others may not (...) members not attending group meetings affecting their contribution to the group."

"*Laziness of some members may make some people leave the group."*

Some participants also noted that transparency within groups as well as a lack of trust between group members may make group work difficult. Interestingly one female participant noted that group work might be more difficult in the town area:

"It might not work in town since people keep on migrating in and out and also forming groups in town is not easy because people vary in opinion and bringing them together is also a very big problem."

In every FGD with the village participants it was stated that to make a group work rules and regulations should be in place. To counter corruption of the group leaders a few suggestions were made by male participants:

"Vetting of group leaders or electing them to take care of integrity issues without considering their clan where leaders come from."

"(...) elect good leaders and they should know them well."

"Having check and balances to safeguard the finances and other group operations like withdrawal of funds from the bank"

One male participant made a recommendation about the formation of the groups:

"they should identify their own membership and they should be people that live close to one another since if someone comes from far you might not know his or her character i.e. knowing one another better before coming together to form a group"

Similar to what has been found during the interviews one of the participants mentioned that to make a group work successfully, politics and gossiping should be avoided.

One participant gave a suggestion to make new systems available for those who do not have them yet:

"The groups should have an apex body to work on the proposal development to get new system for those who did not get through donor findings, or saving a little higher can also work for those who do not have the systems"

One female participant saw a role for the project in the success of groups:

"awareness should be created by the project for community members to pay a given amount of money for maintenance of the system on monthly basis such that people get to really understand the need for the contribution."

All participants indicated that a group size between 15-20 persons would be preferable as this ensures enough income, but still keeps the group manageable in terms of differing ideas.

Beach participants:

Most participants thought this model would work well, but much as with the village participants they had some concerns about people who would not contribute and transparency of group leaders. Their comments on how to resolve these issues were very similar to those comments given by village participants. One female participant had a specific idea about how the systems would be sustained on the beach:

"The landlords to have tough rules for the tenants both old and new for the systems to be taken care of."

In the female beach participants group it was mentioned again that gossips should be avoided to keep the group from failing.

When asked how those who were not able to contribute would be helped two opposing answers came up, the first one by a male participant and the second by a female participant:

"The group members will assist the member who is not able and that's why we are forming the group, not all the members are able, but the few who are not able are also members of our community and group, so the group will assist them."

"At the beach set up even the very old have some source of income and the contribution will be compulsory for every group member, because the SMoTS will not break down every day."

Model 3

The systems are owned by a Governing body for all of Rusinga (CAB, CBO ...). People are still responsible for the system. Those who have SMoTS form compulsory groups. The governing body collects a standard amount of money from the groups. The money is used to buy spare parts that will be placed in a shop in Mbita. The shop is governed by the Governing body. People with SMoTS buy spare parts in the shop and pay for repairs done by technicians.

Village participants:

The male participants think this model could work but only when some conditions are met, most importantly that the community feels they own the body and it should be trusted:

"You know challenges with such bodies, they will tend to think they own the system and they might have regulations that might discourage the members. So I feel when forming this body because it's possible it can work, the whole Rusinga community must participate and they should own the body. That's the only way it can work."

"Yes it can work, but only if we have a reliable body or a trusted one, and people to head the body should be scrutinised by the whole community."

Participants in one female group however thought there would be some problems in convincing the community to contribute to a governing body again:

"It might not work for everyone because of lack of honesty in the contributions and also now that there is electricity around the Island many people might opt to go for electricity than going the SolarMal way. But anyway it can work though it won't be very easy to convince people to contribute especially those who had paid the Ksh 500 that was given to the RMP."

"The Ksh 500 that was collected earlier might not make people contribute once again to any body formed(...)."

Interesting to note here is the comment that the electricity grid has come to the island, according to the participant this could render the lighting part of the SMoTS unnecessary.

Almost all representatives recommend that the governing body should be formed by the groups of SMoTS owners:

"The clusters or groups nominate a representative, who will then elect the executive of the governing body. But groups are members of the governing body."

The female participants who stated before that a governing body might not work, repeated their concerns:

"It will not be easy to form the governing body because of lack of trust and also experiences with past bodies."

The male participants preferred two levels (groups and governing body) of government for the sustainability of the SMoTS while the female participants preferred three levels (groups, sub location and governing body).

Although the participants, male and female, agree that the double payment involved in this model can prove to be challenging, most of them seem to be willing to pay for both the procurement of the spare parts and to get them from a shop:

"It will be difficult and suppose this model is adopted many people may neglect their systems as a result of this since they cannot afford to pay again. But also if we understand the fact that the money we contributed was used to avail the spares it will be easy for us to buy the spares once again. Awareness should be created so that people get to understand since when we just take them without buying we might not be able to get more spares in future when we need them."

One male participant thought the challenge could be avoided:

"Yes it can work, but we have to look into the group thing, double pay of spare parts and repairs. I think members should buy in subsidised prices to avoid the challenge."

Beach participants:

Something interesting happened during the FGD with the male group from the beaches. When the model was explained the participants were very negative about the idea of a governing body for various reasons. The following quotes are the consecutive reactions the men gave to the question whether this model would work or not:

"No, madam the SMoTS were given freely and if there is any body on the island who wants to take over then this is a way the body wants to withdraw the systems from the community, already there are conditions which are not favourable to me and am sure they will not be favourable to many people. No, I don't want any body to own the systems."

"No it will not work, because there are conditions which if I can't meet, like joining the group or contributing the money then the system will be taken away from me."

"first that word governing body has scared me; we need to know those who will head the body and in most cases the projects have failed on Rusinga because of such bodies. Some time back there was this idea; Ksh 500 that was collected from community and we don't know where the money is, they also have harsh conditions that if you can't meet they will take the systems. If I don't talk much I can't support that model no."

When the moderator asked if she could continue with the other questions about this model they answered:

"*No don't ask us anything to do with the body, we don't want a body."*

The women of this group were more positive towards the idea but have similar reservations as the village participants:

"If the body is accepted and respected by the community it will work."

One participant made an interesting comment about the importance of a good representation of the Island in the governing body:

"There will be a challenge if the leaders are coming from one area they might concentrate on their area and neglect some areas of the island."

There were two ideas on who should form the governing body:

"Those who own the SMoTS should form the body"

"The project should help in forming the body before they leave, they have worked on the Island and they know those who can run the body."

The female participants further indicated that there should be two levels of government although what these two levels meant was not clear in all cases:

"Two levels because everybody cannot be reporting to the top level management."

It is possible that the participant did not count the individual group members as one level, but instead assumed that there would be a group representative to consult with the governing body as in other cases.

The female participants did not feel there was any problem with the double payment implied in this model:

"To help the governing body grow people should just buy the components from them. We also own the shop, as a community we want the shop to grow."

The male participants did not want to pay double, instead they proposed that the governing body would just start a shop without this contribution:

"No, because we cannot contribute to them to bring the SMoTS components and expect us to buy from them again. Let the body go into the business we will buy the components from them for maintenance."

Model 4

There is a Governing Body. SMoTS are owned by this governing body. New systems are acquired through seed funding from donors. Technicians will install systems to customers and do repairs and monitoring. Technicians are paid by the governing body per service rendered. People who have a SMoTS installed pay a monthly fee which covers everything. People can join a group when they have a SMoTS, this group saves or finds a way of income generating to pay the monthly fee to the Governing body. Added to this are specific regulations for those not able to pay (because of specific reasons like age) groups or relatives pay their bills.

Village participants:

In general the village participants thought this model was better than the third one, mainly because there was a donor involved in this model:

"It can work easily because of the external support from the donor thus the community will not buy the spares at a very high price also other operational costs will not be very high since there is some external support."

At the same time the funding seemed to be viewed as weak point in the model:

"sourcing for funds from donors and the collection of monthly fee is a major challenge here."

Interestingly the women participants who commented on the previous model that it would not work because of previous experiences with governing bodies were quite positive at first about this model:

"It can work since there is some funding that will help in availing the spare parts and our work will be to only contribute on a monthly basis but the monthly subscription should be fair enough to all community members."

Later on however they return to their previous statement that governing bodies do not work on Rusinga Island:

"If the community members are left to form a body they cannot since no body is trusted in Rusinga, in addition from the past experiences no body has worked well so it should just be left to any willing business man to conduct the business."

Other concerns that were raised were lack of transparency of the governing body and a lack of cooperation of the community members in paying the monthly fee to the governing body.

Most participants felt that the technicians should be paid per service, they gave the following reason for this:

"They should be paid per service rendered since some of them might not do anything within a whole month so if you pay them monthly it will be like a waste paying someone just sited."

One female participant reasoned the other way around and thought it would be better to pay them a monthly salary to cut on costs, as they would do a lot of repairs.

There were two opinions on whether or not the people would accept the system would not be owned by them when the project ends. The first one in phrased by one participant:

"People will not accept since my contribution is in the body thus it is my property."

And the other:

"Households should not refuse, the system should be owned with the governing body, because it's not their (the community members) *property and if we have a governing body to take over then they should not refuse. This will give the governing body the power to sustain the systems."*

To the latter statement a comment of one female participant can be added:

"They will only accept if the project calls for a Rusinga wide meeting and to introduce them to the body they are leaving behind."

Beach participants:

The male participants refused to answer the questions posed by the moderator about this model as there was still a governing body involved. One participant insisted that:

"we don't want to go to any body that will be governing Rusinga, it's like the project is handing over the project to another group/ project, no we don't want unless they open the shop and we can buy from them."

At this point the participants became suspicious of the whole FGD and thought the SolarMal project already had selected a governing body:

"The Rusinga community is very ready to maintain the system, but there is a feeling that the project is planning to force some body to the community, so it's better to be transparent and tell the community rather than imposing the body on the people of Rusinga. The project should direct the community on the way forward than suggesting a body for them or give the community the information earlier or else there will be crisis in 2016 after the project is gone"

Because the men did not want to answer any more questions, the FGD was ended after ensuring them again of the intentions of the FGD.

The women were again more positive about the model

"It can work; it's like an insurance body I don't have to bother about anything I only have to give the body report if I have a problem."

Their concerns were similar to those mentioned by the village participants.

The participants were divided on the question whether the technicians should be employed or not both options have been mentioned.

According to the female participants the people of Rusinga will accept that the system will not be owned by them as long as the project clearly communicates this to the community:

"The project to communicate that in time or else people might disagree after the project."

Analysis of the FGD participants' views

In general people are positive about owning the SMoTS themselves, the reason the participants think it will work is that if a person wants to keep enjoying the benefits of the system, he or she will have to maintain it. However, as was mentioned by one participant, most people only see the lights and probably the phone charging as the benefits of the system and not the reduction of malaria. It may therefore be that if grid power becomes easily available on the Island, which is mentioned a few times, the people may abandon the system. Currently a connection to the power grid is expensive though, so it may be difficult for the Rusinga people to connect to the grid even when it becomes easily available. Still the participant

was right in that in the first model whether or not the system is sustained depends on the priority the SMoTS owner would give the system. According to the beach participants the tenants would not give any priority to the system as it will cost them money which they could just as well spend on rent in a house without a SMoTS installed. However, the costs of maintaining the system may in reality be much lower than what the participant said which may influence the height of the rent. If the rent is not much higher than in other rental houses a tenant may decide to rent the house anyway.

A much heard concern during the FGDs was that they may not be maintained because of a lack of knowledge. This is an interesting comment as the project organises community meetings in a cluster before the systems are installed to ensure the people know how to take care of the system. All households should send at least one representative to these meetings. Apparently this either does not happen or the information is not clear enough.

According to many participants neglect and selling of the systems will happen if the maintenance costs are too high for a household. The presented solution to this was that neighbours and relatives should help that household. In all four models this answer was given as a solution to help those who cannot afford to contribute to a group or pay for repairs. During the interviews this was mentioned quite a few times as well and is apparently viewed to be a valid solution.

Although there are many challenges in groups, the participants seem to think it is a good way to solve the problem of those who are not able to pay. Again if they cannot afford a contribution to the group, neighbours and relatives are pointed out as the ones to help. Almost all challenges can be solved according to the group members by having strict regulations within groups and elect good leaders. Also the groups should be formed by the SMoTS owners themselves and consist of people who live close to each other, this points out that the participants view trust to be important for group efforts. It is interesting to note that many participants, even the most enthusiastic about group work pointed out that transparency of the group leaders or members is very important and should be ensured. It could be all of them had some experience with corruption of group leaders, but maybe it is just common knowledge.

Interestingly some participants insist that the SolarMal project should make an effort to create awareness of either the necessity to join groups before they leave or the need to contribute to a governing body if that is to be created, as this would make the Rusinga people do just that. Similar comments have been made during the interview. It appears that the project instils quite some respect into the community.

Governing bodies may encounter many problems in terms of transparency and trust. Some participants do state however that the process of selecting a governing body should be very transparent and done by people they elected themselves, to ensure the governing body is composed of trusted leaders. Still it is likely at least a part of the Rusinga community (the part who has had dealings with the RMP) will not trust them and certainly will not pay them any money. The people who mention the Ksh 500 issue or the RMP do not seem to be prepared to accept a governing body to own the systems and take care of the sustainability.

The issue of paying double as occurred in Model 3 seems in general not to be the greatest concern of the people, as long as they are able to get the spare parts from a shop. Some participants did make objections to the idea however and proposed that there should be a reduction in the price for those who contributed. This was also mentioned by an opinion leader during one of the interviews.

Another interesting comment that was made by one female participant, this was later clarified and confirmed by one SolarMal staff member, was about the clan structure on Rusinga which may become a challenge when a governing body for the whole of Rusinga is composed of different clan leaders. Apparently the strong clan ties on the Island will lead the different governing body leaders to be inclined to give a preferential treatment to their own clansmen, which would not be beneficial to the trust of the whole Rusinga community towards such a governing body.

Interestingly the participants mention that it will be difficult for a governing body to get funding from donors, while donor intervention seemed to be a standard answer during some of the interviews with opinion leaders and CAB members.

Chapter 5: Discussion, Conclusions and Recommendations

The main research question was:

To what extent are individual or collective options preferred by different members of the Rusinga community in organising the sustainability of SMoTS and what motivations and experiences drive these preferences?

This main research question will be answered and discussed through the sub research questions. Starting with:

Does the sustainability of SMoTS issue have the characteristics of a social dilemma and are the arguments given related to the factors which are important for cooperation in social dilemmas?

A social dilemma is a situation where individual rationality leads to collective irrationality. It is useful to make a distinction in the two uses of the system here. One of its uses is the electrification part and the other is the malaria eradication part. For the malaria eradication part, assuming it works, the fact that people prefer to own the systems individually and tend to prefer paying for repairs and spare parts on their own makes this a social dilemma. When the community members own the systems individually and pay for the maintenance of the systems individually this will lead to a loss of systems as not every member will see the benefit of the system and will choose to save money by not maintaining the trap. This means that there will not be enough traps working on the island to eradicate malaria. The reasons the interviewees give can be understood very well from social dilemma theory. Trust, sanctioning, group identification and leadership are all core social dilemma factors important in shaping the preferences the interviewees have.

The electrification part of the system has less characteristics of a social dilemma, as it primarily serves the people who have it in their house, not the community. There have been signs however that some inhabitants who did not get the system installed in their house turn towards their neighbours to charge their phones or to let their children study in the evening by the light of the system. It is not clear how often this happens, but when it does happen the same applies to the electrification part of the system as the malaria eradication part: when the community members choose to own the systems and repair the system individually, there is a chance that the systems will break down without being (properly) repaired to save money, which will influence those depending on their neighbours for phone charging and light.

What do the CAB members/community opinion leaders prefer concerning organizing sustainability of SMoTS in a collective, individual or other manner? And *What are the arguments CAB members/community opinion leaders give for their preferences?*

Tables 2 and 3 show the preferences of the CAB members and opinion leaders concerning the organisation of sustaining the SMoTS. These results will be summarised below and discussed from a social dilemma perspective.

Ownership

Both CAB members and Opinion leaders prefer to own the systems themselves when the project is over. Very few think that the collective option (the systems are owned by a governing organisation like in an ESCO) would be a good idea.

Repairs and payment for repairs

Most interviewees agree that the repairs could be done by the technicians who are trained by the project. The opinions differ on paying for these services. Whereas the CAB members prefer every household to pay for their own repairs, the opinion leaders are more inclined to use an organised form of paying. For example through a governing body or through small groups. In this case the CAB members choose for the individual option while the opinion leaders are divided between the individual option and the collective option.

Procurement of spare parts and systems

The CAB members mostly think the procurement of spare parts and systems should be done by a businessman, although there are nearly as many of them who think this could be arranged through some form of governing organisation like the CAB. The opinion leaders are more inclined to think that the

procurement should be done by either a governing body or by small groups. In short: the CAB members generally prefer procurement to be done individually (through a businessman) while the opinion leaders think a collective effort would be a good solution.

Financing of spare parts

When it comes to paying for the spare parts the CAB members show a wide variety of preferences, although by far most of them point towards some form of collectiveness such as a small group (like saving groups) or through utilizing *harambee*. The opinion leaders are divided between buying parts on their own or having saving groups or a governing body to be able to finance the parts. So it appears the CAB members have a strong preference for a collective solution while the opinion leaders are divided on the matter.

Upgrading

Upgrades were seen by both the CAB members and the opinion leaders as mostly an individual matter, which every household should take care of on its own. Many interviewees did not consider upgrading to be something that should be tried in the first place.

These preferences combined with the information gathered during the focus group discussions will be discussed by taking a social dilemma perspective. The social dilemma concepts that are used to explain/understand the preferences are: trust, sanctioning, group identification and leadership.

Trust

Most of the interviewees preferred to own the systems themselves. Next to the obvious gain it represents materially, trust plays an important role in their preference for this individual solution. In this case collective ownership was tied to paying money to some organisation, like in the fee-for-service model.

Many interviewees and FGD participants made it very clear that they are not ready to trust any governing body with their money. Of these, many mention specifically the involvement of the RMP and the subsequent misappropriation of their money as the reason for their distrust. According to social dilemma theory, *trust* is an important factor in determining whether or not people will contribute to a group effort (Van Lange et al. 2013).

This trust issue is further specified as a transparency and accountability problem of the leaders of such a governing body. Apparently in previous governing bodies, probably CBOs as these are common on Rusinga, there was no way for the community members to monitor the actions of the CBO leaders. The process of choosing a CBO is meant to assure the leaders will be trustworthy people. An interview with an assistant chief (neither a CAB member or an opinion leader) revealed that leaders for CBOs are chosen during a meeting of a part of the community, the present community members then choose the leaders from their own ranks. As the leaders have been chosen by the community they are assumed to be trustworthy. Nonetheless, it seems that most interviewees who prefer a governing body are aware that something has to be done differently for such a governing body to work correctly. They state that transparency and accountability of the leaders of such a body are often a problem.

Even though almost all interviewees agree that the project trained technicians should be the ones repairing the systems, there are some trust issues when it comes to how they should be paid. The CAB members think this should be an individual matter; the technicians should not be employed but paid per service. Most opinion leaders actually prefer this as well even though they are more inclined to save in groups. The idea people have is that an employed technician could easily neglect his tasks and make some money elsewhere while still being paid. Another fear is that there may be some legal issues involved when employing technicians. Specifically mentioned was that the governing body would have to spend a lot of money on employees should they get injured during their work. There is indeed an employment act called: "The Work Injuries Benefits Act" from 2007 (Parliament of Kenya 2007). The terms for being liable to a compensation however, are that the employee should be severely injured, leading to permanent disablement or death. In the latter case the relatives receive the compensation. Considering the work the technicians will be performing, the chances of them getting severely injured are relatively small. Still, the precise legal implications of the employment acts of Kenya are worth studying before permanently employing any technicians.

As mentioned before the opinion leaders were more inclined to save for repairs and also for spare parts in small saving groups. From the interviews it becomes clear however that there are trust issues in these groups as well which might explain the relatively small number of interviewees that prefer this collective option. The challenges mentioned most often were similar to the challenges mentioned concerning governing bodies: accountability of leaders and transparency. Transparency and accountability can be considered therefore as sub factors of trust. One other interesting challenge that was mentioned by many people is the "politics" which frequently seems to frustrate the group's efforts, and reduces the confidence, or trust, people have that the group will be successful.

Sanctioning

Applying rules and regulations and installing punishments in both small groups and large governing bodies is mentioned often by the interviewees as something that would build their trust in groups. Under the condition that these rules are actually applied, most interviewees think that small groups and even governing bodies can work. Indeed according to social dilemma theory sanctioning is a very effective method of ensuring behaviour that is beneficial to the collective. Sanctioning might also prove to be a solution to most of the challenges the groups encounter. Many community members suggest that the presence of clear rules and regulations might help in solving most issues. One opinion leader mentioned that normally in a group, the leaders are chosen from the group and after that, the leaders make the rules. This practice, if it is indeed common, could explain why there is so much distrust concerning group leaders. It may be preferable if the rules are agreed upon by the whole group and before the leaders are chosen to avoid any misunderstandings and to make the chance of misappropriation of funds smaller.

To apply a sanction, however there needs to be some kind of institution which has the power to enforce it. Some interviewees suggested that this task should be handed to the two chiefs of Rusinga, as they already fulfil this role. Another CAB member thought the CAB could be transformed towards a monitoring and evaluation organ that would supervise an executive governing body. With the Ksh 500 issue however the chiefs were not able to apply sanctions, which leaves some doubts about their suitability as law enforcers concerning the governing of the SMoTS.

It was mentioned earlier on that the people of Rusinga prefer not to employ the technicians. When the technicians are not employed however, the quality of the repairs might be at stake as less qualified mechanics will repair the system without proper knowledge of, for example, what spare parts to use. There will also be no control on the quality of the repairs. This might reduce the life span of the system. It seems there is a tension between the preference of most community members to pay the technicians per service, which may decrease the quality of the system, and the employment of technicians which would ensure the quality is maintained, but could be misused by the technicians. Social dilemma theory suggests that people are more prepared to contribute to a collective good when they are convinced that any sanctions are actually delivered, when the rules are broken. This indicates that if the technicians are to be employed there should be some form of monitoring of the technicians and if they indeed are lax in their duty some sort of sanctioning should be installed. Considering the frequent remarks of corruption on the Island it may be difficult to find a form of monitoring that is good enough to ensure the technicians will be carrying out their tasks.

The preferences for upgrading can be explained by the emphasis that was placed by the project staff at the beginning of and throughout the project that the systems should not be tampered with. The sanction for tampering with the system was that the it would be taken away. As expected from social dilemma theory, sanctioning works to help people cooperate, *i.e.* not breaking the system. Also the punishment (taking away the system) comes close to the most effective punishment in a group, which is being cast out from the group. The fact that so many interviewees said that the system should not be upgraded, affirms the positive effect of sanctioning.

Group Identification

As stated in the theoretical framework, when people are able to identify themselves with a group they are more willing to contribute because they trust the others to do the same. In line with this, many interviewees seem to prefer that the groups are formed from people they know, like neighbours, because they know and trust them, they have some common grounds, contrary to people from, say, the other end of the Island. This shows that there are also trust issues between the community members and attention should

be paid to this when groups are formed. Considering that there are many clans on the Island, this could be a cause of the distrust although this is not mentioned by any of the interviewees or FGD participants.

Leadership

The leaders of the small groups which are found all over Rusinga seem to exert mostly instrumental leadership as mentioned before under Sanctioning. However, as the study of the precise workings and the relationships between the group leaders and the group members was beyond the scope of this thesis, it is not certain whether or not leaders of small groups truly are instrumental leaders. The same applies to the two chiefs of Rusinga: it has not been studied which type of leadership they actually exert.

Still, the group leaders *can* punish their fellow group members if they do not follow the rules. But the leaders themselves often seem to be unaccountable to the group members. If the leadership would be changed from instrumental to relational, meaning that the leader can only encourage members to cooperate, this would not change the fact that someone has to be responsible and accountable for the groups savings. However, it might increase the trust that the group members have in each other which could lead to more willingness to contribute or cooperate, as every member of the group gains the responsibility to monitor the others.

It is difficult to explain from a social dilemma perspective why the CAB members prefer a businessman to procure the systems and parts and the opinion leaders prefer a collective to take on this job. What probably plays a role for the CAB members is that a businessman has his own resources to procure the parts, and one can just buy the parts in a shop when it is necessary without having to pay a monthly fee. What might play a role in the preference of the opinion leaders is the thought that when a monthly fee is paid, or when the parts are paid collectively, a discount can be given to those who have contributed. This reasoning was found a couple of times during interviews and FGDs.

The social dilemma factors clearly have an effect on some of the sustainability themes covered in this research. The effects of the social dilemma factors on the themes are summarized in table 6.

Table 6: Effects of social dilemma factors on relevant sustainability themes

	Ownership	*Repairs and payment for repairs*	*Financing of spare parts*	*Upgrading*
Trust	Trust or actually a lack of trust makes the interviewees prefer to own the systems individually.	A lack of trust makes most interviewees prefer to organize repairs and payment for repairs individually.	The low levels of trust make most interviewees prefer to handle this individually.	No effect
Sanctioning	No effect	Sanctioning increases the trust many interviewees have in a small group or a governing body to handle payment for repairs (through a monthly fee) increases trust in employed technicians to do the repairs.	Sanctioning increases trust in small groups to be effective in financing the spare parts. Also increases trust in a governing body to take care of the financing for spare parts through a monthly fee.	Sanctioning keeps interviewees from tampering with the system during the project and even after the project.
Group identification	No effect	Group identification makes interviewees more likely to join a small group to save for repairs when the group is comprised of people they know. Group identification increases trust in small groups.	Group identification makes interviewees more willing to join small saving groups to finance spare parts, when the group is comprised of people they know. Group identification increases trust in small groups.	No effect
Leadership	No effect	Current leadership makes the interviewees distrust groups and governing bodies, which leads them to prefer to take care of repairs and payment for repairs individually.	Current leadership is not trusted by many interviewees which makes them prefer to handle financing of spare parts individually.	No effect

System of multiple parts

Is the system regarded as a whole or as two or more distinct components by the CAB members/community opinion leaders?

Part of examining the opinions and motivations of the people of Rusinga about how to sustain the system was to find out whether they perceived the system as a whole or as multiple parts.

During the interviews it was found that many community members do appreciate the lighting and phone charging of the system, but only a few mention the mosquito trap as the most important part of the system. This reflects the findings of Oria et al. (Oria et al. 2015). When asked about what parts of the system should be sustained the answer was invariably that the whole system should be sustained. Sometimes the community members summed up the parts that had to be sustained, and included the mosquito trap as well as the lights and phone charging device. Interestingly during the interviews a number of interviewees mentioned that the people of Rusinga should not be allowed to upgrade the system as this was perceived to be detrimental to the intended purpose of the system. These interviewees rather preferred that people would buy completely new systems if they wanted more lights or power for another electrical device. It seems that the community members do recognise the system consists of different parts, but at the same

time regard the SMoTS as a whole, which should not be tampered with. However, it was mentioned in many interviews and during some FGDs as well that sensitisation about the purpose of the system would be necessary to make the people understand its importance in malaria reduction and by doing so ensure the people will take good care of the system. It can be said therefore that the community views the system as two parts. One part that has proven itself (the light and phone charging), and one part that still needs to prove its worth for much of the community.

The effectiveness of the mosquito trap

Currently (May/June 2015) the data that has been gathered on the effectiveness of the mosquito trap is being analysed. The results of this analysis are very important for the sustainability of the system. If the trap does not work, and it does not contribute significantly to malaria eradication, the recommendations for sustaining the system will of course be different from when it does work. This current uncertainty is taken up in the recommendations part of this thesis.

Further remarks

During the study period some other observations have been made that were not directly linked to the research questions or used theory. One of the observations made was the dependency development aid can create. During the interviews but also during informal talks with some of Rusinga's inhabitants the subject of previous projects that were undertaken on the Island came up a few times. The people told that for as long as they know NGOs have been coming to the Island to change on thing or the other. After the projects end, and with it the funding, the people would usually not continue the efforts that were made by the NGOs. Instead they would simply wait until the next development programme would start. Although this probably doesn't happen to every single project that is started on Rusinga, the overall feeling it gave was that this happened quite a lot. It explains why some interviewees, even though they knew that the funding would end for the SolarMal project, still insisted that another donor agency should come up with funding to help them keep the systems. Apparently when there is a long history of development aid, people, in a way, start to count on this funding. This hampers the overall development process as it becomes a seemingly endless repetition of short unsustained results without any lasting development.

Another observation which was mentioned earlier on in this thesis are the complexity and difficulties that arise by making a decision early on in a project. In this case the involvement of the RMP as the link to the community probably will cause problems until the end of the research project. The next decision to still keep some of the previous RMP employees to work for SolarMal added to the confusion of the Rusinga community and made the implementation for the project a lot harder. From informal talks it became clear however that there was not too much choice in employees for the SolarMal project, so if this is true the project might have been forced to do so. The RMP was not known as an organisation that could not be trusted, in fact is was indeed quite well known on the Island for its involvement in previous projects. Apparently it is necessary for larger projects such as SolarMal to remain in control as much as possible, as was done later on with the creation of the CAB.

During the whole research period it was surprising to see how different some community members treat (white) westerners. From yelling "*mzungu*" on the street to frequent requests for funding, it was striking that some people are still convinced a Westerner equals money. Sadly, some people gave the impression to be convinced that white people should be treated with more hospitality, not only because they are guests, but because they are white. The equalisation of westerners with money could have caused a tendency in some interviewees to give desired answers, as they perceived this might be beneficial for them. But mostly it shows that the effects of Western induced polarisation between black and white have still not worn off.

Reflection on research process

The research was carried out with care, however there are some important points which may have influenced the results, or which would have made the research easier, to reflect on. First of all the list used to gather participants for the FGDs was outdated, it would have been better to use a recent list that is compiled by the HDSS team every three months. This could have saved a lot of time. During the interviews it was noticed that some of the interviewees made implicit or explicit requests for extra funding, it seemed they thought the interviewer was able to procure extra resources for them. If this was in the line of reasoning, it may have caused the participants to give answers they thought were desired, especially when

they were asked about what they thought about the system. One of the interviewees (an opinion leader) acted different, according to one staff member, than normal. She was less talkative and willing to answer the questions in English frequently switching to Dholuo. Her behaviour could be explained by a misunderstanding that occurred, as she thought we were there to install the system on her house. During analysis of the interviews it became clear that the interviewer at times completely misunderstood what the interviewee meant. Some interesting information might have been missed because of this.

Although the aim was to have 8 persons per FGD, and a lot of effort has been made by the project staff to achieve this number, most FGDs were held with less than 8 people, the least being 4. This probably led to less discussion, and consequently less information, which can be noticed by the shorter duration of these FGDs and length of the transcripts. During one of the FGDs while we were on the property of one of the CAB members who happened to own a suitable location, this particular CAB member came in and began to discuss with the participants. He was asked to either leave or not to speak during the FGD. When the CAB member decided to leave, the discussion became more lively and at this point the role of the RMP came up in the discussion. It is possible the presence of the CAB member prevented this at first as he had ties to the RMP.

The research plan as it was at the beginning of the thesis was a bit ambitious. The idea was that a few sustainability options would be given to the CAB members right away, and after their presentation the preferences of the CAB members would be monitored during the process of forming the final sustainability plan. Upon arrival in Kenya it almost immediately became clear that finding the sustainability options would be a complex task in itself. This meant that the proposal had to be partly rewritten which took about three weeks. The presentation of sustainability options to the CAB shifted from first activity to the very last of the research period in Kenya. After about three months it was clear that the data would never be analysed properly on time to present to the CAB members, so this task had to be carried out by someone else later on. One other aspect of doing field research in Kenya (although this might be applicable to many other non-Western cultures) was that almost everything takes more time. It was not uncommon for example to be waiting over an hour before someone would show up for an FGD. Luckily there was more than enough time planned to do all the field work. This serves as a recommendation for future field work.

It was very interesting to note that during the field work period, the informal discussions with some of the SolarMal staff, especially with those who came along to the interviews, provided often more useful information than would be gathered from the interview. Apparently a well prepared interview does not guarantee a wealth of information. Speaking informally to people is a very valuable way of gathering information but even more a way of understanding the context in which the interviews are conducted which is just as important.

Recommendations

Options for sustainability

Depending on whether the mosquito trap works, two recommendations can be made , one for an effective trap and one for an ineffective trap. The reasoning behind the recommendations is included for each of the recommendations.

Recommendations for an effective trap

- Find a suitable dealer to take up ordering and selling the traps

- Form saving groups with clear rules on Rusinga Island

- Continue with the sensitisation of the community about the importance of the trap

If the trap is effective, this means that at least the trap should be ordered from Europe. The amount of money necessary to buy the spare parts and transport them to Kenya is quite substantial. The dealer therefore needs to have access to sufficient funds. Most community members thought the dealer should use his own funds, but could not specify anyone who would be able to do this job, except for one CAB member who thought of the owner of the Mbita ferry corporation as a possible dealer. The community members also mentioned that the bank could hand out a loan to the dealer for the first shipment, or that the dealer might attract a donor to provide some seed funding. Given the difficulty with getting donor support, which is often mentioned this option does not seem to be reliable. A loan from the bank may be

an option although a bank probably only hands out loans to people they deem creditworthy and that would mean the dealer already needs to have some funds of his own. There may be people on Rusinga Island or possibly in Mbita who do have the capability to carry the business, in general the area is quite poor, but as the example of the ferry owner shows, there are exceptions. The challenge is to find those who are suitable, and convince them to start this business. This might be a task for the CAB, should this recommendation be used, or as some community members suggested, for the project to make known around the Island that there is an opportunity to start this business.

As mentioned often by many community members, not everyone on Rusinga might have the means to pay for repairs and spare parts. As even the most individualistic thinkers concerning SMoTS acknowledge this, they suggest that the family members or neighbours should help in covering the costs, or that those who cannot afford the costs should call for a *harambee*. It has been mentioned by a CAB member and an opinion leader that the people of Rusinga indeed generally look out for each other and *harambee* is an integrated and widely accepted part of the society. However, these suggestions probably do not provide a reliable structural solution to the shortage of money experienced by some community members. Added to the possibility of the systems being discarded due to lack of finances, the systems might be sold or transported to areas away from Rusinga Island which would contribute to an insufficient spread of the systems on the island.

To make sure there is enough opportunity for the people of Rusinga to pay for repairs and spare parts, it is necessary to form groups. On Rusinga there are already all kinds of groups focussed on saving, loaning or other practices like fishing. There is a limit to the number of groups people can participate in and contribute to, so setting up completely new groups for the purpose of sustaining the SMoTS may be challenging because of this. Saving for the SMoTS could be integrated into existing saving groups, but this creates some challenges of its own. Within these existing groups there may be people who do not own a SMoTS, these people will probably not be motivated to contribute to something they do not directly benefit from. The other way around, there may be people who are not members of a saving group and they would therefore have to join another group, adding one to the list of groups they are part of, or save on their own. It may also be difficult to make clear rules when the purpose of the group is divided, or the rules necessary for the SMoTS saving may not fit the original purpose of the group. Depending on how important the people of Rusinga think the system is, they will agree on joining a completely new group formed with the purpose of sustaining the SMoTS, even though the people may be part of many other groups. It is therefore very important to keep sensitising the community about the importance of the mosquito trap.

Through the analysis of the FGDs it became clear that there might be a difference in what option would work for beach locations and what would work for village locations. The difference is in the landlord-tenant structure. This structure provides an interesting challenge in terms of ownership and financing. As was mentioned in the analysis of the FGDs the beach participants came to the conclusion that the system was best owned by the landlords, as the tenants may take the system and leave the Island or they might not maintain it. However, chances are that the landlord, if given full property rights, will remove the system to place it somewhere else leaving the beaches unprotected. But if the landlord does not get full property rights and the systems must remain on the beach, the landlord would have to raise the rent to accommodate the costs of maintaining the system. This however, as mentioned during the FGDs as well could make their rental houses less attractive to potential tenants compared to houses without the system. The alternative would be that the landlord pays for the maintenance of the system by himself. The latter option may even attract more tenants to the landlord's houses as they have added facilities without costing more than regular housing. During the FGDs this possible advantage was not mentioned though, and it is dependent on the landlord's situation in terms of how many SMoTS he has to maintain whether he could carry the costs financially.

It has become clear during the interviews and FGDs that many people on Rusinga do not have trust in a governing body to which they need to pay money. The formation of a widely supported board of such a body might become a problem as well considering the low levels of trust there are among people within the community because of the clan structure on Rusinga. It is also questionable whether or not any rules will be enforced by the chiefs. Considering these things, it will probably be more fruitful to approach the sustainability of the SMoTS on a more individual basis then to try to create trust for a governing body, which is a very long process.

Recommendations for an ineffective trap

- Find a dealer to sell locally available parts for light and phone charging
- Offer to take back the traps

When the trap proves to be ineffective, people may respond in different ways. It is possible that people will discard the mosquito trap after it stops working, or they disconnect it which will eventually lead to pollution of the island. One of the main garbage disposal tactics on Rusinga seems to be piling it up and burning it. As the trap is mainly made of plastics, this will release toxic chemical compounds into the air. As Rusinga is surrounded by water, it is possible that some of the traps eventually end up there, which would pollute the water on which the community depends so much, or be detrimental to the fauna living there. Another response might be that people will not believe these results as they have experienced a loss in malaria cases and will continue to use the system. Either way the system will eventually stop working, which leaves Rusinga Island littered with broken mosquito traps. This does not only harm the community of Rusinga but it damages the image of the SolarMal project as well. Should the traps prove to be ineffective, it would be best to offer the people of Rusinga once to take back the trap after which it is disposed of carefully. Those who do not want to lose the trap will have to dispose of it themselves.

The lights and phone charging device will probably still be used by the community independent of whether the trap works or not. All parts necessary for these components to keep working, although of lesser quality, may be found in Kenya. It might be a good idea to centralise the sales of these parts close to Rusinga so the system, except for the trap, might be sustained. For this a suitable dealer has to be found much like as described above.

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Appendices

Appendix I: Questionnaire used for interviews with CAB members and opinion leaders

Interview guide

-Good morning/afternoon.

-Thank the interviewee for giving you his/her time.

-Introduce yourself (I am Michiel Wijnands student at Wageningen University the Netherlands here for master thesis research).

-The purpose of interviewing (working on the sustainability issue for SolarMal, to find out what would be good options to achieve sustainability, necessary to know what the community thinks about it).

-I will use your opinions to try and construct some options for sustainability that would work on Rusinga Island and I will use the interviews to answer my research questions in order to finalise my thesis.

-There are no right or wrong answers to the questions I ask, I am only interested in your opinions.

-The interview will probably take about 45 minutes.

-Ask whether it is OK to record the interview because that will help me in analysing the answers you give me.

-Also if something isn't clear to you, or if you want to add something, please do not hesitate to interrupt me and ask!

-Do you have any questions for me now?

Start with asking the interviewees' name.

Do you have a SMoTS/solar system installed in your house?

How long did he/she have a SMoTS installed?/ Do you know of others who have a system installed?

How do you feel about the system?

There has been a lot going on about the sustainability of the system after the SolarMal project end next year. Can you please tell me:

1. How would you define sustainability of SMoTS?

2.What do you think would be necessary to achieve sustainability of the SMoTS?

(after response, explain what sustainability would entail)

I would like to go over the thing necessary for sustainability we just talked about, because I would like to know your opinion on all 6 of them.

3. What do you think about:

-ownership-> -who should own the system (end proj.)? - individual-> why? Why not collective? How?

- which parts should be owned indiv. or coll.? - collective-> what group? Why this group? How?

- other -> why? How?

-maintenance-> -who should be responsible - individual-> why? Why not collective? How?

-which parts? - collective-> what group? Why this group? How?

- other -> why? How?

-selling of new parts/systems-> -responsible? - individual-> why? Why not collective?

- which parts? - collective-> what group? Why this group?

- other -> why? How?

-financing -> -responsible? - individual-> why? Why not collective?

- which parts? - collective-> what group? Why this group?

- other -> why? How?

-storage of parts/systems-> -responsible? - individual-> why? Why not collective?

collective-> what group? Why this group?

- other -> why? How?

-upgrading/expansion of the system-> - responsible? - individual-> why? Why not collective?

- collective-> what group? Why this group?

- other -> why? How?

-other-> -responsible? -individual-> why? Why not collective? How?

- which parts? - collective-> what group? Why this group? How?

- other -> why? How?

5. Do you have any other ideas of how the systems could be sustained?

7. What do you think should change for a cooperative effort/group effort in sustaining the SMoTS to be (more) effective?

8. Have you ever been (are you) involved in any community initiatives requiring you to work with other community members. What were (are) your experiences? What do you like/dislike about the experiences?

Question to get to know possible opinion leaders:

9. Who do you consider to be an opinion leader in this area?

(opinion leader in: maintenance of SMoTS/sustaining SMoTS/ organising the community concerning the project)

-Thank the interviewee.

-Summarise: We have talked about your opinions on different issues necessary for sustainability and how you would like to sustain them.

- What did you think of the interview? Are there topics you would like to add? Do you have questions for me?

Appendix II: Questionnaire used during FGDs with village participants and beach participants

FGD questions

Thank you for coming and welcome. I think you all know about the SolarMal project and the systems they have installed in many houses. Currently the systems are sustained by the project itself, but that will end in December this year. So it will be upon the community of Rusinga Island to sustain the systems. Over the last months I have been interviewing CAB members and community leaders to find out what ideas they have for sustaining the systems. From all these interviews four models came up. I would like to explain each model to you and then ask you some questions related to them. I hope to use the information and opinions you give me to further improve the models.

I would like you to know there are no right or wrong answers, any information you give me is appreciated.

Is it okay if I record this meeting so I can listen back to it for analysis?

Model 1:

The system is owned by the person who currently has it. Parts are paid by the owner and repairs are paid by the owner. Repairs are either done by the owner or by a contracted technician. There is a shop in Mbita that sells the parts for cash or on credit.

Do you think this model could work? Why?

What challenges do you perceive with this model?

If not mentioned as challenges:

What if people neglect their system?

What if people sell their system?

Who is the dealer?

What parts should be available in the shop?

Where does the dealer get the money from to pay for the parts initially? *(own/donor)*

In case of donor: Should it be seed funding or continuing support? Who would need to write the proposals?

Are the prices controlled or is the dealer free to ask whatever he wants?

If controlled: How should this be done?

Who trains new technicians?

Will people be able to buy on credit?

How should those who cannot afford repairs/spare parts get them?

Model 2:

The system is owned by the person who currently has it. SMoTS owners form groups to which they pay a monthly fee. Parts and repairs are paid by groups. Repairs are done by technicians. Joining a group is not compulsive. There is a shop in Mbita that sells the parts.

Do you think this model could work? Why?

What challenges do you perceive with this model?

What would be the best way for these groups to operate? What are the challenges? How can they be overcome?

What would be the optimal group size? Why?

Model 3:

The systems are owned by a Governing body for all of Rusinga (CAB, CBO, ...) People are still responsible for the system. People who have SMoTS form groups compulsory. The governing body collects a standard amount of money from the groups. The money is used to buy spare parts that will be placed in a shop in Mbita. The shop is governed by the Governing body. People with SMoTS buy spare parts in the shop and pay for repairs done by technicians.

Do you think this model could work? Why?

What challenges do you perceive with this model?

What kind of Organisation should the Governing body be? Who would be in the governing body? How are they selected?

Who forms the groups? Who should the groups be composed of?

Should the Governing body make a profit or should the parts be sold at a lower price instead?

Should there be more governing levels between group level and Rusinga Wide organisation?

If yes: How many? Why? What will be their exact purpose?

Do you think people are willing to pay for the spare parts and repairs after they have paid the governing body?

Do you think people are willing to pay to a Rusinga wide organisation?

Model 4:

Governing body. SMoTS are owned by this governing body. New systems are acquired through seed funding from donors. Technicians will install systems to customers and do repairs and monitoring. Technicians are paid by the governing body per service rendered. People who have a SMoTS installed pay a monthly fee which covers everything. People can join a group when they have a SMoTS, this group saves or finds a way of income generating to pay the monthly fee to the Governing body. Added to this are specific regulations for those not able to pay (because of specific reasons like age) groups or relatives pay their bills.

Do you think this model could work? Why?

What challenges do you perceive with this model?

Should the technicians be paid per service rendered or should they be employed by the governing body?

Will people accept that the system is not theirs after the project ends?

Is there another option instead of the donor providing spares and systems?

Appendix III: Fieldwork planning

Date	Activity	Support arrangement
21st Nov.	Pre-test of questionnaire Luore centre at 9.00 am ... at his home at 10.00 am. ... at his home at 11.00 am	Transport: To accompany HDSS team at 8.00 am Translator not required but will be accompanied by Francis
24 Nov.	*2 Interviews with people involved in previous projects from Care Kenya and CCF* ... 9.00 am at her home in Kamayoge ... at 8.30 am at his home	Transport: as above Translator not required but will be accompanied by Maurine
25th Nov.	*2 interviews per day with CAB members:* General community representative at 9.00 am at her home(Wakondo) Assistant chief of Rusinga East at 10.00 am in his office	Transport: as above Translator will be needed more for the general community member: You will be accompanied by Francis
26th Nov.	BMU representative at 8.30 am at his home (Kogalo) Ward representative at 10 am at Suba skills (Rusinga town)	Transport: as above Translator will not be so necessary but will be accompanied by Maurine
27th Nov.	*2 interviews with CAB members* Women's representative at 9.00 am at her home NGOs representative 2.00 pomp at Rusinga Island Trust (Kolunga)	Transport in the morning: as above Translator not needed but will be accompanied by Maurine In the afternoon, Collins to arrange for transport You will be accompanied by Francis
1 Dec.	*2 interviews with CAB members* Youth representative at badilisha youth group at 11.00 am Church representative at 9.00 am at his home	Transport: as above. You will be accompanied by Maurine
2 Dec.	1 interview with CAB member	Transport: this is yet to be determined

	Assistant chief of Rusinga West at his office in Luore centre at 9.00 am. 1 interview with opinion leader leaders as per the list compiled during your interviews	You will be accompanied by Francis
3-4 Dec.	2 interviews per day with Community opinion leaders as per list compiled during your interviews	Transport: as above You will be accompanied by Maurine.
8 December	2 interviews with community opinion leaders as per list compiled during your interviews	Transport: as above You will be accompanied by Francis
9-12 Dec	Short analysis of interviews	-
15 Dec	CAB meeting	-
FOCUS GROUP DISCUSSIONS: Room for the discussion will be determined by the geographical distribution of the participants. Let me get the details of the participants by 8th December to organize for the venue and make appointments.		
16th Dec	2 Focus group discussions per day	Transport: to be arranged as per the time schedule to be made on after making appointments Moderator: Margaret Audio record/translation: Francis Note taking: Maurine
17th Nov	2 Focus group discussions per day	Transport as above Moderator: Margaret Audio record/translation: Maurine Note taking: Francis
18th Dec	2 Focus group discussions per day	Transport as above Moderator: Margaret Audio record/translation: Francis Note taking: Maurine
22 December – 4 January	Not here	-

5 – 9 January	Analysis	Transcriptions of the FGDs audio records to be done by Maurine and Francis
12-15 January	Analysis CAB meeting	CAB meeting will be held at *icipe* Thomas Odhiambo campus (ITOC). No transport will be required but other logistical arrangements will be done by Margaret