Sponge Town KwaVonza

Monitoring, Evaluation and Learning Report

"I Love Sponge Town" written in a kitchen garden in KwaVonza

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Summary

As instrument to the Monitoring, Evaluation and Learning (MEL) a survey was conducted for the KwaVonza sponge town project. In order to monitor the outcomes and impacts of the project intervention a digital questionnaire was administered to 147 respondents in the project area. Moreover, a critical evaluation and learning is done comparing the outcomes of the survey, with the project objectives and the baseline study. Also the overall observations of sponge town KwaVonza and the learnings from the team are taken into account.

In KwaVonza a range of practical measures combining storm water management, water harvesting, regreening and water reuse have been implemented. The interventions included roof rainwater harvesting, surface runoff harvesting, road water harvesting, gully rehabilitation with check dam, kitchen gardening with recycling water, road side tree planting and vetiver grass planting.

Each of the interventions have a positive impact, many residents are aware of the interventions and see the benefits of it. However, levels of participation can and should be higher for a larger impact on the whole of KwaVonza. The situation in KwaVonza with erratic water supply posed the biggest challenges for its residents, water harvesting from roofs, runoff and roads proved good solutions to this. Making water available at the home at higher quantity and quality. And reducing erosion risks and loss of soil. Also interventions at problem spots, such as the gully, proved to be successful in restoring the gully to the original situation and storing water in an agricultural pond. Measures combine retention, recharge and reuse of water, helping to reduce erosion and avail water for both domestic and agricultural purposes.

Especially with kitchen gardening, requiring just a low investment to start off, but with relatively good returns as you can reuse waste water in times of water scarcity, this had led to a change in attitude over the use of waste water. It has shown people you can grow vegetables even on a square meter just next to your house. Making KwaVonza green through tree planting also received considerable and widespread attention, it was seen as something everybody can and should do.

Generally, the project was successful in changing the attitude of KwaVonza residents towards water harvesting, green spaces as well as water conservation through kitchen gardening. Many people indicate they want to be more involved in the different activities and they see the benefits. Overall we see sponges are coming up in different places, though KwaVonza is not yet one big sponge. It needs more participation from all segments of society in town to capitalize upon the shift that is being made, and to ensure it can become one big sponge. For this we see a specific role for champion citizens, social media, entrepreneurs and government intervention.

The steps in the project were helpful, the involvement with the citizens' platform, students and women groups in town worked well. However, a lesson is to be much keener on working with business and government partners from the very beginning and foster good relationships with them.

1. Introduction

Monitoring, Evaluation and Learning (MEL) are critical in any healthy project and project team. Especially in the case of Sponge Town KwaVonza, a new concept in a new environment. Learning is added to specifically address lessons on what can be improved and how. Not only looking at the project interventions itself, but also at the team and project management.

Before to start off, a short re-cap: what is a sponge town all about?

The aim of a sponge town is to make the best out of water extremes of floods and droughts by means of its buffer function. The sponge holds water during rains – limiting flood hazards and releasing water slowly when it is dry – increasing water availability. Offering protection against floods and preventing a water deficit. It is innovative and practical, focusing on functional water management in an urban setting. Enabling cities to 'hold, clean and drain water in a natural way'.

Our point of departure was the Sponge Town vision from the proposal:

> "We envision the emergence of a sponge town movement including all layers of urban society for the wise management/retention of storm water and skilful planning of urban infrastructures through collective efforts encompassing both private, government and international development efforts."

Sponge towns are gaining much traction all over the world, however in Kenya this is a new concept. KwaVonza together with Kajiado are the first towns to integrate sponge interventions. That is why it is all the more important to monitor what has been done and critically assess whether this is the right thing to do. The critical questions asked will be: What have we been doing? What works well, and what does not? And are there better ways of doing it?

Chapter 2 shares the methodology used for the M&E survey, and discusses the role of the baseline study and overall project reflections. Chapter 3 looks at citizens' involvement and participations, Chapters 4 and 5 will go into the interventions, looking at each intervention separate and at the overall picture. Discussing what has been done, how well it works and what can be done better. Chapter 6 goes in depth on the project team, have we used the right approach? Are we the right team?

Chapter 7 will discuss the main lessons we took from KwaVonza and is essential in guiding the upscaling process. KwaVonza is a first step in creating sponge towns in Kenya and beyond. The aim of the project is to pilot and test the sponge concept in one town in Kenya, and after this have a good ground for upscaling to other towns with similar characteristics. Important questions to ask include: What where the failures or mismatches, and why? What aspects to always have in a sponge town? What do we need to focus on more, also as a team?

2. Methodology

The MEL exercise involved administering a questionnaire to capture the views of the residents of the project area of KwaVonza. The survey was conducted between 22nd of August and 28th August 2018 to document the experiences of residents of the project area with respect to the sponge town project interventions. Ongoing monitoring and evaluation has happened throughout the process, mainly with the project team and key involved partners and citizens.

From the target population, a sample of 150 residents (approximately 10% of the population) were to be interviewed on a 50/50 men/women ratio. The survey was in digital format and five students from SEKU visited the respondents, based on targeted and stratified sampling. The project area was divided into four quadrants each allocated an enumerator except for one quadrant which had two enumerators due to its dense population. Each enumerator was to interview thirty respondents. The sample population was broken down as shown in Table 1.

Table 1 Characterisation of the sample of respondents

Number of respondents	*Description of the respondents*
70	Respondents from the baseline survey
30	Implementers of various sponge town project interventions
10	Business owners
5	Water vendors
10	Youths (students)
30	Those who were not involved in the sponge town project

A large proportion of respondents was drawn from those involved in the baseline survey to track their views before and after implementation of the project intervention measures. The sample size is 50% of the respondents that were involved in the baseline survey. A deliberate effort was made to ensure that a sizeable number (30) of those who implemented various Sponge town project interventions to document their experience. We estimate that the total number of direct beneficiaries is about 150, where there could be overlap in terms of one person doing multiple interventions. So the sample size accounts for about 20% of total amount of implementers. Other stakeholders such as business people, water vendors and youths were also allocated a quota to evaluate how well they identify with the project. Further, those who have not been involved in the project were interviewed to get their view of the project and assess its outreach. Therefore, these people have not yet been approached or directly contributed to an intervention, this to see how far the project has stretched out in the town of KwaVonza. The numbers allocated to each group were also in consideration in the weighting of their influence in the project and were considered representative of the entire population.

The questionnaire was divided into the background information (respondent's details and their awareness and involvement in the project), project interventions (separated and overall), outcomes and impact, as well as project management. In this light it will give a clear picture of what has been done and how much impact it has reached, based on the opinion of the citizens. For the different interventions, overall impact and functioning of the sponge team. The respondents are in each section asked for points for improvement.

The M&E exercise was successful in actually administering 147 questionnaires that reflected the characterisation in Table 1. The short fall of 3 respondents was attributed to a lack of people to interview in a sparsely populated quadrant of the study area. Figure 1 shows the overall demographics of the respondents, allowing all ages to be represented and an even representation of men and women. Figure 2 shows a heat map of the locations of the respondents.

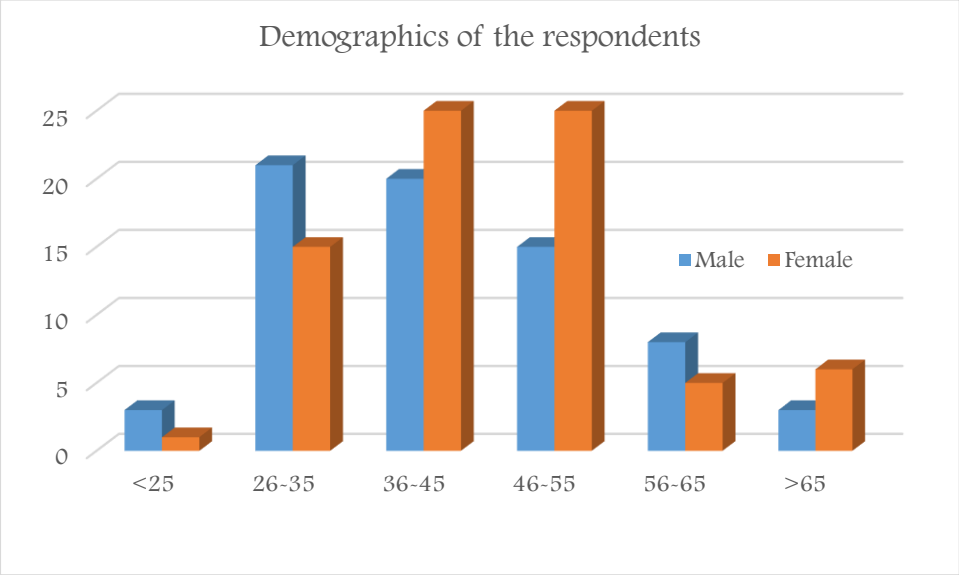

Figure 1 overview of demographics of the respondents

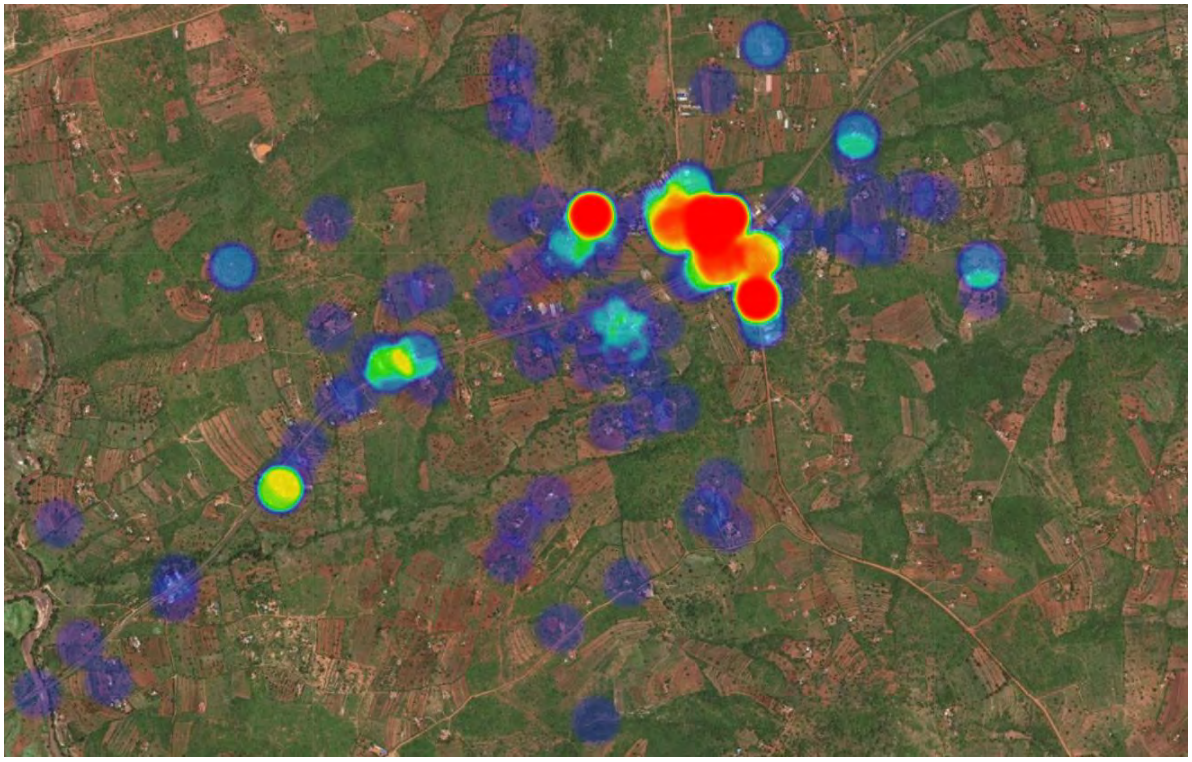

Figure 2 heat map of respondents' location in KwaVonza

3. Citizens' involvement

A majority of 74% of the respondents were aware of the Sponge town project in KwaVonza, see Figure 3. The respondents learnt of the sponge town project from different avenues; project activities, family members, neighbours and friends, citizens' platform, baseline survey, opinion leader, brochure, and project team member. The other 26% was not aware of the specific project, however, most of the respondents had heard or seen the ongoing project activities from the participants' homesteads.

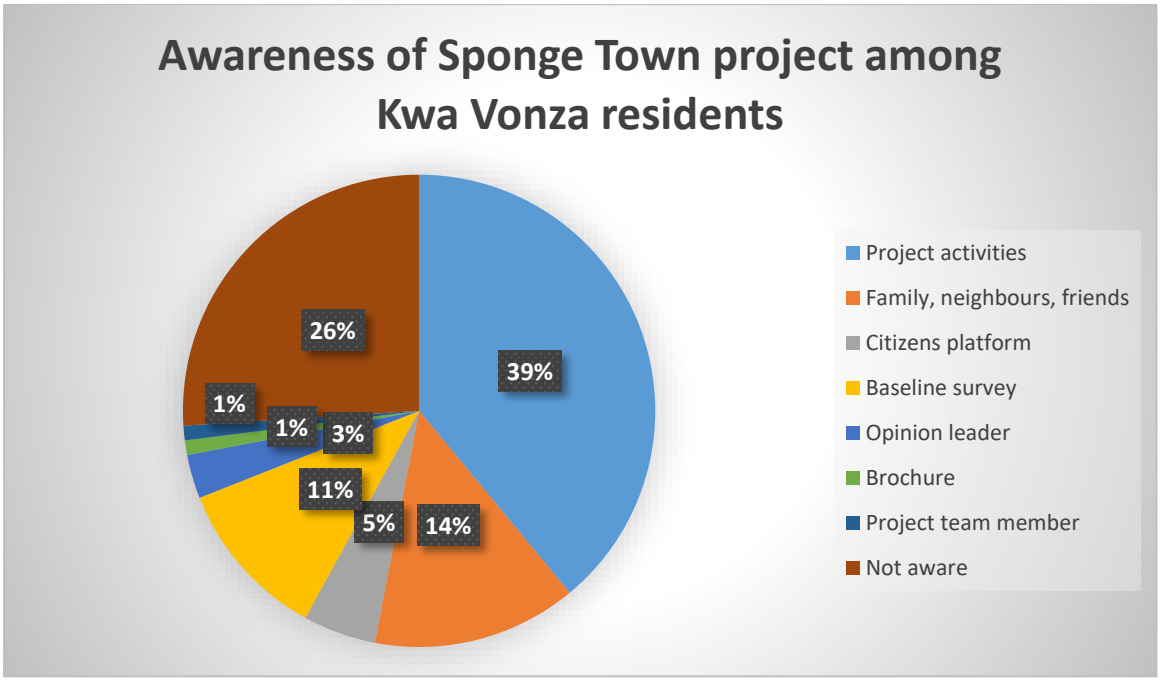

Figure 3 awareness of sponge town project among KwaVonza residents

The direct beneficiaries of the project accounted for 23% of the respondents, with a majority of women 15% compared to 8% for men. These respondents have been directly implementing one or more of the interventions, which will be discussed in chapters 4 and 5. The main reasons why citizens had not directly benefited was because they had not been aware of the activities, had not been trained, or not been contacted by a project member on the ground. Sometimes there were criteria to be selected for interventions, some people indicated they did not qualify. People do indicate that they benefit indirectly from interventions from family members, friends or neighbours.

Respondents indicated uneven levels of involvement and participation in the project. The division between people involved and not is almost 50/50. Meaning that more than double the amount of direct beneficiaries is in a way involved in project activities. When asked whether they would like to be more involved in the project 88 % of the respondents indicated that they would like to be more involved: Through its workshops, trainings and demonstrations as well as implementation of project activities.

Some of the reasons put forward by those who wanted to be more involved in the project were; need of a tank/water, need to benefit from project and take part in project activities because the project seems promising. Mainly they reflected on the benefits and the support for water harvesting techniques that would be very helpful to them and the town. Also people who have already benefited directly indicate they would like to also contribute in a different intervention. Temporary residency and plans to relocate was the reason advanced by those who did not want to be involved in the project.

For the people who like to be more involved, they indicate they want to do so in: kitchen gardening, rain and surface water harvesting, training, tree planting, promoting and encouraging other residents, cost-sharing of interventions, expanding business and through active participation in general.

Generally, the overall awareness and involvement was found to be good for women residents of KwaVonza especially those organised into women self-help groups, unemployed and self-employed youths and older men. Business people and water vendors, and students are also aware of the project however their involvement levels into project activities is slightly lower due to work or study related commitments. Nevertheless, a significant number of university students have been actively involved in planning and training activities of the project. The project should therefore endeavour to reach out to the entire population segments of KwaVonza.

Also the question was asked to describe Sponge Town KwaVonza in three words, the word cloud in Figure 4 highlights what was mentioned.

Figure 4 word cloud comprised of the description of sponge town KwaVonza in three words by KwaVonza residents

Key lessons

From the results it appears that we managed to reach half of the town with the sponge town activities. More importantly, 88% wants to be more involved. Especially the 88% is striking, an important lesson for us that there is a much wider base of people to tap into and encourage to take actions. And of all people who are already involved, they want to do more.

From the baseline study 51% of the respondents indicated they are willing to invest in rain water harvesting. Looking at the results from this M&E this percentage has gone up. Through the positive results people have seen, many people indicate they would also like to do water harvesting. At first there was a trust issue in town due to scams that had happened before. After they noticed the service was good and the organizations are trustworthy, many more people wanted to be involved in the second round. One example of how important it is to invest time with people and gain trust.

Now a lessons for us, as more people want to be involved in activities, it means that we have not reached everybody in town through the channels we used. The main ways of creating awareness in KwaVonza were through the citizens' platform, word of mouth, brochures, radio, etc. On brochures for example, only 1% of respondents indicate this made them aware of sponge activities. A low score what can better be covered through either social media, or posters in often visited places.

One thing is to look at timing of events, mostly done during day-hours on weekdays. These events mainly attracted women, elderly and unemployed, but for business people and students it is difficult to attend. There should be more diversification in when to hold events in order to give all citizens a chance to participate.

Another thing is on the ways of creating awareness, this should be geared towards different interests of for example youth and business as well. Thinking about specific marketing strategies highlighting the commercial value of water harvesting and triggering youth through social media. In the project these lessons have been incorporated in later stages, also geared towards the upscaling. However, it did not change the actual implementation anymore. It is a lesson for the next sponge town to think about your channels of communication and promotion well and well in advance. In order to reach all different citizen segments, and align their views and needs in design and implementation.

4. Impact from interventions

In this section the outcomes and impacts of the various project interventions were evaluated. The questions were divided into: roof water harvesting, surface water harvesting, kitchen gardening and use of grey water and tree planting. In this chapter the feedback from the respondents who have implemented and direct benefited is presented and discussed. 30 people were targeted from being direct beneficiaries in the project, the other respondents who have implemented did this on their own initiative. Often indicating the positive impact for their neighbours motivated them to take this step. Figure 5 highlights the direct beneficiaries on the map.

Implementation of road water harvesting, check-dam and water pond done with a women's group, will be shortly discussed separately as well.

Figure 5 map highlighting who have directly benefited in green

4.1 Roof rainwater harvesting

During the baseline survey 51% were willing to invest in rainwater harvesting tanks. In the survey a total of 43 respondents had implemented roof rainwater harvesting systems, equalling 29% of the respondents. 23 respondents were part of the direct beneficiaries of the project and took part in the subsidy program. The project team subsidized 50% of the cost of the storage tank, the other 50% plus the entire roof harvesting system of gutters and slab was invested by the household itself.

This also means that outside the targeted 23 direct beneficiaries (16%), another 20 respondents (13%) have started to do roof water harvesting on their own initiative, or they already did. Many indicated the positive impact to their neighbours inspired them to do it themselves as well, however some had already done it on their own. Examples of roof water harvesting systems are shown in Figure 6.

Figure 6 examples of roof harvesting systems in KwaVonza

The respondents who implemented roof rainwater harvesting did so because: they wanted sufficient water at home or they had invested in rental houses thus needed sufficient water. Also they mentioned that roof rainwater is safe for drinking water, you can reduce cost and to save time and energy otherwise wasted during water fetching. These respondents have witnessed a change in the water quantity and quality from the water they harvested from the roof.

Respondents who had not implemented roof rain water harvesting mostly mention they were not able to: because of limited funds, no property rights to install a tank, no house ownership, not a permanent resident. Some mentioned the roof was too small to harvest enough water or of too poor quality. Some

have other sources of water like a shallow well, or they are just used to storing water in jerry cans. A number of people also indicate that they lacked information about the project, otherwise they would be interested to join in the subsidy-program. These are the respondents who have not seen any change in the water quantity and quality in their homesteads.

Water quantity

Figure 7 gives an overview of the changes in water quantity, availability and buying from water vendors. Water quantity has greatly improved among those households that have implemented roof water harvesting. Out of the 43 who implemented, 40 indicate they now have more water compared to before. Moreover everybody indicated that the availability of the water at home has improved. A majority of 70% says water availability has highly improved, the other 30% says it has moderately improved.

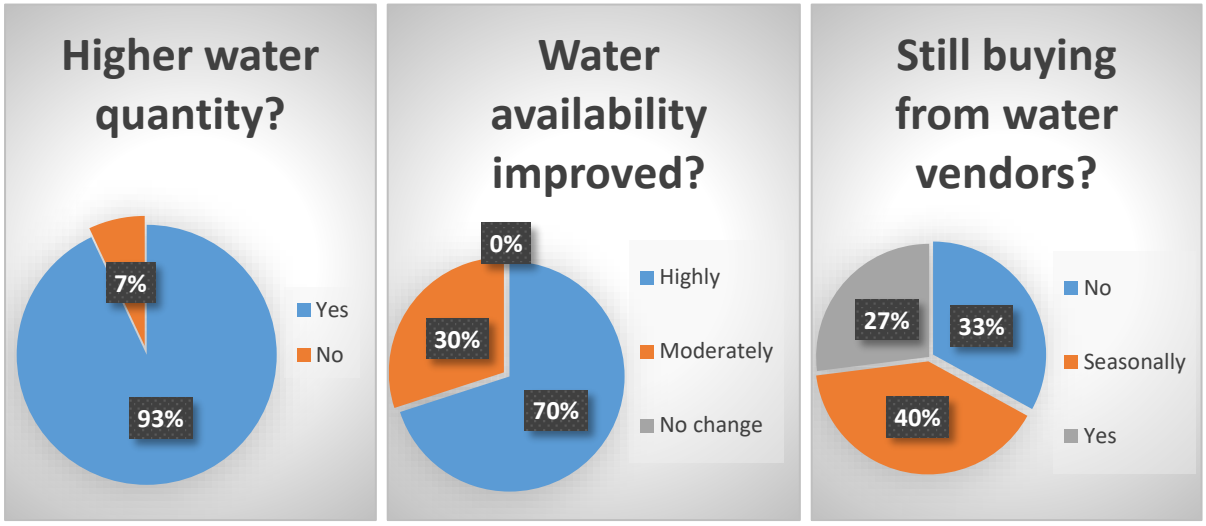

Figure 7 overview of change in water quantity, availability and buys from water vendors

The three persons indicating they did not see a change in water quantity did indicate that the water availability has improved at the home. This may mean that otherwise they would get the same amount of water, though this had to be fetched or delivered from elsewhere. So it is still an improvement that the water is now available at the home itself, saving time and costs of fetching or delivery.

When it comes to buying water from vendors, 33% no longer buys from water vendors. 40% indicated that they no longer get their water supplies from water vendors throughout but seasonally, especially during dry season after exhausting the harvested rainwater. The average monthly savings as a result of roof water harvesting was KSH 2000. For those who still get their water supplies from water vendors spent between KSH 25 and KSH 1200 daily (average KSH 170). Most of the water harvested is primarily used for domestic use, especially cooking and drinking.

Respondents indicate they like to either expand or improve their system to enable more water harvesting. Either by improving the roof and the gutter system, in order to optimize the catchment area to harvest water from. Others indicate they would need more storage capacity to ensure they can use the water for a longer time, or start selling the water to others.

Water quality

In terms of water quality, 81% said that the quality of water from the roof harvesting has highly improved. The other 19% indicates it has moderately improved.

The improvement in water quality was evident in the levels of water treatments by the respondents. 41% was treating water before the adoption of rainwater harvesting through various methods including boiling and chemical treatment. After the implementation of roof rainwater haversting this number reduced to 26% due to the better quality of the harvetsed roof rainwater. They recognize harvested roof water as of good quality due to the fact that there is minimal chance of contanmination during its capture, conveyance and storage. Respondents say they find the water more reliable, it has reduced water borne diseases and the water is fresh, compared to the salty water they normally get from the river.

From the water quality reports in the baseline study it appeared that all water sources tested were suitable for domestic purposes: these were Masinga dam piped water, roof harvested water, borehole water and water from Mwitasyano river. However the last source, the river, had evidence of bacteriological contamination. And this is exactly the source of water from which water vendors take the water which they deliver in town. Especially coliform and E.coli were high in the river, coliform was also present in Masinga Dam piped water and roof water, in order of lesser amount (see Annex 1 for the results). Overall roof harvested water came out the best in terms of chemical analysis, it has benefits in terms of low conductivity, low calcium and overall hardness, low in iron, no fluorides, no sulphates and no suspended solids. So it makes the water more suitable for domestic use, however a low amount of cloriform is present, therefore treatment of water is still recommended also in case of roof water harvesting.

When it comes to roof rain water harvesting, the respondents have a lot of interest in it because thy find rood water harvesting as increased domestic water supply, the water is reliable, it a sustainable system since once you install a tank you just wait for rains, reduced water borne diseases due to clean drinking water thus there is improved water quality and quantity, reduced long distances in looking for water hence time wastage in fetching water can be used to do something more beneficial, the water harvested is very fresh compared to the stream water that is salty, the amount spent in buying water can now be saved.

Financial picture

Availability of financial institutions offering loan facilities in the project area is still poor. This explains the low number of people accessing loans. Further, the locals are perceived as not credit worthy and usually loans advanced to them attract high interest rate. In the baseline survey 18% indicated that they borrow from financial institutions but in the current survey only 9% accessed loans to assist them in buying the water tanks. The loans were advanced through SACCOs, microfinance institutions and churches and averaged KSH 20000 (200 USD) with a pay back period of between three months to one year. This also means that the other 91% did not take loans, thus was able to collect the necessary money in short time to pay for the roof harvesting system. In other words the capacity and willingness to invest in water harvesting systems is there.

Respondents were in agreement that, were they to sell the water harvested, it will fetch KSH 20 on average with most opting to sell between 10-300 jerricans (20 litres) of water. However, no one indicated that they were willing to sell the water harvested. However, for the individual households have considerable savings in the long-term because they buy less or no water from water vendors. Table 2 presents a calculation that gives insight into what savings can be made over time and what the return period is on tank investment. Considering the full price of a tank, gutter system and slab; opposite to the project which supported individuals with a 50% subsidy to the price of the tank only.

Table 2 Financial picture of roof water harvesting tanks

Tank volume in Litre	**Price tank** (including whole	**Price per 20L jerry can** (as currently	**Savings per tank** (based on not needing to	**Money saved per tank per year**	**Return period tank investment**	**Money savings in 10 years** (not considering

	system and labour)	sold by vendors)	buy jerry cans)	(based on 3x filling of the tank)		maintenance costs)
5000	44300 KSH (443 USD)	20 KSH (0.2 USD)	5000 KSH (50 USD)	15000 KSH (150 USD)	3 years	105000 KSH (1050 USD)
10000	85400 KSH (854 USD)	20 KSH (0.2 USD)	10000 KSH (100 USD)	30000 KSH (300 USD)	2.8 years	210000 KSH (2100 USD)

Changed view of roof water harvesting

All people who have started doing roof water harvesting had changed their attitude towards it. With 77% indicating a drastic change. They were surprised with the impact of a single roof water harvesting system to their household. The reasons for this changed view on roof water harvesting are mainly the increased amount of water which is now available to them in a very accessible and easy way. Respondents also indicate improved hygiene, a possibility to grow vegetables at domestically and overall improved living standards. For some of the respondents it means they no longer have to walk for long distances to fetch water, while the water quality is also very high compared to the surface water sources they would fetch from. A win-win situation.

The safety of water is also an important aspect mentioned by many respondents as an important benefit of roof harvested rainwater. In one case a landlord has provided a roof harvesting system for tenants to use, which has increased the appeal of his houses and happy tenants.

That is also the reason that the roof water harvesting systems are highly recommended by all the people using it. The respondents especially point out that in a dry area with serious water quantity and quality issues it is an adequate solution. The water comes in seasons and the harvesting now provides a way to make it available for a long time. Also the economics of it are key, one respondent indicated that with the sales of the collected rainwater she was able to pay school fees for their children. Overall the compelling factors are that harvested water is free of charge, of better quality, and saves a lot of time. Respondents indicate they would like to see their neighbours also implementing the same.

Key lessons

Many people in KwaVonza have retorted from doing treatment at household level due to good quality of rainwater harvested from the roof. However, for roof water harvesting it is still advised to do treatment of the water, also when a flush system has been installed. More attention has to be put on self-supply systems including water treatment.

From the results it is clear that roof water harvesting has a very positive impact on the households who have implemented this. The big question is now on how to make use of these results to ensure that many more people start to implement and create a larger ‘sponge’ effect. Word of mouth has it spreading, though it needs to be capitalized upon. How can we promote and encourage this development so that more people will join in? The support base is very big, also people who have not implemented roof water harvesting yet see the benefits. There is a possibility to work with champions and set up check-off systems with trusted retailers and masons in town. A subsidy system was important to build trust between beneficiaries and retailers, but it can be phased out once a solid and reliable check-off system is in place.

The intervention from the project in terms of subsidies worked very well and was very popular. Indeed, residents in KwaVonza are still requesting to join in the subsidy scheme. At the start some hiccups had to

be overcome, there was a lack of trust due to previous scams. After we proved a reliable service many more people wanted to join and we extended the subsidy program twice.

In conclusion the intervention with the subsidy scheme has proven its worth in solving the issues of non-reliable and expensive water. Through self-supply and providing a high quality alternative water source, it has greatly improved water quantity, availability and quality at household levels. It has also led to significant savings and a possibility to sell water once enough storage is established. In sum the water is cheaper, better in quality than the original source of water from the river, and much more reliable than tap water. In this way small sponges have been established within many homes in KwaVonza. Now it is key to leave a check-off system behind with the retailers in town, based on the trust that is now established. This will enable more residents to invest in roof water harvesting systems in the short-term and bring about a larger change towards a creation of a sponge town. Now that the benefits come out clear and many residents see this, also the retailers and hardware stores should venture it to advertise for roof harvesting systems. The artisans who have been doing these jobs are skilled and can help new implementers as well. Basically, it is key to create a snowball effect.

4.2 Surface and road water harvesting (with check-dam and ponds)

Another method of harvesting is through collecting surface runoff and storing this in a pond. Surface runoff comes from roads and general surfaces, and together form a catchment. Mostly a combination of road and surface water harvesting is used. From the road it is common to divert the water flowing in the drainage channels next to the road, or by extending the mitre drains which already divert water from the road. In some instances, water was taken from the road surface, or the area across the road; in these cases a type of rolling dip was installed to make water flow across the road, into the diversion channel leading to the storage reservoir. Due to the limited spaces in urban areas, this approach is mostly practiced in peri-urban and rural areas. Figure 8 shows examples of ponds that store the surface/road runoff harvested water.

Figure 8 examples of ponds to store surface/road harvested water

Eleven respondents had implemented surface water harvesting. The water harvested is generally utilized for agricultural use such as vegetable farming through irrigation, drinking by livestock, planting of vegetables and fruit trees, and some bit of domestic use, like washing.

Nine out of eleven respondents who implemented surface water harvesting methods indicated that the quantity of water available at their disposal had improved. The quality is however not sufficient for all uses, and needs water treatment mainly against turbidity. Common treatment methods include: filtration, allowing the water to settle for some time, and boiling when they want to use the water for household chores. Another intervention which is advisable is to include a silt-trap before the water reaches the pond to prevent silts and sediments filling up the pond. The water from surface harvesting was not used for drinking. They all indicated that through the increase of water availability their living standards have improved.

Financial help/loans to implement the surface water harvesting systems was difficult to come by, and they had to get support from the project especially in doing the heavy earth works. However the respondents still indicated that they would recommend one to invest in surface water harvesting structures especially in an area like KwaVonza with water scarcity. They do advise that the issue of affordable credit availability has to be addressed. Respondents said that their levels of dependence to water vendors has waned as a result of their water harvesting activities especially after storm events. They also indicated that they had no intention of selling the harvested water since the return period for dry spells in KwaVonza is too short and they would need the water. If they were to sell the water they indicate a lower price compared to those with roof harvesting systems, on average 5-10 KSH was said per jerry can.

All respondents also indicate that their attitude towards surface water harvesting has changed and they would recommend others to do surface water harvesting as well. Though they also see challenges, mainly in the high rates of evaporation in the area. This makes the water diminish fast and it takes a big investment to cover up the pond. It is recommended that low-cost measures are tested, for example fine-maze shade nets and planting of trees.

A majority of the ponds has diverted road runoff water, which is an important source of water harvesting. Part of the rehabilitation of the on-farm ponds was to improve the diversion channels by installing silt traps in combination with planting of vetiver grasses. This led to silts being trapped before it entered the pond, so more storage space is left for water, improving the capacity of the pond. Additionally, vetiver grasses stabilize the soil and the banks of the channel, reducing erosion risk and improving protection of the structures (can also plant vetivers at the banks along the pond). Moreover vetiver grass strips filter out sediments and other pollutants, improving overall water quality in the pond.

Implementation of check-dam and pond at Mwende group

Mwende group consists of about 25 members. Amongst other things they do farming together, they grow vegetables and have a tree nursery. The farmland of the group lies below the land owned by Agnes, one of the group members. Besides this land there is a deep gully eroded by road drainage water, coming from a culvert which is the start of the gully. Because this gully is so deep, it was impossible for the group to use this water, instead it quickly flowed away. In this gully a check-dam has been constructed. Within 1 rainy season the gully completely filled up with sediments. Figure 9 and Figure 10 show the before and after pictures of the check-dam situation. From there an intake was made to direct the water which comes from the culvert and it was diverted into a large storage pond. With the water in this storage pond the women group can easily access irrigation water for their farming activities.

Figure 9 check-dam before....

Figure 10 ... and after

However, there were some issues with the group contribution. This was very little, many members indicated they did not have enough money. Though the assumption is also that group members are less willing to invest in a collective effort as it is unclear how it will work and how much they will get out of it. So investments from group members lagged behind. At the same time the pond was constructed, so it was useless not to invest in a solar pump and tank, to facilitate the irrigation activities. Currently this was done with buckets, but this became very tedious and nearly impossible once water levels dropped. This caused that the farming which was started by the group did not last long progressing into the dry season, the produce therefore was disappointing.

Key lessons

The main lesson learned from the group implementation is that it is essential to work on a plan with the group altogether before starting construction activities. It is key that they (partly) invest in it and are committed to the work. Also because only then they get insight in what inputs it needs, and what returns it will give them. The facilitators, in our case the sponge team, should have given more attention in developing a plan with the group and also training on financial and business management topics. With that basis the chances of establishing a successful peri-urban collective farm would be much higher.

The overall conclusion is that with a single intervention of one check-dam an entire 250m3 pond can be filled up after one rain event. At the same time this check-dam has brought up the level of the gully to surface level, making it available for people to pass again and even re-install the road that was previously there. The gully rehabilitation with the check-dam was done well with positive results and created a little sponge again. However, even more could be done if the Kenya national highways authorities would have allowed us to work within the road reserve to tackle these issues. Unfortunately we also learned that this involves a lot of bureaucracy and in the end there was no willingness to work together on this matter. What can be done better is to seek for administrative and political partners who can influence state authorities to collaborate.

Also the interventions with the ponds and linking them the road side channels with improved structures increased the amount of water retained and the quality of the structures. It increased protection and reduced silts and other pollutants entering the pond. So it has built upon what residents had already started, focusing on making more use of alternative water sources and improving its capacity. Sponging it up a little more.

The design of the check dam cum pond is very strong. A conspicuous amount of concrete was used together with shade net and metal fencing. All this make the pilot pond very effective, but on the other hand rather expensive. It would be important to introduce designs that are easier to be implemented and more affordable to farmers and farmers groups.

4.3 Kitchen gardening

A kitchen garden is a vegetable garden in proximity to the house, for which you can use the waste water from your kitchen. It can literally be one square meter and can also make it vertical. Ideal for people living in urban areas with little space around the house. It does not necessarily need to be next to the kitchen, it can be any garden plot inside your property where you can grow vegetables.

From the survey 24 respondents indicate they have participated in the training on kitchen gardening, of those 22 have implemented and 2 did not. Five respondents are doing kitchen gardening without having received training. All 29 respondents who have a kitchen garden indicate they use grey water for their gardens, mostly combined with other water sources to make it sufficient.

The techniques implemented include: sack, tires, plastic bottles, old containers/boxes and raised bed gardening in almost equal measure as seen in Figure 11. Most often it is a combination of different materials which people either have in their homes or which is easy to get by. The other techniques used include seed beds or used polythene/plastic bags. Everyone has some leftover material in the home which can be used for kitchen gardening. Sacks are the most preferred technique, as you can plant many vegetables in a small space.

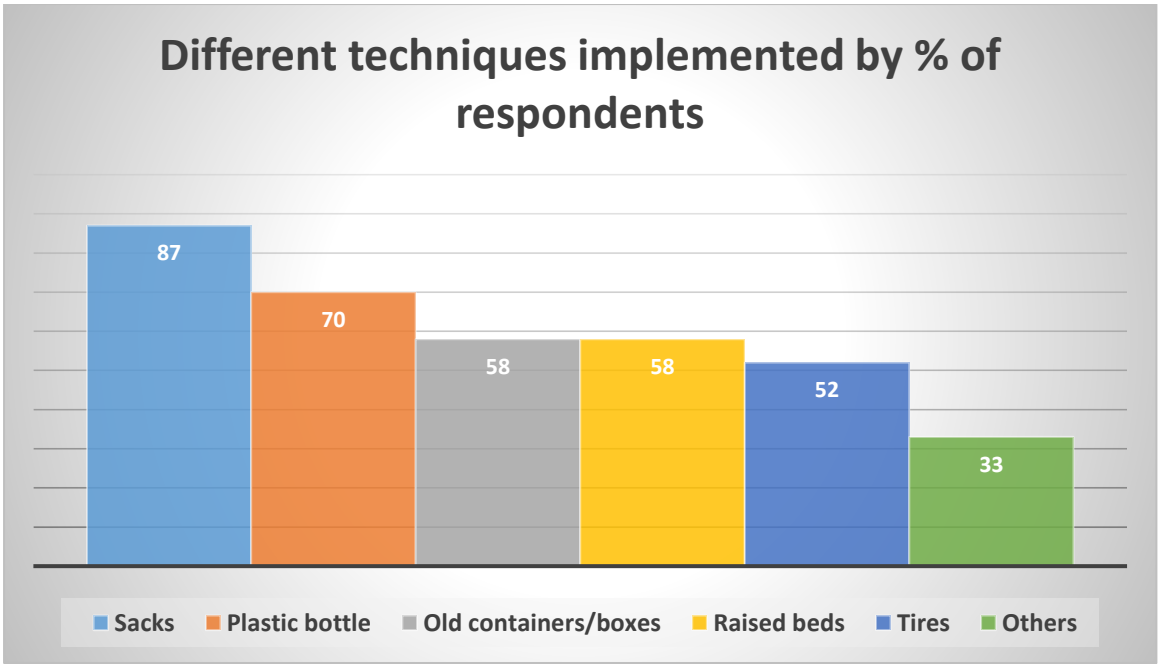

Figure 11 adoption of kitchen gardening techniques

The motivation behind the selection of a kitchen gardening technique varied from the ease of getting the materials to be used (availability and cost), and an opportunity to reuse waste water generated at the household. Furthermore it requires little water to provide ready food, resulting in savings when purchasing food products on the market. It has improved food security at the household level at a reduced price.

Vegetables planted in the kitchen garden include; sukuma wiki (type of spinach), spinach, cow peas, onion, tomatoes, coriander. The commonly bought vegetables from the market include the sukuma wiki, tomatoes, cabbage, onions and coriander. 28 respondents indicated that vegetable availability at home improved due to the implementation of kitchen gardens. And 22 respondents buy less food at the markets, due to their home production. Figure 12 shows examples of kitchen gardens in KwaVonza.

Figure 12 examples of kitchen gardens in KwaVonza

Furthermore, the use of kitchen gardens greatly changed how people view re-using waste water, see Figure 13. 96% of respondents indicate their attitude has changed, of which 73% indicates a drastic change. This shows that the training on kitchen gardening and focus on using grey water systems changed existing attitudes. From the baseline study 51% indicated they re-use water, so it also means that the combination with kitchen gardens opened up new possibilities highlighting the usefulness of grey water.

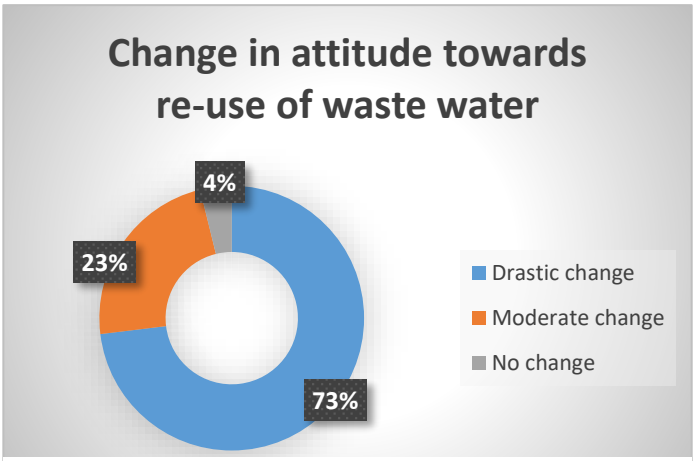

Figure 13 change in attitude towards re-use of waste water

Total cost incurred in implementing a typical kitchen garden include, bottles, seedlings, water, protection, pest management and labour. Averagely, to implement a kitchen garden in KwaVonza, one would spend a total of KSH 680 per month and in return, one can expect a net income of KSH 1388 per month. Figure 14 shows the average cost and income of kitchen gardens and highlights a comparison for 8 selected kitchen gardens.

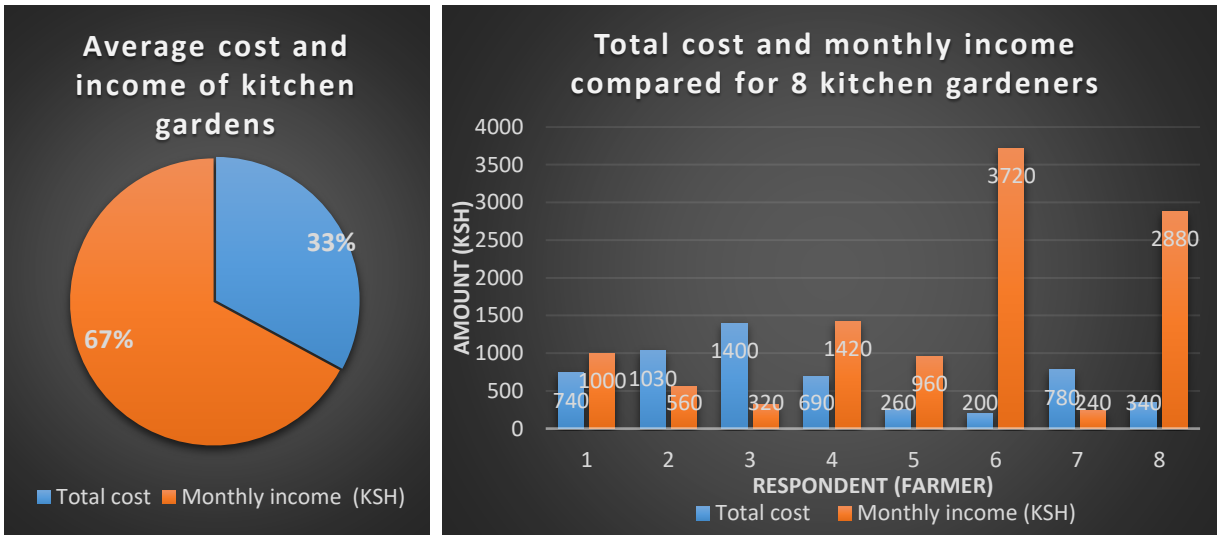

Figure 14 Cost and benefit analysis of kitchen gardens in KwaVonza

Kitchen gardens are viewed as: easy to implement and manage, use less water through recycling of grey water, it is quick when one needs vegetables, occupies less space, and waste materials are not disposed but used purposefully. Watering of the kitchen gardens takes very little time, because the water is at hand near the kitchen garden and in general the water requirement is not big. The main benefits of kitchen gardens are that you can save money and improve food security at your home, if you do well you can even increase income from your vegetable sales. For these reasons a majority of the respondents recommends other residents to implement kitchen gardening also.

Some of the challenges faced by respondents in implementing kitchen gardens included: insufficient water, no manure available, pests and diseases, and animals destroying the vegetables.

Key lessons

Kitchen gardens are likely to have spurred the re-use of grey water. Adding to the bigger sponge function, it means water is kept within the 'household catchment' and more care is taken to put the water to good use. It especially contribute to the recycling loop of water, which is an aspect especially important for a town set-up, and also especially in dry places where groundwater levels are low. Becomes in situations with many built surfaces or compacted soils, water is quickly getting lost once it is left to flow. Recycling the water several times is therefore a crucial thing to do reduce on the water demand side. And be sure there is not too much abstraction from the sponge if little water is supplied to the sponge.

In terms of kitchen gardens and grey water re-use the implementations have been done well. A very practical training and 'who has the best kitchen garden competition' really sparked the uptake well. Kitchen gardens should be promoted more, looking at their benefits they hit many birds with one stone. Preventing disposal of waste, re-using grey water, providing vegetables at home for a more nutritious diet and increased money available due to savings and sales. It is therefore advised to hail champions more and increase the amount of kitchen gardens in town.

So far it has been difficult to make it spread to a substantial amount of households doing kitchen gardens. Those who have started their kitchen gardens are very enthusiastic, but not all have taken it up. Part of the reasons being that residents in the commercial centre either rent a house, do not stay long or in case of students, only rent for part of the year. Furthermore kitchen gardens are not seen as very appealing to for example landlords and students.

For follow-up the question should be asked on how to reach students, as they form a large majority of residents in KwaVonza, can we make kitchen gardens more attractive to them also? Or to landlords promoting a collective kitchen garden at their properties? Or to local restaurants serving their food to residents and visitors. The promotion should be geared towards these segments of KwaVonza society and therefore more focus should be on the ease of implementing and the business model of it.

The idea and implementation have been done well with success, the promotion and innovations on it can be improved in order to take it to the next level.

4.4 Tree and Vetiver planting

In Kitui, the sponge town project has also mainstreamed tree planting in its activities and has provided tree seedlings for road side planting. This is part of the green infrastructure approach to water management which aims to protect and restore the natural water cycle, and provide additional benefits which trees and vegetation provides for human beings. Especially in an urban set-up it is crucial to integrate green infrastructure for the liveability and preventing it from becoming a heat island.

Trees

Eight respondents received tree seedlings (600 total) for planting in their homes and along roads and pathways, while twelve people bought seedlings themselves for planting. Tree species planted included *Melia Volkensia*, *Mukengeta*, *Sambalau*, Red bottle brush, Moringa and Neem trees. These are tree species which are selected carefully on the characteristics of: drought resistance, beneficial produce (fruit, medicine, fodder) and providing shade (canopy shape and no shedding of leafs).

The survival rate for the seedlings was 82%, with challenges of water availability and seedlings unable to withstand local climatic conditions causing not all seedlings to survive. A majority of the respondents of 96 % who had planted trees recommended to embrace tree planting. Some of the sites where the respondents suggested that tree planting can be done included; homesteads/farms, school/churches, town centre, alongside roads/streets, on the hill and its slopes, along rivers, and on bare lands.

Figure 15 Senna Siamea tree planted along the road in KwaVonza

Generally mentioned benefits of tree planting by respondents include:

- Trees act as wind breakers and attract rains, it provides a better micro-climate and beauty.
- Provide shade and keep the compound cool, thus there is comfortable and fresh environment within the homestead.
- Provides direct benefits such as timber, fuel and fruits; timber can be used in construction, fuel like charcoal and fire food used in cooking and fruits that are important in diet. All these direct benefits can be sold at the market and provide you an extra source of income.
- Water holding capacity of grass and trees enhances water availability to be used by plants for growth, hence the increase in crop yield production.
- Tree growing provides more blossom for bees resulting in production of more honey which can be harvested and sold at the market. Due to high demand of bee keeping, bee hives are also made from the tree logs that are easily accessed by the locals.

It is also said that trees need a lot of water in the initial growth stages and requires proper management. In terms of watering, fencing/protection, pruning and pest management. Especially in dry areas it is certainly not a given for a tree to be planted and mature by itself, it needs intensive tending to grow well and sustain.

Vetiver

Vetiver grass splits were also availed for piloting by the project. Vetiver is a type of grass adopted globally for land reclamation purposes. With a capability of its roots penetrating deeper into the soil within a short time it can hold the soil together very well and greatly reduce erosion impact. It can therefore greatly stabilize steep slopes and it can filter out pollutants also when planted in water diversion channels.

In the project area, 20% of the respondents know what vetiver grass is, but only 5% had planted it. The low numbers of Vetiver grass awareness in the project area could be due to the fact that the grass is not native to the area. However, due to inherent characteristics of the grass in terms of being very useful for different types of green infrastructure, the local population was receptive to its adoption in the area.

Key lessons

Tree planting is a very good addition in making the town spongier, because trees literally shape-up the soil and making it able to store more water. In fact trees directly increase the sponge function of a town. Especially in a built environment it is essential to build-in these functions of green infrastructure. And the spread of trees goes much further, to a larger part of residents than kitchen gardens for example.

The crucial part with tree planting is on management, especially in drylands. Trees need to be watered and protected from animals, like goats and termites. It is important that residents themselves are responsible for trees. This was done well in the implementation, residents received seedlings to plant both at their homes and along the roads and pathways near their homes. This was done well with a high survival rate (82% respectively). For planting trees along roads there is room for improvement, mostly in creating good relationships with the road authorities. This needs to be fine-tuned well and still the residents need to take care of the trees. Only in that scenario tree planting can be done along the major roads. Also other public spaces are suitable for tree planting, however for this there was a lack of management. However, if an active committee can be established it is possible to do tree planting in other public spaces, which would

make great contributions to the overall greening of the town. This also depends on the town and active groups/committees who can carry this responsibility, this has to be well established beforehand.

Vetiver is a good alternative which is introduced and helpful to residents harvesting surface water. It can be improved through creating a vetiver nursery in town where other residents can come to buy slips to plant at their own homesteads, either at the compacted soil in the homestead or in diversion channels, to protect the soil from eroding.

5. Reflection overall impact

This chapter will reflect on the overall sponge impact of the several interventions that were implemented. How do they relate to the set objectives and the overall goal of making it a sponge town? Firstly, we take a look at how the respondents view and rank the different interventions. Furthermore, we measure the impact of the interventions with the set objectives from the project. Then going into depth on how the measures have contributed to a sponge effect, and whether a sponge town has been created. Additionally, recommendations from the respondents are shared lastly.

5.1 Perception on Sponge Town interventions

Firstly respondents were asked to rank seven different interventions in order of preference and importance for creation of a sponge town. So the most important intervention would be ranked 1 and the least important was ranked 7, see Figure 16.

Find below a short description of surface water harvesting, road water harvesting and water ponds, as they have not been treated separately in the above chapter.

Surface water harvesting includes all systems that collect and conserve surface runoff after a rainstorm for storage in open ponds and reservoirs. This can provide water for direct household use (treatment is generally required), irrigation, livestock, and aquaculture. Storage can also be the goal of collecting surface water, whether through open reservoirs or direct infiltration to aquifers below ground. Storing water in an aquifer conserves water better as it prevents evaporation, unlike open reservoir systems. This water can be harvested and stored through various techniques.

Road or path runoff; the road or path acts as a catchment and runoff is often diverted through a system of canals to the intended destination. This technique is often coupled with stone or earth bunds to prevent soil erosion and water runoff. Crops or trees with high water demands can be planted in or beside the canals, which retain much of the passing moisture. The water is collected from the road though a cut off or a canal to the point of storage.

Ponds, pans and dams; are the diversion, collection and storage of water from some external catchment area to a natural or constructed basin structure. These structures vary in makeup and size, ranging from small manually dug farm ponds to large community earth and sand dams. Minimizing seepage is usually a main priority for these structures and can be done by compacting clay soil at the base, or by lining it with impermeable material such as plastic pond lining. The use of these structures depends on its water storage capacity, but is usually intended for livestock, small-scale irrigation, or domestic purposes if needed.

Figure 16 below shows the ranking of the different interventions. The blue colour shows the amounts of time an intervention was ranked 1 or 2, kitchen gardens and surface water harvesting scored highest to this. Then orange shows the same for ranks 3, 4 and 5, and grey for ranks 6 and 7. What stands out is that tree planting is seen as an average and reliable performer, maybe not the winner in terms of importance but very good to have on board.

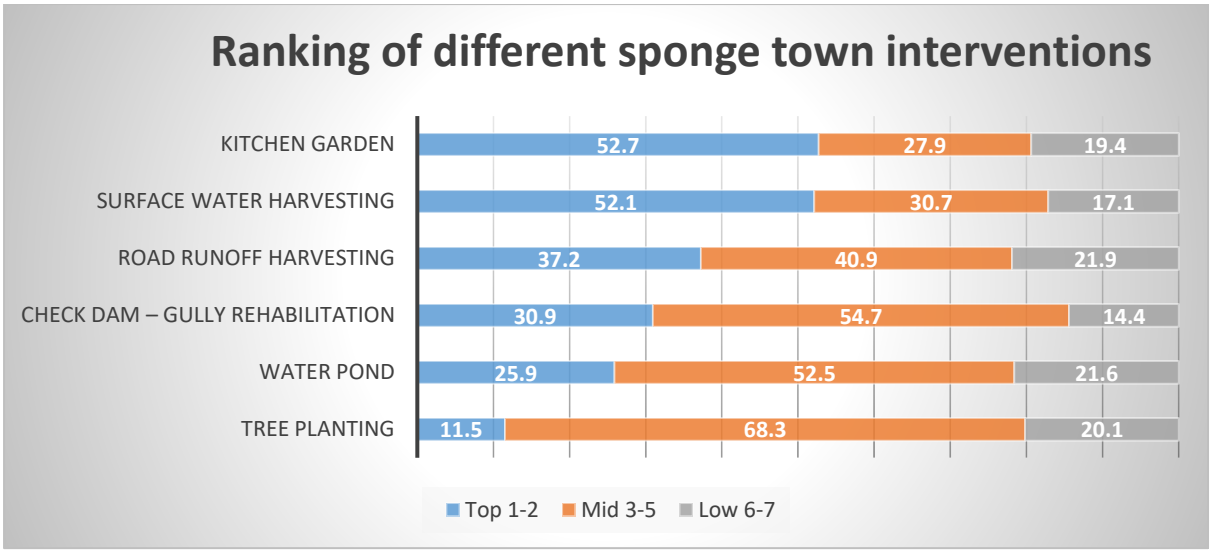

Figure 16 ranking of different sponge town interventions

* *Unfortunately there was a bug in the questionnaire causing roof harvesting not to be included in the ranking exercise.*

Overall kitchen garden with surface harvesting are seen as most important interventions. Looking at the outcomes of what was done in KwaVonza this makes a good combination. Many people have ventured into both, providing them with water at hand, at reduced price, with a possibility to make savings on vegetable purchases. A win-win-win. Ponds and gully rehabilitation was done at a limited amount of locations, and are also not applicable everywhere, together with flooding not being a serious problem in KwaVonza it is understandable that these are not viewed as important.

It gives a good indication that people see the benefits for their households first, on which interventions focussed on mainly in this project. After which the interventions for the public space, in gullies, along roads, etc., are also viewed as important. There is no one single measure which is disregarded by the respondents, this also shows the importance to combine: water harvesting, growing vegetables, recycling water, storage, preventing erosion, green infrastructure and gully rehabilitation all together in order to achieve the big picture of the Sponge Town.

The respondents were also asked their opinion about sponge towns in general. Below you find a summary of the views they expressed:

- Rainwater harvesting is very important, the sponge town concept should be spread to other towns. It can really work well in other semi-arid places. It keeps and conserves seasonal water within the town catchment and can transform KwaVonza from arid to green.
- Simple and affordable water harvesting and farming methods in drylands to improve current living situation.
- Rainwater harvesting is economical, very sustainable and clean water is produced. It is very important because it ensures water availability at homesteads. Also it is readily available and cheap to residents in a sponge town, everybody can implement it.
- It has improved our standard of living.
- Sponge town needs very active and reliable project activities for them to grow gradually.
- Sponge town does not realise its potential yet.
- I would like other people also to implement the measures in order to benefit.
- It makes the people know the value of grey water.
- It specifically helps the less fortunate in a town, making it a very helpful project

5.2 Comparison to the set objectives

This section will look into the objectives that were set at the start of the project. Also we have look at the theory of change to discuss what the contributions have been from the five different activities in the project and what has contributed most to the impacts. Eventually we discuss whether this has created the impact we want to see and the reach of it.

In Table 3 an overview is given of the results measured against the set objectives at the start of the project. Throughout the activities the situation has changed, mainly based on the meetings with the citizens' platform and the baseline study. In that phase the real issues were verified, which were different then some of the assumptions made. One clear example is on flooding, this was not considered a problem by a majority of residents. The sponge team also recognized this, though also came up with type of interventions like gully rehabilitation, road runoff harvesting and tree planting which also cater for storm water management, but in a more diverse manner.

Table 3 measuring results against the set project objectives

	Target (from project plan)	Result	**Remarks**
Town administration	10+	OK	Especially with the County technical team also assigned to SymbioCity
County government and technical offices	10+	OK	Good inputs from different technical offices, both at county and local levels. Nevertheless, collaboration proved to be difficult and constant pushing and pulling was required
Local university staff	5+	OK	One staff was involved closely in the working team, others were involved in guiding students in research and design
Young university graduates	20	OK	25 students of both SEKU (university level) and KEWI (Kenya Water Institute = college level) were involved in baseline study (8), design (12) and monitoring (5).
Citizen platform	30+	OK	A consistent 40-50 people were present in the meetings with the citizen platform
Beneficiaries from improved drainage systems and infrastructures.	70% of population will benefit from decreased flooding of main town infrastructures.	- Gully resolved with check-dam and pond - Tree planting to reduce road side erosion	- Flooding not considered issue by residents - Gully rehabilitation with check-dam and pond successful for Mwende self-help group – helping 25*5=150 people - Tree planting has larger effect to overall KwaVonza – not to specific households. - Road side drainage insufficiently handled due to non-matching timelines with planned road construction and formal prohibition of tree planting by KENHA
Beneficiaries from improved water sources.	To be defined during project planning phase	10 ponds rehabilitated	Combined with road water harvesting and vetiver grass planting
Beneficiary from household measures	10 % of the population benefits from incentives on RWH systems from local micro-credit. At least 50% of the	48 tanks: 48*5=240 On a population of 7500 est. this equals 3.2%	48 tanks by project subsidy – outside also people started to do roof water harvesting. 13 in survey representing 10%, leading to 130, taking 50% bias in involved project people – 65. 65*5=325 On a population of 7500 est. this equals 4.3% Totalling to 7.5%

	beneficiaries shall be women.	More than 50% of beneficiaries are women	
Increased fruit production at household level	500 households	Focus has been on trees and kitchen gardens.	More than 600 trees planted with 82% survival rate, among them. (more people initiated this on their own initiative) More than 29 kitchen gardens who produce vegetables at household level
Additional, not in project objectives	- Clear change in attitude towards re-use of waste water, 96% changed - Many local artisans involved in installing roof harvesting systems, check-dam and ponds.		

Figure 17 shows what was said on the vision, change agents, outcome and impact foreseen at the start of the project. In Table 4 we will shortly go into each aspect and discuss what has come about from the project.

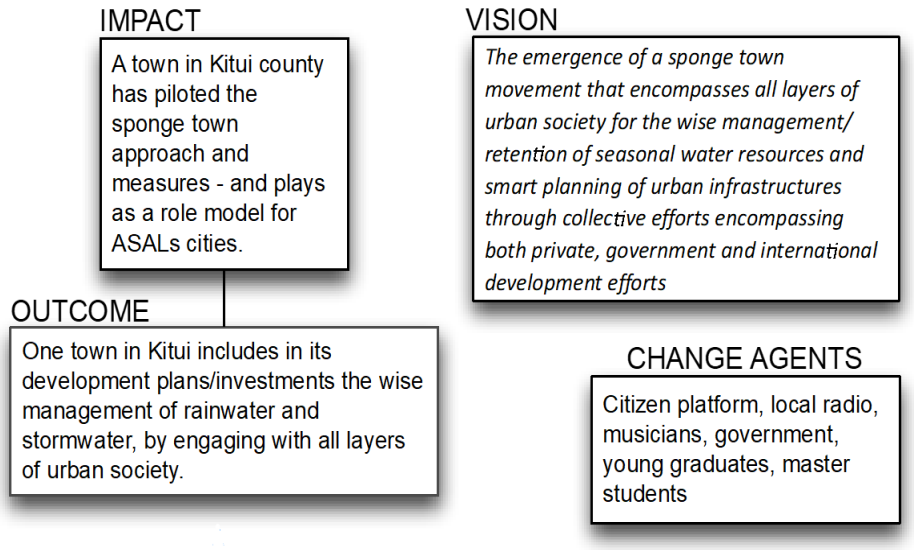

Figure 17 change agents, outcome, impact and vision from the project proposal

Table 4 positives and negatives on Sponge Town KwaVonza

	+	-
Vision	+ Urban society actively engaged + Movement from word of mouth + Wise management of water resources – in harvesting, storing and reuse	- More promotion to business and students - Planning and government needs to be closely integrated
Change agents	+ Citizen platform + Young graduates and students	- Government at County level
Outcome	+ Business for local retailers, hardware shops and artisans + Private investments by residents + Rainwater management is carried by the residents of the town	- Development not captured in plans
Impact	+ Range of sponge town options piloted in semi-arid booming town	- Role model for ASALs towns? May need more in terms of wide-scale impact, range

	+ KwaVonza is representative for many towns in semi-arid regions + Successful pilot – KwaVonza has sponged up – though not yet a complete sponge	of measures (groundwater recharge, flooding) and government involvement. → Kajiado Sponge City crucial partner in up-scaling

Looking at Table 4 above it becomes clear that the impact has been reached through wide support from the citizens and private sector operators within KwaVonza. This is the strength of sponge town KwaVonza. A shift in political leadership has made the collaboration with the government difficult, this is one important learning point. Interventions that cut across and require large financial capacity, are normally the responsibility of the government. A bottom-up approach can work well when a government is pushed to take action. However, citizens cannot do those interventions on their own. Government is also crucial for integrating interventions in regulations and plans, for long lasting impact. In order for it to reach further, we are happy to be in partnership with the Sponge City Kajiado project. Because the scenarios in terms of practical interventions and project management are different. Therefore we can learn from each other, and take up a wider scenario of successes and lessons for the upscaling. This will be done through a Sponge Town guideline, guiding booming towns in ASALs on how to create a sponge town.

The impact we see in KwaVonza is very encouraging, the town has certainly sponged up. Multiple areas have the characteristics of a sponge, though for various reasons mentioned in this report it is not yet one big sponge. However, because of the many initiatives from residents copying their neighbours and also starting up water harvesting, the prospects for KwaVonza look good. The close collaboration with the citizens' platform and local entrepreneurs have contributed most to the overall impact. These people have really built the different components of a sponge town. The collaboration with government and business actors can be improved, so to enable larger investments to be done.

5.3 Reflection on 3R contribution to the sponge function

Overall the measures have focused much on water storage and re-use at household level. Less so on recharge. The gully rehabilitation with a check dam and tree planting have increased water retention and recharge. Table 5 below shows an indication of how each intervention contributes to either retention of rainwater, recharge of aquifers and the reuse of water. The water drops indicate to which extent it contributes from zero to a maximum of 3 drops.

Table 5 indication of 3R contribution of each intervention

Intervention	**Contribution to 3R**			***Additional***
	Retain rainwater	Recharge aquifers	Reuse water	
Roof water harvesting	💧💧💧	O	💧💧	Make water available at household level – reducing surface runoff erosion
Surface water harvesting	💧💧	💧💧	💧	Reducing surface runoff erosion – store for agricultural use
Road runoff harvesting	💧💧	💧💧	💧	Reducing road runoff erosion – increase road safety
Gully rehabilitation – Check-dam	💧	💧💧💧	💧	Regain lost soil – even out at surface level – reduce risk of more erosion

Storage pond		Suitable for agricultural use – capture road/surface runoff
Tree planting		Reduce surface runoff erosion – hold soil together – increase infiltration capacity of soil – beauty & shade
Kitchen garden with grey water		Value addition through grey water reuse – savings and sales from vegetable production – increased variety in diet

In KwaVonza groundwater tables are very low and there are no successful practices of shallow wells and just few examples of boreholes with enough water supply. These boreholes can go 100m deep. Also there is very little knowledge on groundwater levels, recharge of aquifers and levels of abstraction. This became clear during the baseline study. Because of this, the interventions have focused mostly on diversifying water supply, making the most out of the seasonal rain events, and focusing on storing water and making the use and re-use more effective.

Few interventions specifically looked at recharge of aquifers or retaining water in the soil moisture. These interventions had multiple benefits, mainly in reducing erosion and thereby restoring soils and land. For example road runoff harvesting and tree planting, water is not so much retained at a level where it is available for people to use, however it does make sure that the water is infiltrated within the area and not letting it run off with a high risk of erosion. It therefore also contributes to the sponge, though it is less clear where this water is going exactly and where it is stored. Because there is little knowledge on groundwater flows and geology in KwaVonza, and also little use of deep groundwater sources. The interventions have mostly contributed to retention and re-use of water, more so than recharge of water.

Most of the interventions are on the side of retaining the water, as the main problems in KwaVonza dealt with unreliable and insufficient water supply that comes at a high price. The seasonality of water provided problems, especially during the rains when water from the river is turbid. The solutions therefore focused on diversifying overall supply, making it available throughout the year and using it beneficially.

In this Sponge Town KwaVonza has succeeded, the many roof harvesting tanks and surface/road runoff storage ponds have greatly increased the quantities of water available for the residents. They are less reliant on water vendors and have saved much on costs and time in either buying or fetching water. The available water is considered of higher quality and is now within short reach, making it much more easy to use. This is also a reason why kitchen gardens have sprouted more than ever before, the combination with the necessary water is made, and all water can be reused. So two strides have been made, the retention of water over time and the reuse of grey water.

The interventions are spread quite evenly over the entire area of KwaVonza. The amount of interventions are a bit below the objectives, however it has already triggered more people outside the direct beneficiaries to also implement. And a number of measures like tree planting and gully rehabilitation contribute to the larger regreening of KwaVonza and not to specific households.

5.4 Other methods to be implemented

In addition we asked what could be improved to the project, some recommendations stood out:

- Create awareness through local media (do this before survey)
- Include other micro-business ideas and provide training on this
- Needs more involvement of all KwaVonza residents. E.g. through working with different groups to improve the level of implementation.

- More training to the entire community
- Provide more methods of water harvesting
- The project should be expanded to County level
- It needs continuous interaction with respondents through workshops and seminars
- Implementers should be encouraged to educate others about the interventions.
- Prior passing of information to residents about the project goals

5.5 Social impact marketing

An external partner was consulted to work on social impact marketing through social media mainly. This was done because the team recognized the need to reach other segments in society, like business, students, government actors which we have reached insufficiently. Another reason for the social media campaign is because of the upscaling, aiming to reach more people and trigger their attention and interest. First it is about creating awareness about practical sponge town solutions, furthermore to spur participation and spread wise behaviour on water management in towns, and finally to get new people interested and trigger action. Especially to involve county governments, town administrations, business partners and individuals to get involved actively in transforming their town into a sponge town.

The social media activities are underway and have so far triggered good attention on social media platforms. Especially on twitter there is good interest and response from interesting organizations and institutions. However, the upscaling is just in its initial phase and it is therefore too early to conclude on how it has worked. At this moment we see it has been beneficial to have a strategic framework for the use of social marketing, on how to brand yourself and what steps to follow in the marketing campaign. This creates a clear path on how to do the social marketing with logical steps. This is a nice way of working and is more effective than the sharing 'bits and pieces' like we used to do. That has already been a good learning, we will continue on this way and foresee to reach more interested people and organizations.

Key lessons

Main lessons are shared by the respondents themselves. Mainly they state that the citizens need to be continuously aware and involved of all activities taking place, prior to when it will actually happen. It comes out clear that they want to be in the middle of it and on top of it, then they will be eager to be deeply involved. Building community partnerships early in project development strengthens a relationship between community and project management and ensures smooth participation.

They also recommend to have more continuous interaction through different types of training, for example on micro-business ideas. And lastly to have champion citizens to educate others. All aspects of close collaboration with the citizens in order to maximize implementation and success. The understanding is that people make or break a town, once they are in, you have a wonderful pool of resources which can really make a change. Now that the interventions make sense, it is key to have wide-scale implementation and support new ideas and entrepreneurs.

6. Sponge project team evaluation

In this chapter we evaluate the project team on their management of the project and on the different activities they have been involved in.

6.1 Respondents' rating

Respondents rated various aspects of the project including clarity of objectives, project management, training and demonstrations, respect of timing and deadlines, achievement of project goals, and sustainability of project interventions. Figure 18 shows respondents' perception with respect the highlighted aspects. This information comes from all the respondents who have indicated to have been either little, moderately or deeply involved (43%, 28%, 29% respectively).

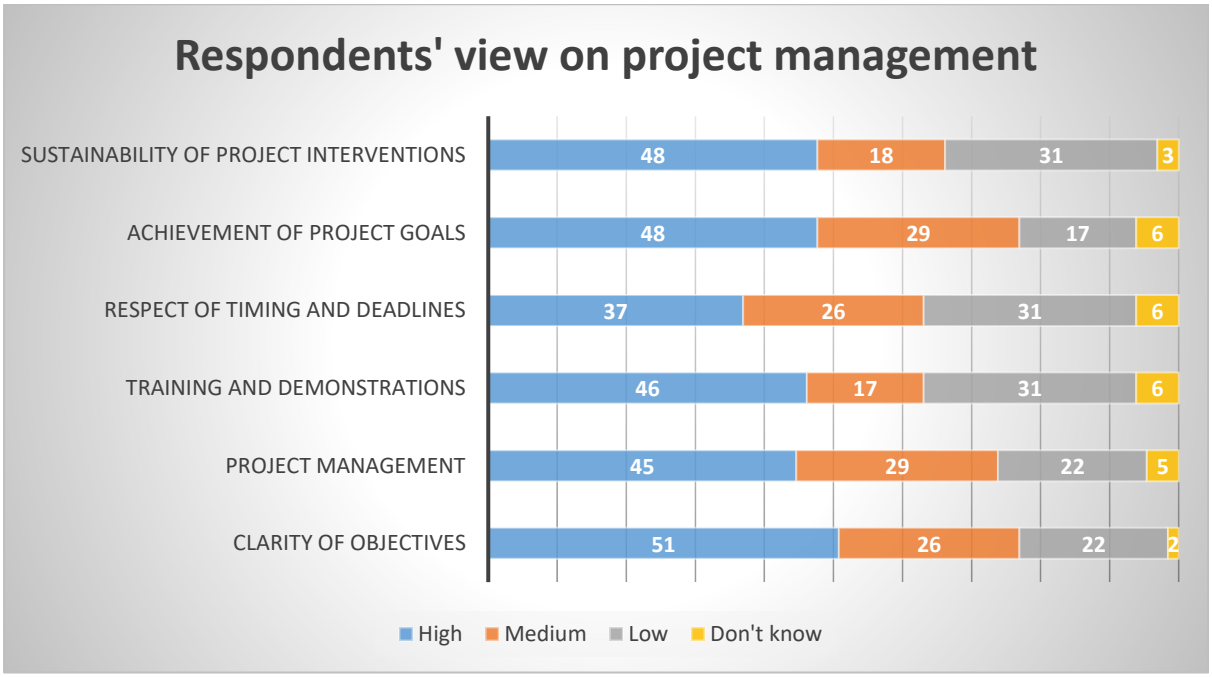

Figure 18 respondents' view on project management

Overall the scores show a positive view on project management, though there is also room for improvement. It shows that the objectives for the sponge town project have been communicated well, this is the basis for the interventions to take place. However respect of timing and deadlines scored the lowest. This may have to do with other suggestions from respondents' to communities more continuous throughout the activities one what will be done. We see that in some scenarios interventions were going on in few places, without knowledge of the rest of the community. This is an important learning point, to involve the citizens in all the actions to take and keep them updated regularly, even if it does not always concern themselves.

What to be improved to the sponge town project?

The six implemented activities i.e Kitchen gardening, Roof water harvesting, Tree planting, Gully rehabilitation, on farm ponds and Vetiver was successful with majority of the farmers benefiting in both or one of them. However, it does not mean that where everything is success there is no room for improvement. The respondents gave out their ideas on what can be improved, such as:

- Continue in creating awareness so that more people can benefit
- Increase number of people for trainings
- Sponge town team should offer trainings and create awareness through barazas (public meetings) prior the activities they are doing to avoid doubts from residents.

- The sponge team should inform Area Chief to get more people to involve in the project.
- The team should create awareness before any activity.
- They are very active team and reliable people
- Make us much updated, always.

Respondents indicated throughout other questions also that they like to see more trainings and demonstrations wherein they can take part. This together with the emphasis on awareness and continuous updates and communication will be taken as points for improvement.

6.1 Successes, failures, lessons

In Table 6 success, failure and lesson from the project activitiesTable 6 each of the project components is discussed with 1 success, 1 failure and 1 lesson.

Table 6 success, failure and lesson from the project activities

Component	Responsible partner	1 success	1 failure	1 lesson
1. citizen platform	SEKU and SASOL	Existing platform was very instrumental and active.	Was initiated by local government and had a bias in terms of which representatives were there and which not.	Needs effort in getting everybody on board while keeping good relations with local government.
2. baseline study	MetaMeta and SEKU	Clear verification of real problems. Some assumptions already tackled.	Lack of bio-physical data like groundwater, weather, etc.	Do not assume you will receive reliable data from government authorities.
3. design and planning	MetaMeta and SEKU	Active participation of students of university and vocational levels. Brought refreshing link with citizens in developing neighbourhood plans.	No demonstrations and practical courses added for the education institutes, missed opportunity.	Value could be added by linking (Dutch) master students on urban planning to the team.
4. implemen-tation	Sasol	Good involvement of local retailers and craftsmen.	Bigger structures in collaboration with county government did not succeed. Overall there was very little support from government.	Team should put more effort in lobbying at influential government entries. On the long term government is vital.
5. learn and spread	MetaMeta	Different types of media triggered much attention. Successes were	Some segments of society were not reached due to one-	Outsource what other people do better, or for something you don't

		shared quickly with the aim to create a domino-effect.	sided sharing of messages.	have time for. In our case on (digital) marketing.

The project team has been successful in keeping the project on track according to plan. Some changes were made in time planning and budget, though the main lines remained the same. Collaboration was good and smooth, due to the long-standing relationships of the partners. However, the SEKU representative did not always deliver sufficiently nor on time. This has caused MetaMeta to spend more time on the project taking up some of the activities that were allocated to SEKU. This in order to ensure that the overall deliverables would be comprehensively and timely achieved.

Overall the collaboration was good, with much space for discussion and open minds for new ideas and constructive feedback. It was pleasant also to work with the citizens' platform, the students, local government staff, local retailers and artisans and all the beneficiaries in the project. We had a clear division of responsibilities which worked well throughout the project. We believe our main successes have been in working with the citizens' platform, community groups, local retailers, entrepreneurs and artisans. This has really done a great deal in KwaVonza. However, a sustainable relationship with high-level partners such as government has been a failure and should be taken up much more intensely from the start in sponge towns to come. In the process of design and implementation we have recognized some of our shortcomings and have responded to this. Engaging specialists on social marketing, engaging with business partners in KwaVonza and trying to add to the implementation based on initial feedback. We have always critically analysed ourselves and taken the lessons to heart.

If the collaboration with the government didn't become strong, on the other hand this made us reflect on how this kind of project can best achieve its objectives. Can a two years project really bring change at government level, taking into consideration the amount of efforts needed and the low political will especially at times when elections are taking place? Isn't it better in these cases to focus on planting a seed of change with the community and nurture the sprouting seedling? Make sure that the seedling gets some water and its roots get deep into the ground.

Looking back the team had the right balance of experience, expertise and practical know-how. However, high-level connections at county level government were lacking. The collaboration with SEKU was beneficial in terms of student involvement, though there is still an opportunity to develop practical courses based on sponge towns. In terms of the approach we kept it local, with much interaction with the citizens' platform and groups active in KwaVonza. This proved beneficial for a quick uptake of different interventions at household level and for a number of public spaces in town.

Additionally there was a collaboration with Symbiocity, a different initiative on sustainable urban planning also working in KwaVonza. We had very good interactions with them all along the way, though because of vast delays with their implementation it was not possible to complement each other's interventions in practice. However in the developing and designing steps of the project we worked closely together, which was beneficial to both parties in gaining insight in the situation and sharing ideas. We also held citizen platform meetings together and ensured to speak to the citizens with one voice.

Key lessons

Overall the team is suitable for the job, we have key expertise and experience that can help any town transforming into a sponge town. It is important for the team members to take our lessons seriously, and basically focus on connecting to government and outsourcing/consulting other parties for services that are not our strength. It is best to focus on what we do well, and organise the sponge team in such a way that

it can do exactly this. For some activities therefore, we need to connect with other people who can open up doors and reach out to others. So the core remains the same, we rely on our strength, understand what can be done better, and engage with others where needed.

In a future, similar project we would certainly change some aspects when it comes to team management. To ensure full commitment and timely and efficient project activities it is best that partners are direct co-signatory of the contract with the funding party (and not sub-contracted). This would increase scrutiny and accountability. Additionally, payments must be better anchored to activities, involvement and quality inputs to the team efforts. We relied excessively on trust, but trust doesn't always pay back if it is not reciprocated in form of efforts and commitment to the common cause. In an ideal situation, trust and commitment would be the sole drive for efficient and quality collaboration. This unfortunately is not always the case and is the reason why it is always important to have strong contractual terms that safeguard the project, its partners and most importantly the common objectives.

7. Conclusion

Looking back on sponge town KwaVonza we see a lot of things have changed. Many residents have implemented interventions on water retention and reuse, improving their water quantity and quality at household levels. Also recharge of water has happened through check-dams and road runoff harvesting, coupled with regreening. The benefits of the improved buffer function for both individuals as well as certain areas, come out clearly. The interventions implemented all contribute to a sponge effect. However we also see that it is yet scattered and not yet one big sponge. Rather we see sponges coming up in several places, with improved participation and more uptake of measures in the public space these sponges can be connected and finally become one big sponge.

Have we done the right thing?

Based on the issues verified in the baseline study and through the citizens' platform the focus has been on diversifying water supply and restoring problem spots. These solutions answered to the actual situation on the ground and have shown to benefit the residents. Big strides have been made in preventing water and soil to be wasted. It has improved the buffer function in town, for households as well as problem spots. Especially increased water availability at household level for a longer duration has helped many residents.

The right thing was done in focussing on self-supply systems, ensuring that residents do not rely on unreliable, expensive and low quality water sources. More focus is needed on the groundwater situation in order to strategize recharge of water resources. Furthermore green infrastructure should be integrated throughout all interventions. It is a simple add-on to many structures and should be promoted more, in this way you make optimal use of improved water availability and immediately sustain the water resource through vegetation and a cooled down micro-climate.

Are there better ways of doing it?

The following recommendations deal with the specific interventions on the ground and how these can be expanded and/or improved:

1. Innovations on different low-cost methods of rainwater harvesting and conservation
2. Training/support on how to finance rainwater harvesting infrastructure
3. Support to micro-business and entrepreneurs in the water sector
4. Enhancement of road side water harvesting and tree planting activities together with soil stabilization on slopes through the use of vetiver grass.

What were failures or mismatches and what to do about them?

Failures were mainly found in the project management and the collaboration with government authorities. More effort needs to be put in creating strong links in government and fostering good relationships. Regulations, planning and big investments are needed for organised growth of a town, which is the mandate of the government. Residents and businesses can be motivated through these measures and enabled to implement together at a public level and also at household levels.

In terms of practical interventions they answered to the needs, however in some cases more strategic collaboration and clear agreements have to be made in early stages, especially when working with groups. Furthermore, fine-tuning is needed to be of interest to different actors, like students and business, which responds to their needs and wishes.

What aspects to always have in a sponge town? Sponge-Takeaways:

- Put the residents in the drivers' seat

- Kill or confirm your assumptions before going into solutions.
- Support innovation and practicality. Keep it simple for residents, but also trigger entrepreneurs to invest in commercial and effective solutions.
- What works, works.
- Always and relentlessly communicate with residents on the plans and activities.
- Fine-tune interventions for different segments of society, answer to their interests.
- Promote self-supply water systems when water supply is erratic and unreliable.
- Focus on effective uses of waste water and combine with practical uses like kitchen gardens.
- Always integrate green infrastructure with all 'water' structures you implement.
- Foster good relationships with government.
- Always keep the bigger picture in mind, one intervention has an effect on the next. Make use of the inter-relations, let them solve each other's issues, or amplify solutions.
- Give it time.

Key lessons

Four lessons we like to share here which are amended from the publication on the akvo.rsr project webpage, where updates were regularly placed. These we believe comprise essentials in developing a sponge town.

1. High cooperation with town residents is essential

From the very start the residents have been at the core of all activities. Before anything the team would meet with the community platform to ask them what they want, present our ideas, get their feedback and learn together. They often surprise us, prove our assumptions wrong and come up with out-of-the-box solutions. This results in smooth implementation with a lot of co-investment and work done by KwaVonza residents. People make up the town, thus they also make the Sponge Town. In this regard it is crucial to continuously update and involve the residents in all activities and ensure they are aware of what happens at all time. Also listen well to their demands and try to organise events for different segments of society to ensure there is something in it for everybody.

2. Get government on board

We have had a change of governor of Kitui County during the project time, this changed the political agenda. While the collaboration with county government was good, the support for an urban water plan faded with the entrance of the new governor. However, in this scenario it was necessary to first develop a good relationship with the government officials. This can take time and it is questionable whether two years, without having a prior working relationship, is enough. Although it is very important for the long term sustainability and high level interventions. It is always good to have them on your side. A lesson for the team is to put more effort into developing these relationships and strategize the collaboration with government in order to influence decision-making. Another approach can be bottom-up, planting a seed in the community and try to influence different levels of policy makers and government authorities to take it up.

3. Source from within

There are so much local resources, skilled workers and expertise within a town. There is an amazing blend of young and old, men and women who are experts in different sectors. In the creation of Sponge Town, all has been sourced from within, giving the local economy a boost, building skills and enabling them to continue with the work in the future. Plus the trust is already established, the people are familiar with each other which eases implementation.

4. Outsource where needed

Sometimes you find out there are some gaps in what you are doing. You notice you have not been able to reach a specific group of people, or not managed to set-up a business approach for example. In these cases

it is good to reflect upon yourself as a team and see if you need to outsource certain activities. It can also help to kick-start a different approach, once you have seen a different way of working you can try to take it up yourselves afterwards.

These four lessons are at the core of Sponge Town, integrating the full concept deals with people, hard-ware solutions and governments, which need to lift each other to a higher level. Adopting such an approach would immensely improve the resilience of projects and people.

7.1 Reflection on MEL method

The monitoring and evaluations survey have given insight into various aspects of the Sponge town project in KwaVonza. In addition to specific quantitative analytics, the evaluation undertaken as part of the monitoring and evaluation of the project activities yielded some significant observations that provide important context for conclusion in this report.

Most emphasis has been put on the socio-economic conditions of citizens and the factors on water quantity and quality that affect their livelihoods directly. Biophysical conditions have initially been checked in the baseline study, out of which the issues (flooding, drainage) were deemed not pertinent. Therefore the focus of the MEL has also been on the adoption of measures at household level. The few hotspots for which interventions took place have been investigated and monitored closely.

Unfortunately some mistakes had been made in the questionnaire which were found out after all the data was collected. Therefore a bits of data are missing, hampering some analyses and mapping out of interventions.

Annex 1: Water quality test results

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NAIROBI

KENYA

CHEMICAL ANALYSIS FOR WATER SAMPLES

SAMPLE SOURCE & DESCRIPTION: MASINGA DAM

SAMPLED BY: CLIENT

CLIENT: METAMETA RESEARCH-KITUI

PARAMETER	RESULT	REMARK
pH	7.05	
APPARENT COLOUR ^{o}H	5	
TRUE COLOUR ^{o}H	5	
CONDUCTIVITY µ/S/CM, mg/1	150	
TURBIDITY, F.T.U	1.2	
CALCIUM HARDNESS AS $CaCo_3$, mg/l	20	
TOTAL HARDNESS AS $CaCo_3$, mg/l	60	
TOTAL ALKALINITY AS $CaCo_3$, mg/l	40	
CARBONATE ALKALINITY, mg/l	0	
IRON, mg/l	0.2	
FLUORIDES, mg/l	0.05	

SULPHATES, mg/l	65	
DISSOLVED OXYGEN, p.p.m	5.7	
NITRATES, mg/l	0.5	
NITRITES, mg/l	0	
CHLORIDES, mg/l	38	
TOTAL COLIFORM/100ml	-	
TOTAL FAECAL COLIFORM/100ml	-	
DISSOLVED SOLIDS, mg/l	120	
SUSPENDED SOLIDS, mg/l	0	
TOTAL SOLIDS, mg/l	120	
BIOCHEMICAL OXYGEN DEMAND, mg/l	-	
CHEMICAL OXYGEN DEMAND, mg/l	-	
RESIDUAL CHLORINE, mg/l	-	

GENERAL REMARKS: The water meets the standard for development as a domestic water source.

REMARKS BY: PROF.P.M.A. ODIRA **SIGNATURE:** ..... **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE:** ..... **DATE:** .....

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CHEMICAL ANALYSIS FOR WATER SAMPLES

SAMPLE SOURCE & DESCRIPTION: TANK WATER/ ROOF WATER

SAMPLED BY: CLIENT

CLIENT: METAMETA RESEARCH-KITUI

PARAMETER	RESULT	REMARK
pH	6.97	
APPARENT COLOUR ^{o}H	5	
TRUE COLOUR ^{o}H	5	
CONDUCTIVITY µ/S/CM, mg/1	16	
TURBIDITY, F.T.U	1.4	
CALCIUM HARDNESS AS $CaCo_3$, mg/l	6	
TOTAL HARDNESS AS $CaCo_3$, mg/l	16	
TOTAL ALKALINITY AS $CaCo_3$, mg/l	14	
CARBONATE ALKALINITY, mg/l	0	
IRON, mg/l	0.3	
FLUORIDES, mg/l	0	
SULPHATES, mg/l	0	
DISSOLVED OXYGEN, p.p.m	5.6	
NITRATES, mg/l	0.5	

NITRITES, mg/l	0	
CHLORIDES, mg/l	18	
TOTAL COLIFORM/100ml	-	
TOTAL FAECAL COLIFORM/100ml	-	
DISSOLVED SOLIDS, mg/l	40	
SUSPENDED SOLIDS, mg/l	0	
TOTAL SOLIDS, mg/l	40	
BIOCHEMICAL OXYGEN DEMAND, mg/l	-	
CHEMICAL OXYGEN DEMAND, mg/l	-	
RESIDUAL CHLORINE, mg/l	-	

GENERAL REMARKS: The water meets the standard for use for domestic purposes.

REMARKS BY: PROF.P.M.A. ODIRA **SIGNATURE:** ..... **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE:** ..... **DATE:** .....

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CHEMICAL ANALYSIS FOR WATER SAMPLES

SAMPLE SOURCE & DESCRIPTION: PRIVATE BOREHOLE

SAMPLED BY: CLIENT

CLIENT: METAMETA RESEARCH-KITUI

PARAMETER	RESULT	REMARK
pH	6.88	
APPARENT COLOUR ^{o}H	5	
TRUE COLOUR ^{o}H	5	
CONDUCTIVITY µ/S/CM, mg/1	725	
TURBIDITY, F.T.U	0.9	
CALCIUM HARDNESS AS $CaCo_3$, mg/l	292	
TOTAL HARDNESS AS $CaCo_3$, mg/l	400	
TOTAL ALKALINITY AS $CaCo_3$, mg/l	116	
CARBONATE ALKALINITY, mg/l	0	
IRON, mg/l	0.2	
FLUORIDES, mg/l	0.18	
SULPHATES, mg/l	480	
DISSOLVED OXYGEN, p.p.m	6.0	
NITRATES, mg/l	0.6	
NITRITES, mg/l	0	

CHLORIDES, mg/l	90	
TOTAL COLIFORM/100ml	-	
TOTAL FAECAL COLIFORM/100ml	-	
DISSOLVED SOLIDS, mg/l	750	
SUSPENDED SOLIDS, mg/l	0	
TOTAL SOLIDS, mg/l	750	
BIOCHEMICAL OXYGEN DEMAND, mg/l	-	
CHEMICAL OXYGEN DEMAND, mg/l	-	
RESIDUAL CHLORINE, mg/l	-	

GENERAL REMARKS: The water meets the standard for use for domestic uses.

REMARKS BY: PROF.P.M.A. ODIRA **SIGNATURE:** ..... **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE:** ..... **DATE:** .....

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CHEMICAL ANALYSIS FOR WATER SAMPLES

SAMPLE SOURCE & DESCRIPTION: MWITASYANO RIVER

SAMPLED BY: CLIENT CLIENT: METAMETA RESEARCH-KITUI

PARAMETER	RESULT	REMARK
pH	7.40	
APPARENT COLOUR ^{o}H	110	
TRUE COLOUR ^{o}H	100	
CONDUCTIVITY µ/S/CM, mg/1	334	
TURBIDITY, F.T.U	80	
CALCIUM HARDNESS AS $CaCo_3$, mg/l	110	
TOTAL HARDNESS AS $CaCo_3$, mg/l	160	
TOTAL ALKALINITY AS $CaCo_3$, mg/l	118	
CARBONATE ALKALINITY, mg/l	0	
IRON, mg/l	0.8	
FLUORIDES, mg/l	0	
SULPHATES, mg/l	80	
DISSOLVED OXYGEN, p.p.m	5.1	
NITRATES, mg/l	0.8	
NITRITES, mg/l	0	

CHLORIDES, mg/l	95	
TOTAL COLIFORM/100ml	-	
TOTAL FAECAL COLIFORM/100ml	-	
DISSOLVED SOLIDS, mg/l	370	
SUSPENDED SOLIDS, mg/l	50	
TOTAL SOLIDS, mg/l	420	
BIOCHEMICAL OXYGEN DEMAND, mg/l	-	
CHEMICAL OXYGEN DEMAND, mg/l	-	
RESIDUAL CHLORINE, mg/l	-	

GENERAL REMARKS: The water meets the standard for development as a domestic water source.

REMARKS BY: PROF.P.M.A. ODIRA **SIGNATURE:** ..... **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE:** ..... **DATE:** .....

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PUBLIC HEALTH ENGINEERING LABORATORY

REPORT ON BACTERIOLOGICAL EXAMINATION OF WATER

Name and Address of Sender: METAMETA RESEARCH KITUI.

Sender's reference number:

Laboratory reference number: - 361-BE -01

Nature of sample: DAM **Date of collection**: 12th/05/2017

Where collected: MASINGA DAM + **Date of arrival in Laboratory**: 12th/05/2017

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1. Plate/Colony/Total viable at 37°C……80……../ml
2. MPN of Coliform organisms……..100……../100ml
3. MPN of E.coli……0……/100ml
4. MPN of faecal streptococci……/100ml
5. MPN of Cl.perfringens……/100ml
6. Staphylococcus Aureas…… ……/100ml
7. Shigella……/100ml

Date of report: 18th/05/2017. Remarks: There is no evidence of bacteriological contamination.

REMARKS BY: PROF.P.M.A ODIRA **SIGNATURE:** …… **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE**: ……. **DATE:** ……..

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PUBLIC HEALTH ENGINEERING LABORATORY

REPORT ON BACTERIOLOGICAL EXAMINATION OF WATER

Name and Address of Sender: METAMETA RESEARCH KITUI.

Sender's reference number:

Laboratory reference number: - 361-BE -02

Nature of sample: ROOF WATER **Date of collection**: 12th/05/2017

Where collected: TANK **Date of arrival in Laboratory**: 12th/05/2017

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1. Plate/Colony/Total viable at 37°C……60……../ml
2. MPN of Coliform organisms……...50……../100ml
3. MPN of E.coli……..0……/100ml
4. MPN of faecal streptococci……/100ml
5. MPN of Cl.perfringens……../100ml
6. Staphylococcus Aureas…….. ……/100ml
7. Shigella……../100ml

Date of report: 18th/05/2017. Remarks: There is no evidence of bacteriological contamination.

REMARKS BY: PROF.P.M.A ODIRA **SIGNATURE:** …… **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE**: ……. **DATE:** ……..

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PUBLIC HEALTH ENGINEERING LABORATORY

REPORT ON BACTERIOLOGICAL EXAMINATION OF WATER

Name and Address of Sender: METAMETA RESEARCH KITUI.

Sender's reference number:

Laboratory reference number: - 361-BE -03

Nature of sample: BOREHOLE **Date of collection**: 12th/05/2017

Where collected: PRIVATE BOREHOLE **Date of arrival in Laboratory**: 12th/05/2017

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1. Plate/Colony/Total viable at 37°C……10……../ml
2. MPN of Coliform organisms……..0……../100ml
3. MPN of E.coli……..0……/100ml
4. MPN of faecal streptococci……/100ml
5. MPN of Cl.perfringens……../100ml
6. Staphylococcus Aureas…….. ……/100ml
7. Shigella……../100ml

Date of report: 18th/05/2017. Remarks: The water has no evidence of bacteriological contamination.

REMARKS BY: PROF.P.M.A ODIRA **SIGNATURE:** …… **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE**: …… **DATE:** .....

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REPORT ON BACTERIOLOGICAL EXAMINATION OF WATER

Name and Address of Sender: METAMETA RESEARCH KITUI.

Sender's reference number:

Laboratory reference number: - 361-BE -04

Nature of sample: RIVER **Date of collection**: 12th/05/2017

Where collected: MWITASYANO **Date of arrival in Laboratory**: 12th/05/2017

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1. Plate/Colony/Total viable at 37°C……150……../ml
2. MPN of Coliform organisms……..250……../100ml
3. MPN of E.coli……..5……/100ml
4. MPN of faecal streptococci……/100ml
5. MPN of Cl.perfringens……../100ml
6. Staphylococcus Aureas…….. ……/100ml
7. Shigella……../100ml

Date of report: 18th/05/2017. Remarks: There is evidence of bacteriological contamination.

REMARKS BY: PROF.P.M.A ODIRA **SIGNATURE:** …… **DATE:** .....

APPROVED BY: DR. S.W. MUMENYA **SIGNATURE**: …… **DATE:** ……..

CHAIR, CIVIL & CONSTRUCTION ENGINEERING