The Role of Training Programs in the Sustainability of Potable Water Projects

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Abstract

In rural regions around the world, 1.7 billion people rely on public taps, hand-pumps, protected wells, protected springs, and rainwater for clean drinking water. Up to the present, there has been little focus on how training programs in communities receiving the water points fit into the overall picture of sustainability. Many factors of sustainability such as financial management and operation, and governance of the water point are dependent on human skill, which are often first exposed to a community through training programs. To understand better how trainings affect the sustainability of water points, I sent surveys to personnel from NGOs who have worked as trainers in water development projects in Senegal, Malawi, Honduras, and India. I also conducted surveys and focus groups with NGO personnel and the community members who went through their trainings in three villages in Senegal. I then compared perspectives of trainers and community members using Grounded Theory, facilitated by using Nvivo 10. The results of all four countries' results from NGO personnel showed that the central themes found in responses were *management*, *community*, *knowledge*, *NGO and community relations*, and the *trainer-learner relationship*. Comparing the central themes of the trainers and learners in Senegal, the two groups' responses showed that mutually tied themes were *knowledge*, *management*, *mechanical*, and *profits/finances*. In order to improve training to make water points more sustainable, I recommend that NGOs consider how people trained will relate to the rest of the community and, furthermore, see how the trainings and information learned will function in the community after the NGO leaves the community.

1. Introduction

1.1 The Need for Potable Water

In rural regions around the world, 1.7 billion people rely on public taps, hand-pumps, protected wells, protected springs, and rainwater to attain potable water (World Health Organization and UNICEF 2013). These technologies are often called water points, or, generally, any sort of system that brings drinking water to a geographical location that communities can access. Safe drinking water is defined by the United Nations (UN) and, generally, by other organizations, as water that is clean for drinking purposes and also available in large enough quantities for hygienic purposes (Stockholm International Water Institute 2005). The creation of water points in rural communities is not just a project, but also a service that should function over an extended period of time (WASH Sustainability Charter 2011). Because these technologies can be vital sources of drinking water that people need throughout their lifetime, it is important to understand how these water sources function over time after they are installed.

In recent years, the issue of potable water access has garnered more attention from large international organizations such as the UN and the World Health Organization (WHO), along with smaller non-governmental organizations (NGOs). The UN addressed one of the Millennium Development Goals (MDGs) to be specifically about potable water access. In 2002 the United Nations' Secretary-General, Kofi Annan, introduced the Millennium Development Goals (MDGs). A task force, the UN Millennium Project, brought together by Annan, developed these targets of development for worldwide use to address issues, including: extreme poverty, gender equality, education, and environmental sustainability. The tenth MDG is to halve the proportion of people without sustainable access to safe drinking water and sanitation by 2015 (relative to 1990 levels) (UN Millenium Project 2005). There has been great improvement in the area of drinking water access around the world, especially since the creation of this goal. As of 2011, the coverage of improved water sources has exceeded target levels worldwide at 89%, 1% above the target (World Health Organization and UNICEF 2013).

The need for clean drinking water is clear, especially in terms of human health. Worldwide, diseases transmitted through water or human excrement are the second-leading cause of death among children (Stockholm International Water Institute 2005). For example, lack of access to clean drinking water is frequently cited as a primary reason for malnutrition and stunting in young children. Potable water also effects the achievement of other MDGs. For example, access to clean drinking water helps reduce child mortality, and clean water for use during childbirth reduces maternal mortality risks (Stockholm International Water Institute 2005). The effect that water has on human health makes it imperative that there be continued work to expand sustained access to clean water.

Although wide coverage of the number of people who have access to potable water is important, the creation of water points in rural communities is not just a project, but also a service that should function over an extended period of time (WASH Sustainability Charter 2011). The MDG target for potable water access includes the word "sustainable", and the importance of this word is being

recognized. The UN rapporteur on the human right to safe drinking water and sanitation has recently released a report declaring that sustainability is an essential and fundamental human rights principle for realizing human rights to water (de Albuquerque 2014).

1.2 Defining Sustainability and its Relationship to Potable Water Projects

Sustainability itself is a difficult term to define as it has many variations. The most significant issue with defining sustainability is that its definition varies widely amongst experts and organizations. Moreover, the definition is also dependent on what the goals of an organization are and how they value specific goals (Hodgkin 1994). With this in mind, it is important to understand that organizations installing a water source can approach sustainability in different ways, depending on what aspects of the definition they want to emphasize most and what value they attach to those aspects (Lockwood, Wakeman and Bakalian 2007). Another significant issue of the definition of sustainability is the disjunction between the perception of the goals and value of a water source by those implementing a project versus the community that is getting the water source. For example, an organization implementing an intervention may be concerned with the health benefits for a community with the creation of a water source. But the community may be most concerned most with convenience (Lockwood, Wakeman, & Bakalian 2007; Hodgkin 1994).

Thus, for simplicity and to recognize the variability of the definition of sustainability across people and places, in this research I will use what has been considered a foundational quality of the overall definition of sustainability: whether a water source supplies the benefits it was set out to provide over an extensive period of time, even after all significant forms of external support have been withdrawn (Lockwood, Wakeman and Bakalian 2007).

The sustainability of potable water sources so that water points can be effective as well as long-term technologies of change are a challenge for water services in the developing world. A WaterAid study conducted of water points throughout Tanzania revealed that 46% were non-functional (WaterAid Tanzania 2009). This percentage represents approximately 30,000 water points nationwide that, had they worked, would have served 7.5 million rural Tanzanians (WaterAid Tanzania 2009). Although Tanzania is only one country out of many that have water access issues, it is a good example of how simply installing a water point is not enough to ensure an ongoing service of water. A review by the Rural Water Network Supply in 2009 estimated the statuses of water points (See Table 1). Countries with notable high percentage of hand-pumps that are not working include Côte D'Ivoire, the Democratic Republic of the Congo, Nigeria, and Sierra Leone.

Table 1: Hand-pump data from select sub-Saharan African countries

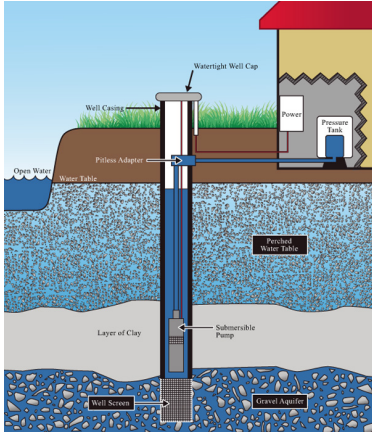| Country	Estimated rural population (millions)	Estimated rural coverage	Hand pumps n functioning
Angola	8.6	40%	30%
Benin	3.7	60%	22%
Burkina Faso	10.5	44%	25%
Cote d'Ivoire	9.2	74%	65%
Democratic Republic of the Congo	35.3	29%	67%
Guinea	5.5	38%	20%
Liberia	1.7	52%	31%
Malawi	10.0	62%	40%
Mali	8.6	35%	34%
Mozambique	12.6	24%	25%
Niger	9.0	36%	35%
Nigeria	65.3	49%	50%
Sierra Leone	3.0	46%	65%
Uganda	22.0	52%	20%
Zambia	7.0	36%	32%

Source: All statistics were compiled from UNICEF and national government statistics (Rural Water Supply Network)
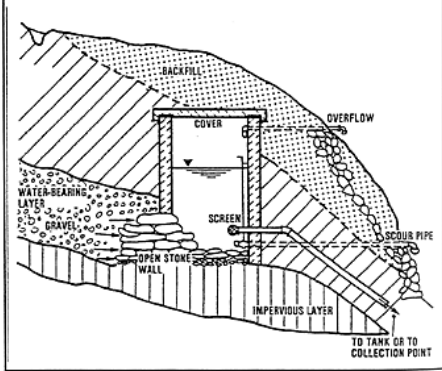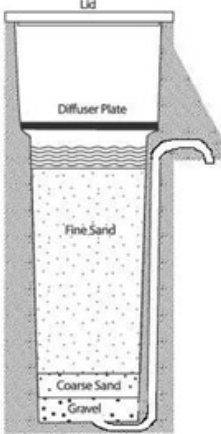
1.3 Water Projects and Technology

There are many kinds of technology that can be used to create a water point. Although this research emphasizes social and communal aspects of water point implementation, the technology used to build a water point does matter (Harvey and Reed 2004). The kind of technology used to create a water point is an important choice and including communities in this decision process is an essential part of making the water point sustainable (Breslin 2003). Thus, there are a variety of technologies that are used for the creation of a water point (See Table 2). Because there are many ways to find water around the world, various methods have been developed either to tap into already collected water or to collect water for human use. Different water technologies will be used depending on the environments that people live in. Communities located in rainier climates may benefit more from collecting rainwater than communities in drier climates who may not be able to

collect rainwater. These communities, however, may be able to tap into a nearby aquifer or aboveground water source.

Table 1: List of water technologies used around the world and in different environmental contexts

Water point technology	Description	Illustration
Borehole	A tube is drilled down to the water table. Boreholes can be either hand-dug or machine drilled, depending on the depth of the water table. Water can be pumped up by a machine or another mechanical device (Harvey and Reed 2004).	 (Skipton, Hygnstrom and Woldt 2012)
Hand-Dug Well	This technology is also used when groundwater is the potable water source; the operation and maintenance costs are low. This is a less expensive option than a drilled borehole. Water is brought to surface using a bucket (Harvey and Reed 2004)	 (Gromicko 2013)
Hand-Pump	A water-lifting device, operated by human power, usually using the hands, arms or feet. A lever and fulcrum act as the mechanism for pumping water to the surface (Harvey and Reed 2004).	 (Save the Children)

Gravity-Fed Water Schemes	Water is collected from a naturally occurring water source such as a spring. Pipes bring the water down from a higher elevation, and then it is collected in a central container, ready for community use (Niskanen 2003).	 (United Nations Environment Programme)
Rainwater Catchments	Rainwater is collected from a catchment area, usually a roof of a home, and then funneled into a storage container such as a cistern or tank (Texas A&M AgriLife n.d.).	 (Meena 2003)
Biosand Filters	There is a layer of sand or gravel in a concrete or plastic container. A shallow amount of water is kept inside in order to let the bioactive layer grow, which contributes to reducing the presence of disease-causing organisms in the water (Centers for Disease Control and Prevention 2014)	 (Centers for Disease Control and Prevention 2014)

Although it is essential to include the community in deciding which technology will be used to create a water source, it is also important that the community know how to maintain and finance the water source so that it continues to function over a long period of time. Thus, technology that requires specialist skills is not likely to be as sustainable as technology that requires general mechanical skills. Furthermore, local innovations that have already been used should be considered in the interest of sustainability (Harvey and Reed 2004).

1.4 Training and Potable Water Projects

Examining how the mechanical and financial maintenance by the community for their water projects is part of a broader understanding of how human behavior affects the sustainability of a water point. This emphasis on the need to understand human behavior also comes with the general understanding that community participation is an integral part of determining if water installations will be successful and sustainable over time (Narayan 1995). After evaluating 121 water points created by various development agencies throughout the world, researchers concluded that, overall, community participation allowed for the advancement of water management and organizational skills and allowed for local organizations to take newly learned skills and apply them to their own development programs (Narayan 1995).

If there is a significant foundational issue that underlies many sustainability indicators, it is human behavior and skills. Many indicators of sustainability for water points that have been developed include an emphasis on the availability of funds to maintain the water point, accounting transparency, and the ability to repair a broken water point (Sugden 2003; Schweitzer & Mihelcic 2012; Hodgkin,1994). Although never explicitly stated, what may underlie the success of these aspects of sustainability is the ability for those in the community after an external organization has left to execute these activities in a way that will allow for the water point to function.

Thus, a significant tension of building a sustainable water point in a community is that communities need to participate in the decision-making of the project in order to for the project to be successful. Good decisions, however, can be difficult to make in communities where there may be limited knowledge of the technical and management skills necessary to make the good decisions that will allow the water point to be sustainable. Thus, there can be a tension between community participation and making the right decisions necessary to make the project successful and sustainable (WaterAid Tanzania 2009).

A way that this tension can be resolved, however, is through the educational and training components that come with installing a water system in a community. It is already evident that training is a part of many potable water projects (WaterAid 2011). Training can encompass things essential for sustainability, such as understanding the management of technical and financial aspects of maintaining the water point (Adank and Kumasi 2013). This kind of training is fundamental to ensuring that water points continue to provide services after their initial installation.

How trainings are conducted can range widely from program to program. Some trainings emphasize participatory methods that have been suggested to allow learners to develop skills that would be considered essential to maintaining water points, such as problem solving and resource management (Srinivasan 1990). From this point of view, trainings could be used as a chance to broaden the narrow sector-specific perspectives of individuals and also to encourage teamwork (Srinivasan 1990). Trainings are also meant to be a time of "meaningful practice", which allows the participants to connect what they are learning to what they already know (Center for Affordable Water and Sanitation Technology 2011, 63). This can be done with group discussions, case-problem studies, and hands-on activities (Center for Affordable Water and Sanitation Technology 2011).

Trainings for water projects can vary by topic. Some emphasize the operations and maintenance of the technology that manages the potable water, such as the pump or water kiosk. Other trainings can be about how to set up and sustain a

water committee, or a group of people from the community that oversees and manages the water system. Other topics of trainings can include community health promotion, project planning, monitoring and evaluation, and drinking water quality testing (Center for Affordable Water and Sanitation Technology 2011).

Furthermore, the role that trainers and participants play within the training project and the water development project overall can be especially essential. Trainers are people who "help people to learn to do certain things" (Center for Affordable Water and Sanitation Technology 2011, 23). Unlike a facilitator, a trainer knows the content (s)he is teaching well and can use facilitation skills and teaching methods to promote effective learning (Center for Affordable Water and Sanitation Technology 2011). In recent methods for training, there has been an increased emphasis on breaking down the power relationships that can inherently exist in a trainer and trainee relationship. Thus, some manuals now call those who participate in trainings "learners" (Center for Affordable Water and Sanitation Technology 2011).

1.5 Countries of Focus

To narrow the scope of this wide-reaching topic, I chose four countries substantial for studying the relationship between training and water point sustainability: Senegal, India, Honduras, and Malawi (See Figure 1). These countries were chosen because all have relatively high percentages of rural populations: 47% of the total population in Honduras, 57% in Senegal, 84% in Malawi, and 68% in India live in rural areas (The World Bank 2013). My research focuses on rural water access since rural regions are areas where the populations are generally poorer than their urban counterparts, and also because it is more difficult to bring services like potable water to more comparatively remote regions of the world (Stockholm International Water Institute 2005).

Figure 1 : Locations where surveys were conducted. Green markers are the countries of the NGOs that completed the survey (Google Maps)

Although bringing water to rural populations is on the whole more difficult than in other regions of the world, all four countries have very high success in bringing improved water sources to their populations (See Figure 2). Some such as Malawi have made significant progress in expanding access to improved water sources (from 42% in 1990 to 83% in 2011). Other countries like Honduras already has high percentages of access in 1990, and have continued to expand access even further.
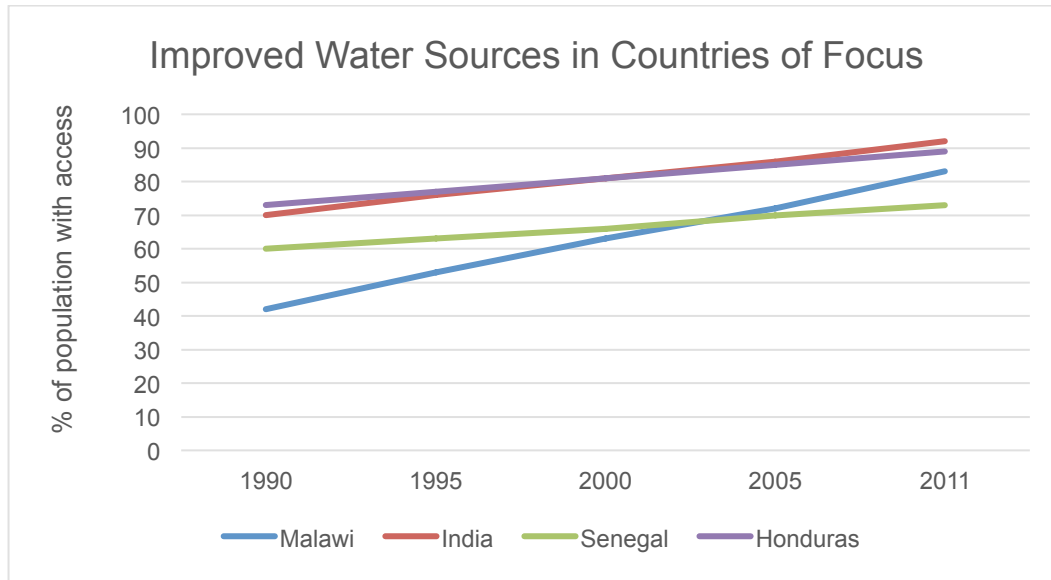
Figure 2 : The countries of focus for my research have increased percentages of coverage for improved water sources (The World Bank, 2013)

At the same time, there are differences between these countries, especially in terms of water resources. Water withdrawal and freshwater reserves in these countries varies significantly. The country that has the most serious freshwater access issues is India, where the total freshwater withdrawal as a percent of actual renewable water resources (ARWR) was approximately 34.9% in 2010. For the other countries of focus, ARWR in Senegal was 5.7% in 2002, 7.9% in Malawi in 2005, and 2.7% in Honduras in 2003 (Food and Agriculture Organization of the United Nations n.d.).

In order to better compare the opinions and perspectives of the NGO personnel and the community members on trainings and sustainability, I focused on Senegal because I studied abroad there in the spring of 2014. I asked questions about trainings that were conducted by an NGO in the region of Thiès, Senegal (See Figure 3). This NGO, Réseau Africain pour le Développement Intégré (RADI), is a pan-African organization that has an office in the region of Thiès, where it works on many development projects, including water access projects.
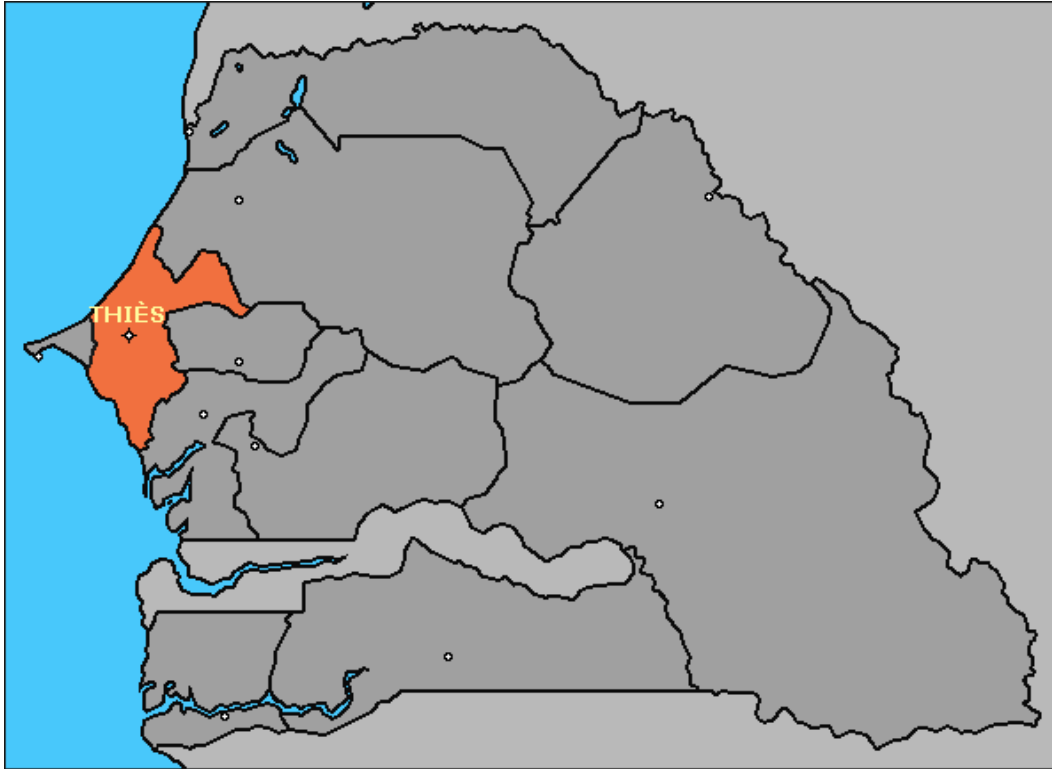
Figure 3 : The orange region is Thiès, Senegal, where I conducted my field research (Académie des Sciences Luventicus, 2005)

2. Methods

2.1 Surveys

I created two surveys to examine the perspectives of those involved in community trainings: one for trainers and one for community members who have been trained. The questions for trainers (IRB-AAAN1168) were intended to gauge how they viewed their role as part of sustaining water point projects as well as gauge their relationship with the community members. These questions were sent to educators via email or hard copy to fill out. In each email, there was a consent form attached that was addressed to the subjects of the survey, and the survey itself was attached as well (See Appendix 1 and 2). The respondents were asked to complete the survey by themselves on their own time. Surveys completed in Honduras, Malawi, and India were completed between March 2014 and July 2014. From these countries, I received two surveys, each representing one NGO working in each country.

For the recipients of the survey in Senegal, all questions were asked in French and completed in French. To translate the survey from English into French, I was assisted by the personnel at the Réseau Africain pour le Développement Intégré (RADI), as well as by personnel from the West African Research Center in Dakar, Senegal. For all recipients of the survey in the other three countries, the surveys were in English and filled out in English. The trainers in Senegal were contacted through RADI because RADI has previously worked with education and

potable water development. In an email, I sent the consent form as well as the survey (See Appendix 3 and 4). Four NGO-personnel surveys were completed in French in Senegal, three from RADI personnel and one from another local NGO. All the Senegal surveys were completed between April and May 2014.

I designed the trainer survey to examine how trainings were structured for communities. I used this question to examine the amount of time allocated, the size of training groups, and how often training sessions occur. Then I asked more open-ended questions to better understand what role the trainers saw themselves playing, what they believed the goals of the trainings to be, and how these trainings contribute to the sustainability of the water points built for communities. In some cases, respondents added outside documents to elaborate on their responses.

I also created surveys for the community members in the three villages in Senegal that I visited who had completed trainings for potable water management during different times (IRB-AAAN4711). These questions were first developed in English, translated into French by myself, and then reviewed by bilingual speakers at the West African Research Center in Dakar, Senegal, and by RADI. Then, a bilingual speaker of French and Wolof (a national language of Senegal) who works at RADI translated the French questions into Wolof. Both the consent form and the survey itself were translated in this manner (See Appendix 5 and 6). These questions were very similar to the questions posed to the NGO personnel. I did this in order to make comparisons of opinions on similar subjects easier. Furthermore, I wanted to examine how community members felt about the utility of their trainings and how what they learned contributed to the sustainability of the water points.

2.2 Field Work

The questions for the community members were asked verbally in Wolof with the help of a translator. Abdulaye Diallo, a former teacher in Senegal, was my translator who translated from Wolof to French. I recorded all responses by hand in French and English. All the surveys were given to groups of people who were asked to do the survey because they were members of the *Comités de Hydraulique* (Hydraulic Committees) or *Comités de L'Eau* (Water Committees). The strategy that I used to have people respond to my questions was a kind of convenience sampling where I was put in contact with a community leader in the village with the help of RADI, and then the community leader would help me gather the people who would be able to answer my questions. Focus group sessions were held either in public village centers, or in someone's home, and they often lasted no more than an hour, often less.

After filling out responses to the survey questions, I asked the members of the committees to show me the mechanical pumps that pump water and explain to me how they worked. I would ask the community members general questions about how they maintained the water systems and how they found the water systems to work for them. Along with the machines, I was often shown the fields used for market gardening, orchards, as well as the watering trough for the animals.

2.3 Data Management and Analysis

Survey Responses for all but one survey were sent and collected via email. All these surveys were saved on my laptop and my backup drive in their original form. Since I received one survey in hand-written form, I took the survey, typed up the responses, and saved it on my laptop and my backup drive. All the community member surveys were conducted by hand, then later scanned to PDFs and saved on my laptop. A bilingual speaker of French and English translated the surveys that were completed in French.

For my analysis, I used Grounded-Theory Method in order to identify themes from the data I collected versus imposing them *a priori*. Grounded Theory is a method of looking at qualitative data and analyzing it by letting the data determine their own theoretical framework. Thus, in order to discover this theoretical framework, the researcher reads through the data and assigns themes to sections of the text. (Glaser and Strauss n.d.). In the case of my research, themes can range from "sustainability" to "community" to "capacity building".

Using QSR Nvivo 10, I coded the data with themes that emerged from my survey responses as I read them. Sections of text can have multiple themes, as long as the user assigns it to that specific section of text. To start off my analysis, I first ran a word query of the data to see which words appeared most frequently in the responses. I furthered my search for themes by simply reading the text and as I was reading, assigning sections of texts to a theme. This technique is called constant comparative method, in which the researcher is constantly comparing the current coding done to the coding of the same theme that has already been done previously. Because this technique requires a study of all coded texts, the researcher relies on memory to make comparisons. It is from this reading and assigning of themes that the researcher begins to see the theoretical properties of the themes and understand better how they connect to other themes (Glaser and Strauss n.d.).

From the initial coding process, I used an Nvivo feature to determine where themes overlapped, and Nvivo was able to record the number of instances where each of the themes that I had designated overlapped. From here, I further narrowed down themes and combined themes under larger ones when they were related or when I considered the themes to be overarching themes (See Figure 4).

Import surveys and supporting documents

Run Word Count for starting point in themes search

Code text for themes

Tally the results of frequency of themes

Find where themes overlap

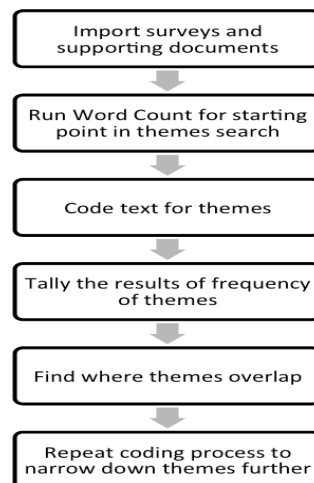Repeat coding process to narrow down themes further

Figure 4: Nvivo framework and process of analysis

In order to find the themes that were most connected and pervasive throughout the responses, I found themes that were the most connected to other themes. I did this by determining whether two overlapping themes had a strong connection. A connection was considered strong by counting the number of times one theme overlapped or was co-coded with other themes. A strong theme was considered such because compared to other themes, it had more overlaps with other themes. For example, sustainability can overlap with three other themes where the instances of overlap between sustainability and each theme is four textual overlaps or more. I would have chosen four overlaps to be the threshold for a strong connection because four overlaps was relatively higher than overlaps. Because the theme "sustainability" had three themes where it had a strong connection with the other theme, it can be considered a central theme, or a theme that is strongly connected to other themes. The number of instances one theme needs to be strongly connected to other themes in order to be considered a central theme depends on its greater relative number of times that theme is strongly connected to other theme (See Figure 5).

Count the number of textual overlaps between all themes → Determine how many thematic overlaps are considered strong → Count the number of strong thematic overlaps to determine central themes
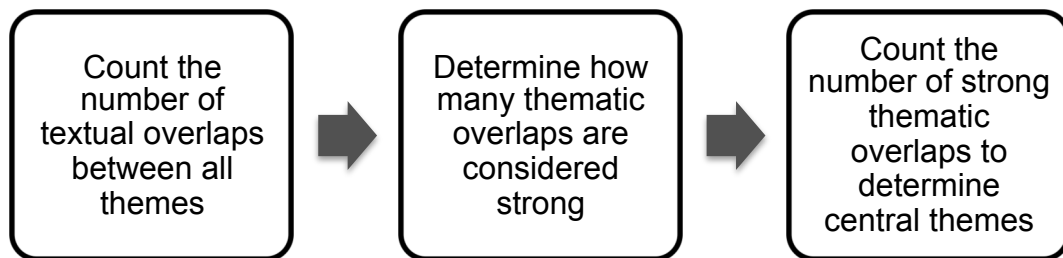
Figure 5: Flowchart explaining how I found strong themes and central themes

3. Results

3.1 NGO Personnel and Trainers

3.1.1 All Responses

From the various NGOs to which I sent my survey and filled it out, I used a total of nine responses (See Table 3). One NGO that participated was able to provide me a survey from its home office, and this was used twice to represent the NGOs training methods in Malawi and Honduras.

Table 3: The number of NGOs that responded to my survey. Note that one survey was used twice to represent the trainings in Malawi and Honduras.

Country	Total number of NGOs represented	Number of survey responses
Senegal	2	4
Malawi	2	2
India	2	2
Honduras	2	2

With one of my questions, I asked respondents to explain how their organization structured its trainings in general. I asked them about how often they conducted trainings, how long trainings usually last, and how many people would be in trainings, and they responded by explaining the structure of trainings (See Appendix 7).

In the trainers' survey, there were instances where themes fell under very similar categories, or could be categorized as sub-themes of larger themes. Themes like *finances, governance, maintenance, management, mechanical,* and *problem solving* all can be considered *capacity building* of some sort of skill set. When assigning themes to text, I aimed to be as specific as possible with my assignment of theme. For example, I assigned *capacity building* to text when the response was vague on what kinds of skills they wanted to address in trainings. Other themes that were grouped together based on similarity or sub-theme relationship were: *community* and *trained people to rest of community relationship. Knowledge* and *application* were also grouped because application is often a demonstration of knowledge. *Motivation, health,* and *quality of life* are grouped together since *health* and *quality of life* are considered in these responses as motivations for doing trainings. *Role of NGO* and *relationship between NGO and community members* are grouped together as well. So are the themes *participatory learning* and *trainer-learner relationship* (See Figure 6)

Capacity Building
Finances
Governance
Maintenance
Management
Mechanical
Problem Solving
Change
Community
Trained People to Community Relationship
Environment
Gender
Government/Politics
Knowledge
Application
Measure of Effectiveness

Motivation
Health
Quality Of Life
Profit
Role of NGO
Relationship between NGO and Community Members
Sustainability
Trainer-Learner Relationship
Participatory Learning

Figure 6: Grouping of themes that were used to code the NGO personnel responses

Using Nvivo to track the number of thematic overlaps for all the NGO responses together, the central themes were *management* (seven strong overlaps), *community* (eight strong overlaps), *knowledge* (10 strong overlaps), *NGO and community relations* (six strong overlaps), and *trainer-learner relationship* (eight strong overlaps) (See Figure 7). The number of textual overlaps for all intersecting themes was considered greater than the rest of the results when the two intersecting themes had 10 textual overlaps or more. This does not mean, however, that all intersecting themes had greater than 10 textual overlaps (See Appendix 8).
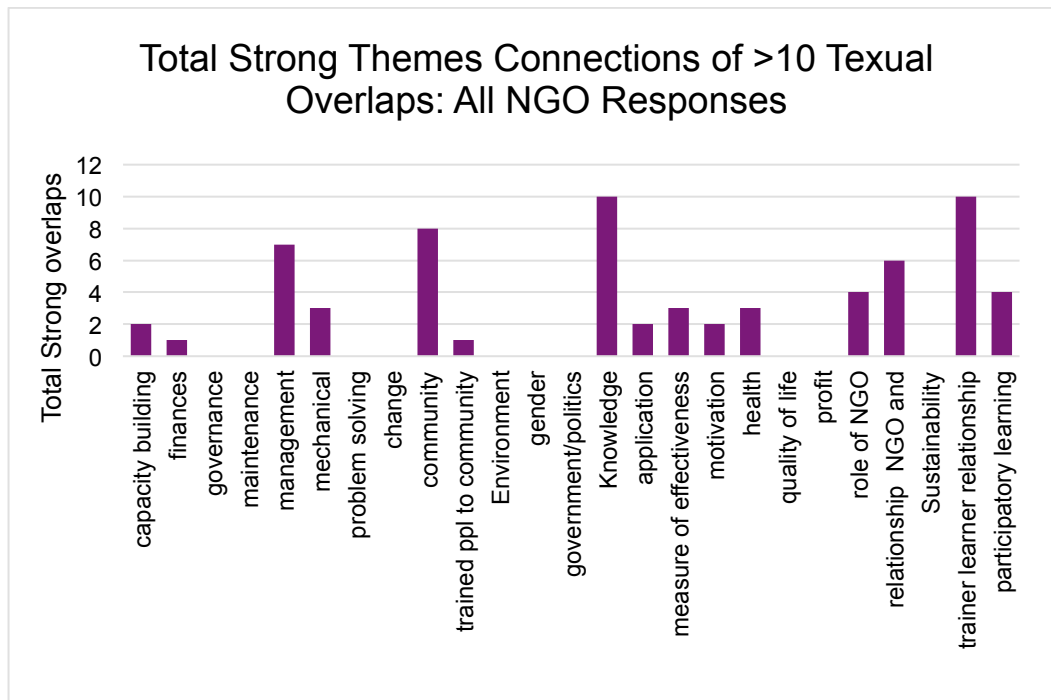

Figure 7: The strong theme connections are tallied for each theme for NGO responses from all NGO responses and supporting documents.

3.1.2 Honduras Responses

The central themes in the Honduras responses and supporting documents were: *community* (five strong overlaps), *knowledge* (five strong overlaps), *health* (four

strong overlaps), *trainer-learner relationship* (five strong overlaps), and *participatory learning* (five strong overlaps) (See Figure 8). Central themes were themes that had more strong overlaps than other themes. The total number of textual overlaps for all intersecting themes was considered greater than the rest of the results when the two intersecting themes had five textual overlaps or more. This does not mean, however, that all intersecting themes had greater than five textual overlaps (See Appendix 9). The threshold of five textual overlaps was interpreted to be to a strong connection between two themes because there was more textual data to analyze in this set of data compared to other responses from other countries.
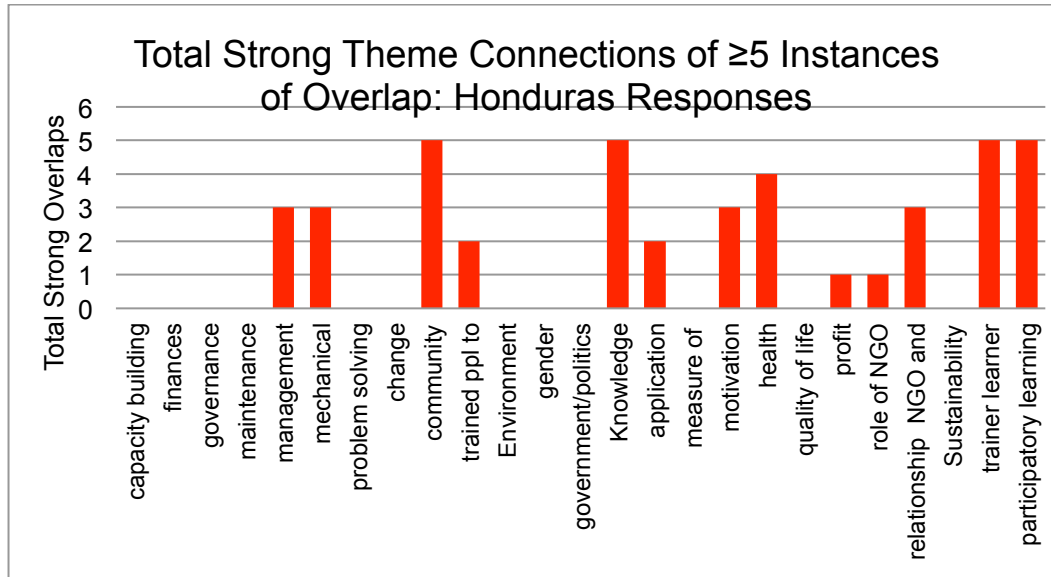

Figure 8: The strong theme connections are tallied for each theme for NGO responses from Honduras and supporting documents

Community was a theme that had significant overlaps to other themes as well. One theme that overlapped often with other themes was *management* (nine instances of overlap). This theme is best exemplified by a need to emphasize community buy-in to pay for a water service. One of the training modules states, "*Instructor answers questions and emphasizes how important it is to promote that people have to pay for water to keep the project going*" tying together financial management and the significant impact the entire community has on making that successful. *Community* is also connected to how the people trained by the NGO relate to the rest of the community (11 instances of overlap). This concept is best exemplified by this excerpt from a training manual:

> *Emphasize the importance of being a WASH Promoter. People and children look up to them. They will be the role models for changed behavior. Calls on their good spirits and endurance as well a commitment and courage for change and healthy people.*

Community is also strongly connected to *health* (seven instances of overlap). Messages about health are communicated to the entire community than just individuals. This is best seen in one NGOs desire to message their goals to a widespread audience:

> *Health situation: If there is a health facility it is always good to be in touch with local Health Agent. Health representatives will confirm health messages that will be communicated to the community.*

Another strong theme that was connected to other themes was *Knowledge*. *Knowledge* was especially connected to *health* (six instances of overlap) and recognizing what is clean and healthy water to drink. This is best illustrated by this excerpt from a training manual:

> *Class discussion: Emphasizes weaknesses of the methods in the pictures. Clear water is not necessarily safe unless it is treated with chlorine. Using sun for disinfection is not enough to kill microbes in large amount of water.*

Knowledge was also connected to *mechanical skill* (18 instances of overlap) or how one works the physical machinery of a water pump. This is best exemplified by one NGO's "Operator Training Checklist" where a NGO representative evaluates if the operator of the water point knows how to work the machine. Example questions are "*Before sending water to the distribution tank what should you do?*", and "*What do you do if the water at the tap does not have a chlorine level of at least 0.2 ppm?*" In a survey response, one NGO stated that: "*The key objective is to get the participants to a level where they can install a bios and filter by themselves, know the rules of use and maintenance of the filter in depth.*"

Participatory learning was also strongly connected to *knowledge* (19 instances of overlap). Often during trainings, knowledge is imparted by using participatory methods as exemplified with this excerpt from a training manual: "*Participants stand around the containers and explain what they see. Sort out clean, covered containers and clean, covered containers with tap.*"

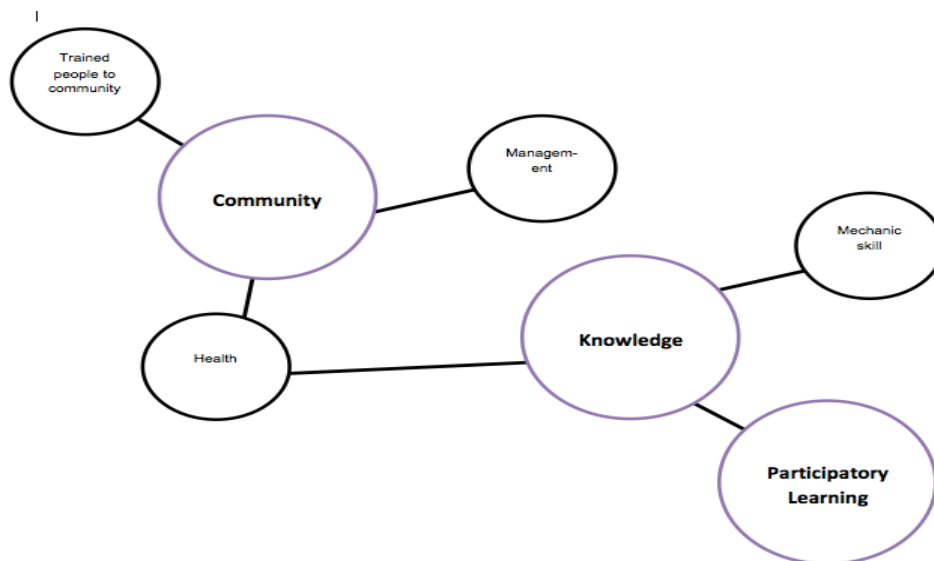All the themes previously discussed are interconnected to create a web of themes (See Figure 9).

Figure 9: Theme map of the central theme (purple circles) and strong supporting themes (black circles) for Honduras responses

3.1.3 Malawi Responses

The central themes in the Malawi responses and supporting documents were: *management* (12 strong overlaps), *knowledge* (nine strong overlaps), *measure of effectiveness* (four strong overlaps), *NGO and community relationship* (eight strong overlaps), *trainer-learner relationship* (13 strong overlaps), and *participatory learning* (12 strong overlaps) (See Figure 10). Central themes were themes that had more strong overlaps than other themes. The total number of textual overlaps for all intersecting themes was considered greater than the rest of the results when one theme was strongly connected to five textual overlaps or more. This does not mean, however, that all overlapping themes had greater than five textual overlaps (See Appendix 10). The threshold of five textual overlaps was used to correspond to a strong connection between two themes since there was more textual data to analyze in this set of data.
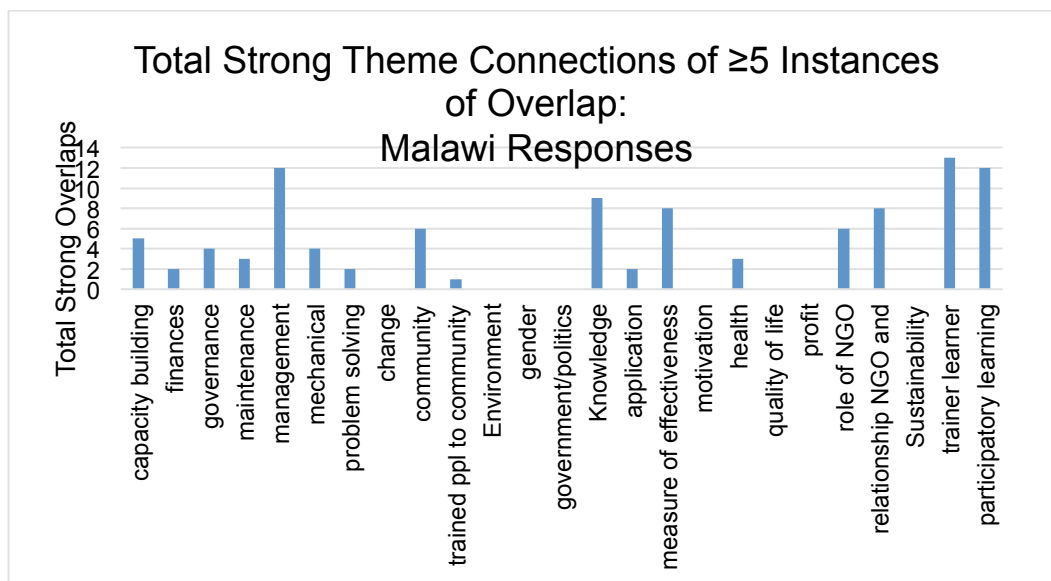
Figure 10: The strong theme connections are tallied for each theme for NGO responses from Malawi and supporting documents

Management was a theme that had significant overlaps with other themes. One theme that it often overlapped with was *measure of effectiveness* (10 instances of overlap). This is best exemplified by an excerpt from one of the survey responses:

> *With respect to water committee trainings, we can gauge how much water committee members have learned by observing if they are able to manage finances, keep accurate records, and follow their constitutions.*

Management is also strongly tied to *trainer-learner relationship* (11 instances of overlap). This is best exemplified by a training module from one NGO specifically about governance:

- *Give each participant a cardboard to write in their names and position*
- *Let them put the names in a cup/cap.*
- *Tell them that with immediate effect their titles ceases until the sessions end*

- *Ask them about their honest feelings about being 'dethroned' and whether the dethroning that has taken place can have effect.*
- *Bring them to their groups to discuss the terms leadership and governance*
- *Let them brief in plenary*

Trainer-learner relationship was also a theme that had strong connections to other themes. One theme that it had a strong connection with was *relationship between NGO and community members* (13 instances of overlap). This overlap is best exemplified by a response from an NGO:

After the water treatment and supply system is commissioned for use, we then make semi-regular follow-up visits (which are also additional trainings in financial management, administration, and conflict resolution).

The *trainer-learner relationship* theme also overlaps with the theme, *application* (14 instances of overlap). The relationship between these two themes is best exemplified by this excerpt:

With respect to water committee trainings, we can gauge how much water committee members have learned by observing if they are able to manage finances, keep accurate records, and follow their constitutions.

Another theme that had strong connections to other themes was *participatory learning.* One theme to which it had strong connection was *governance* (10 instances of overlap). This can be seen in an excerpt from a governance-training manual:

- *Let participants write on the cards (one idea per card) of where they want to take Associations*
- *Put these cards on board*
- *Let them prioritize from these cards*
- *Take 3-5 cards and let them in groups state things they want to do after the workshop on these cards*

All the themes previously discussed are interconnected to create a web of themes (See Figure 11).

Figure 11: Theme map of the central themes (purple circles) and supporting themes (black circles) for Malawi responses

3.1.4 India Responses

The central themes in the India responses and supporting documents were: *community* (four strong overlaps), *knowledge* (five strong overlaps), *role of NGO* (four strong overlaps), and *trainer-learner relationship* (six strong overlaps) (See Figure 12). Central themes were themes that had more strong overlaps than other themes. The total number of textual overlaps for all intersecting themes was considered greater than the rest of the results when the two intersecting themes had three textual overlaps or more. This does not mean, however, that all overlapping themes had greater than three textual overlaps (See Appendix 16). The threshold of three textual overlaps was used to correspond to a strong connection between two themes since there was less textual data to analyze comparatively in this set of data.
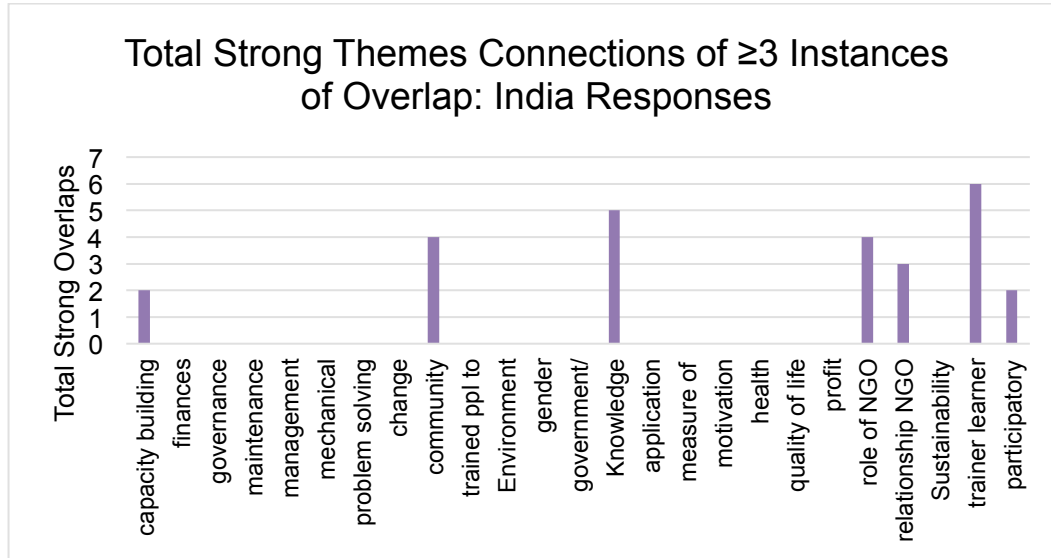
Figure 12: The strong themes connections are tallied for each theme for NGO responses from India and supporting documents

In the India responses, *community* was a strong theme. One other theme that it was strongly connected to was *role of NGO* (nine instances of overlap). This can be exemplified in a response to the survey saying that: "*People are also encouraged to nominate women for the training sessions.*" And furthermore, "*For encouraging women to attend we provide facilities for stay and women with small children are allowed to bring their child for the trainings.*" *Community* was also strongly connected to *trainer-learner relationship* (four instances of overlap). An example of how they overlap can be seen in the following quote from the survey responses: "*Each project team plans the annual training in discussion with the community members.*"

Knowledge was also a theme that had strong overlaps to other themes. One theme that it was strongly connected to was *trainer-learner relationship* (10 instances of overlap). The following excerpt from one survey response best represents this overlap:

> *During the training, the trainer is mandated to make an assessment of the learning that the trainees had. This is done through a review of the main points/ important points by asking trainees to speak about what they learnt.*

Knowledge is also strongly connected to *trainer-learner relationship*. This overlap is best seen in the excerpt below from the survey responses:

> *At the end of each training programs we collect feedback from each participants that reflects their understanding and the scope of improvements.*

The *role of the NGO* was another theme that had strong connections to other themes. One theme that it was strongly connected to was *trainer-learner relationship* (eight instances of overlap). This overlap can be best understood through the goals that one NGO sees its trainings in achieving:

> *The overall goals of the trainings are:*
>   1. *to enhance skills and capacities of community members/ leaders*

2. *To inform and educate them on polices, laws, relevant subject*
3. *To empower them by the process of trainings*

All the themes previously discussed are interconnected and support one another (See Figure 13).
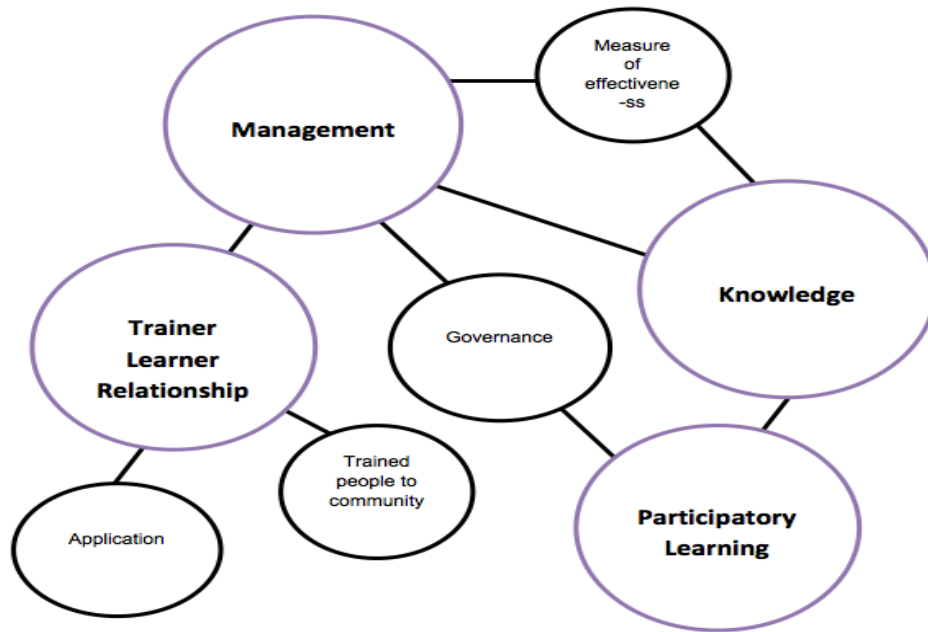

Figure 13: Theme map of the central themes (purple circles) and supporting themes (black circles) for India responses

3.1.5 Senegal Responses

The central themes in the Senegal responses and supporting documents were *capacity building* (four strong overlaps), *finances* (four strong overlaps), *management* (four strong overlaps), *mechanical* (five strong overlaps), *change* (five strong overlaps), *community* (eight strong overlaps), *knowledge* (four strong overlaps), and *trainer-learner relationship* (four strong overlaps) (See Figure 14). Central themes were themes that had more strong overlaps than other themes. The total number of textual overlaps for all intersecting themes was considered greater than the rest of the results when the two intersecting themes had three textual overlaps or more. This does not mean, however, that all overlapping themes had greater than three textual overlaps (See Appendix 12). The threshold of three textual overlaps was used to correspond to a strong connection between two themes since there was less textual data to analyze comparatively in this set of data.

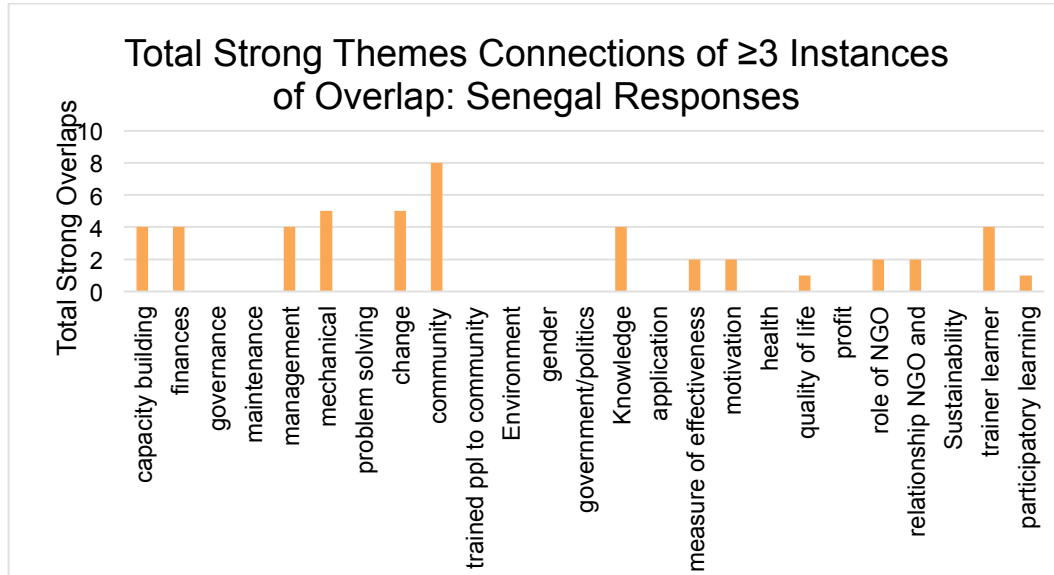Total Strong Themes Connections of ≥3 Instances
of Overlap: Senegal Responses

Figure 14: The strong themes connections are tallied for each theme for NGO responses from Senegal and supporting documents

One theme that had strong connections to other themes was *change. Change* overlapped often with *mechanical* (four instances of overlap). This best illustrated with the quote below from the survey responses:

> *The most desired aim of these programs is to succeed in changing the behavior of people and their management of hydraulic work and the economy of water through the acquisition of new knowledge.*

Change is also connected to the theme *community* (three instances of overlap). This is best exemplified by this quote from the survey responses: "*The efficacy of a program is determined by the changes in behavior of the population.*"

Community was another theme that had strong connections. *Community* was strongly connected to *knowledge* (five instances of overlap). This overlap is best exemplified by the following quote: "*our programs are successful if our participants can answer every question they are asked and if they spread the information they have learned to their communities.*" Community is also connected strongly to the *role of NGO* theme (five instances of overlap). This overlap is best exemplified by this quote from the survey: "*We encourage people to participate in our program by telling them about the importance of water for society.*"

Trainer-learner relationship was also another theme that had many strong connections to other themes. *Measure of effectiveness* was one theme to which *trainer-learner relationship* had a strong connection (five instances of overlap). This overlap is best exemplified by the following quote: "*We evaluate our programs by looking at the responses of our participants to questionnaires.*" *Trainer-learner relationship* is also connected strongly to knowledge (five instances of overlap). This relationship can be best understood with the excerpt from the survey responses:

I develop the tools of the program, as well as prepare the program with all interested parties (the population, service technicians, local collectives as well as technical and financial partners)

All the themes previously discussed are interconnected and support one another (See Figure 15).

Figure 15: Theme map of the central themes (purple circles) and supporting themes (black circles) for Senegal NGO responses

3.2 Community Members in Senegal

The three villages that I visited in Senegal all had built and managed their water technologies for varying periods of time and therefore had gone through trainings during different times (See Table 4). The most recently built water technology was built in 2011 and the oldest was in 1993, making the technology 21 years old.

Table 4: Descriptions of the villages visited in the Thiès region of Senegal. Names of the villages have been replaced with letters to account for IRB (Diop, 2014)

Village	Age of Water System	Technology	Population (Estimated)
A	Built in 2011	Machine and Water Tower	600
B	Built in 1998	Machine and Water Tank	800
C	Built in 1993	Machine and Water Tank	400

The central themes in the Senegal community members responses were: *knowledge* (five), *management* (four strong overlaps), *mechanical* (three strong overlaps), *problems encountered* (three strong overlaps), *profits* (three strong overlaps), and

sustainability (three strong overlaps) (See Figure 16). The total number of textual overlaps for all intersecting themes was considered greater than the rest of the results when the two intersecting themes had three textual overlaps or more. This does not mean, however, that all overlapping themes had greater than two textual overlaps (See Appendix 13). The threshold of two textual overlaps was used to correspond to a strong connection between two themes since there was less textual data to analyze comparatively in this set of data.
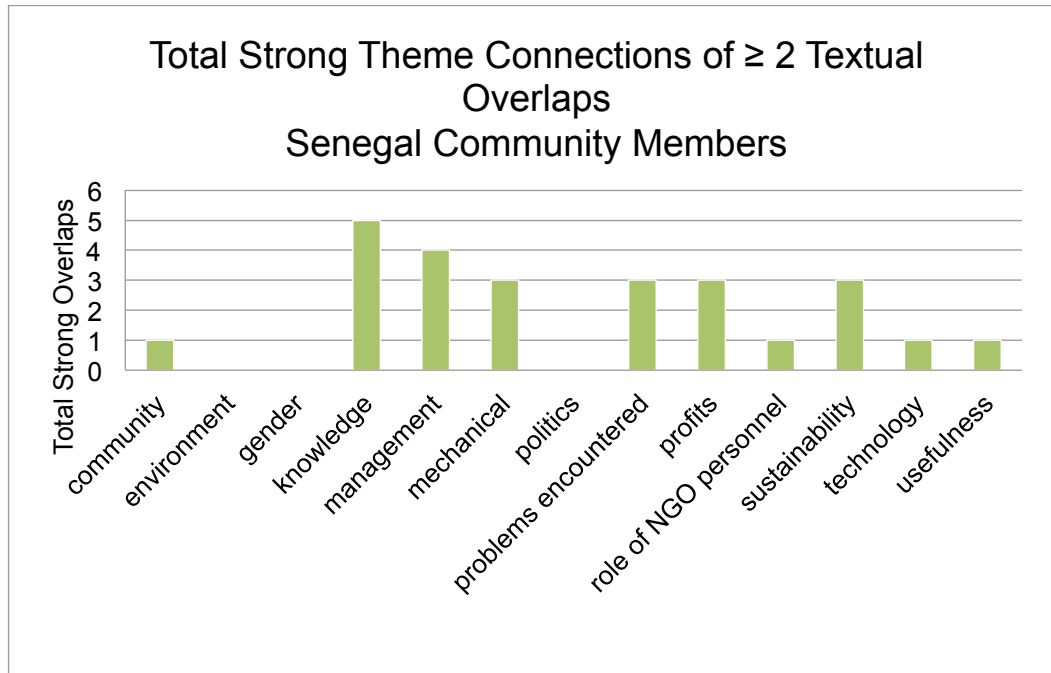
Figure 16: The strong themes connected are tallied for each theme for Senegal community member responses

One theme that had strong connections to other themes was *knowledge*. *Knowledge* was strongly tied to the theme of *management* (five instances of overlap). Examples of this overlap was that community members explained how much fuel they used to power their water pumping machines on a daily basis and that one focus group said that the trainings allowed the community to have knowledge to manage other projects in the future. *Knowledge* was also connected to *sustainability* (four instances of overlap). This overlap of the two themes is best displayed when one focus group said that the knowledge that they learned allowed them to keep the machine that pumps the water in good condition. Another example of this thematic overlap was when one focus group said that they hoped to pass down the knowledge they learned during trainings to younger people in the village.

Another theme was connected strongly to other themes was *problems encountered*. This theme has strong connections to the theme *technology* (two instances of overlap). This is best exemplified when during two different focus group sessions, communities explained that the current technology that they had did not have the ability to pump as much water as they wanted, or the water tank was too small to serve the community well. Furthermore, this is related to the strong connection between *problems encountered* and *role of NGO* since in both of the same focus groups,

community members asked for the help of the NGO to replace or update the old technology. Another focus group, however, explained to me how they fixed their machine when it broke down and told me the prices of the parts for replacement. There was also an instance of a community running into problems of trying to hook their machine-pump to electricity in order to not use gasoline, since it would be cheaper, but they had yet to make it work.

Management was also another theme that had strong connections to other themes. *Management* is strongly connected to *sustainability* (three instances of overlap). This theme is best exemplified by the age of some of the water pump machines that the communities had (the oldest being 21 years old) and still functioning to pump water from the borehole. Also, one focus group explained that they clean the entire water pump machine every three months.

All the themes previously discussed are interconnected to create a web of themes (See Figure 17).

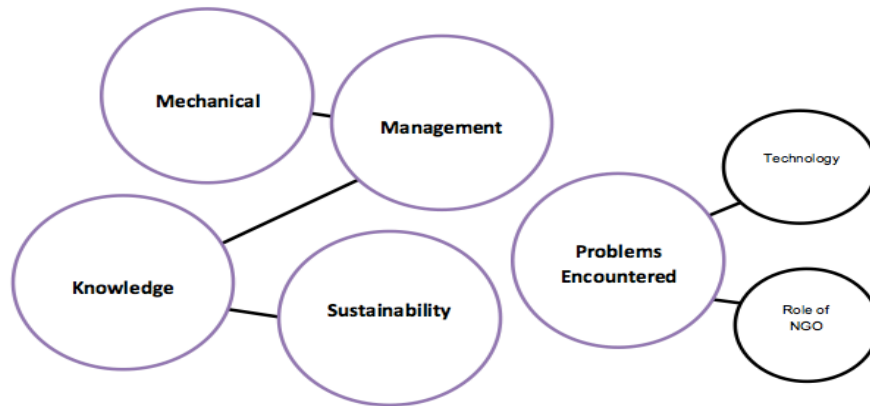Figure 17: Theme map of the central theme (purple circles) and supporting themes (black circles) for Senegal community member responses

3.3 Comparing Trainers and Learners Senegal

When comparing which of the trainers' and the learners' responses share strongly tied themes, there were four themes that both groups emphasized in their responses: knowledge, management, mechanical, and profits/finances (See Table 5).

Table 5: Comparison of the strong themes of both Trainer and Learner responses in Senegal. Green highlighted themes are strong themes for both Trainers' and Learners' responses

Strongly Tied Themes	Knowledge	Management	Mechanical	Problems Encountered	Profits/Finances	Sustainability	Capacity Building	change	community	Trainer-learner relationship
Community Members	x	x	x	x	x	x				
Trainers	x	x	x		x		x	x	x	x

4. Discussion

4.1 NGOs' Responses

If there is anything that these responses reveal, it is that trainings cover a wide variety of topics. While trainings generally cover subjects meant to build the capacity of learners, capacity building, as is evident from the six sub-themes that are under it, entails many different kinds of knowledge.

Furthermore, different organizations, based on the teaching curriculum, can emphasize different kinds of skills that are taught and explained in trainings. For one NGO in Honduras, their trainings revolved around the installation of bio-filters and, therefore, the *management* and *mechanical* themes heavily defined the Honduras data. Another NGO from Malawi focused one of their trainings on governance, and this made the Malawi data more representative of the thematic connection between *governance* and *participatory learning.*

Knowledge was a significant theme, though out all responses from NGO from all four countries as well responses from the Senegal community members, this is more or less an obvious theme to come across while reading about trainings. To build on this, *Knowledge* intersects with other themes to bring out interesting overlaps. When *knowledge* overlaps with *mechanical skill*, the most evident take-away is that acquiring knowledge about such skills in necessary, especially if the technology is new. From one of the responses of an NGO in Honduras, the operation and maintenance of a bio-filter by learners in the training, when done independently, can be seen as an indication of general independence that the training wants to create and pass onto the learners.

Knowledge also intersected with *health* in the Honduras responses. In this case, the NGO conducting this training wanted to explain how to identify clean water, and to explain that some methods (for example, sunlight to disinfect water) does not actually kill microbes. The intersection of *knowledge* and *health* ties to motivations

behind why this training exists: to bring and sustain the service of clean water to a community.

Knowledge, *trainer-learner relationship*, and *participatory learning* were all themes throughout the responses from all four countries, and often overlapped with one another. The overlap of *participatory learning* and *trainer-learner relationship* is an indication of trainings constructed as times of "meaningful practice". Throughout the responses, the participatory methods of training that were mentioned were: group discussion, participant demonstrations, hands-on activities, and case study problem. It is this kind of learning that allows learners to connect what they already know with the new information they are processing (Center for Affordable Water and Sanitation Technology 2011). Furthermore, when learning, "people remember 20% of what they hear, 40% of what they hear and see, and 80% of what they discover by themselves" (Brikké 2000, 6). With participatory learning methods, the likelihood that participants will remember the information presented is much greater and therefore the trainings overall are more effective.

A specific instance where trainings demonstrated how the *trainer-learner relationship* interacted with a specific skill being taught during trainings was the governance training created by one of the Malawi NGOs. This training asks that the learners be honest about their feelings on being "dethroned". Governance can be a topic that brings out sensitive topics of power in a community. But it is through this kind of discussion and role-playing that the learners can simulate the inherent risks in real life (in this case, being honest with other people) while maintaining other parts of the interaction that are relevant. Furthermore, role-playing "permits testing out different ways of behavior in a given situation" (Brikké 2000, 12). Especially since governance is a difficult concept to teach, having a trainer to guide the learners through the training in a way that addresses the issue at hand without falling into the dangers that can occur in real-life makes it more likely that the learners will pull information from the training that they can use in the future.

An aspect of training structure that came to light while reading the NGO responses was the difference between the NGOs addressing the community-at-large and the people who go through trainings as learners. The community members who go through trainings are the main form of communication between the NGO and the larger community. This is emphasized in one Honduras NGO response stating that WASH promoters are role models for the community and the kids in the community, especially for changed behavior. This sentiment is echoed in one Senegal NGO response saying that trainings are considered successful if the participants spread what they have learned to their communities. Thus, while many NGO trainers emphasized the entity of the community (and implying the whole community) in the responses, others did not explicitly talk about this difference. It is unlikely that training sessions will be available to all the people who live in a community. Furthermore, it is not necessarily the goal for trainings to include all members of the community. This is based on the idea that the best trainings for operations and management of water points are small group sessions; even large lecture sessions are encouraged to break up into small group work (Brikké 2000). Because of the emphasis on small groups leading to effective learning, it is logistically not likely that all people in a community can participate in training. Thus, this connection and need for learners in trainings to then become spreaders of

information to their communities is a facet of the trainings that should be recognized and emphasized.

        Community also overlapped with *Role of NGO* in the Indian NGO responses to reveal interesting ideas about how the NGO helps effect change in a community. One of the Indian NGOs explained that it encourages communities to nominate women for their training sessions, and it makes it possible for women to attend by allowing women to bring their children with them. In order to make trainings more inclusive, outside groups sometimes need to include groups that may not be included otherwise—in this case, it would be women (Center for Affordable Water and Sanitation Technology 2011). By including women in trainings, the "Social Sustainability" of the water point is addressed by focusing on gender inequities that can exist in communities (Water and Sanitation Program 2000, 3). Social Sustainability includes equity aspects of the water project, which "include looking at how fairly the burdens and benefits from the services are shared across different socio-economic, gender, ethnic, and caste groups" (Water and Sanitation Program 2000, 3). Furthermore, the intervention of an NGO may be necessary in order to include often-excluded groups in the process of building and using water resource since community-based approaches may reproduce existing inequalities of wealth and power in the community, unless there is an external intervention (Cleaver and Toner 2006).

4.2 Senegal Community Members' Responses

        The tie of knowledge and sustainability examples in the community members' response is extremely interesting when discussing the passing down of knowledge to younger generations. Since this kind of action is out of the purview of the immediate project and trainings, this shows the importance of the non-project aspects of people's lives to the sustainability of a water point. It is "the complex livelihood inter-linkages that make an impact in one area likely to be felt in others and the potential for unintended consequences arising from any intended interventions or acts" (F. Cleaver 1999, 599). Thus, these kinds of behaviors are not necessarily intended by trainings, but they affect how trainings and the information learned function in a community.

        The intersection of the themes of technology and problems encountered revealed some conflicting results. While one focus group discussed how they were able to fix their broken down water-pumping machine (See Figure 18), there were other instances in the other two focus groups where the community members could not overcome the problems that they had with the water supply, specifically referring to the capacity of their water tanks to serve the various needs of the community. This is likely an issue of what is more easily fixed and what takes less amounts of capital up-front to fix or change, bringing up the issue of resource constraints (F. Cleaver 1999). In the case of the water-pumping machine breaking down from need of a new part, it is relatively easy to replace. To build or expand a water tank (See Figure 18), however, is a significantly different issue as well as it would take much more money.

Figure 18: Water tower (left) and water pumping machine (right) in one of the villages where I conducted focus groups

There were other focus groups where problems that were occurring with the water-pumping machine were discussed, such as one focus group trying to get their machine to run on electricity and not gasoline because electricity would be cheaper. Getting the machine to work on electricity, however, was a different matter. This kind of issue is indicative of the limitations of a community's resourcefulness when addressing the problems at hand. While the people working on this issue were completely aware of the costs of running the machine on electricity versus gasoline, there seemed to be structural problems that made it difficult to achieve their goals. These structural and resource constraints can have a sever impact on projects (F. Cleaver 1999).

The times at which these community members went through trainings (based upon the age of the water tanks and machines) shows the different stages of time that these technologies are functioning in. The ages of the technologies were from three years to 21 years old. While there were issues with capacity and other technological issues, the technologies were functioning overall and bringing water to the community. It is important to note, however, that when communities do have some issues with the technology, they still keep the technology functioning as well as it possibly can so that users will still want to use the service and therefore pay for it. With collected funds, improvements could be made to water points, which could attract more revenue and allow for further upgrades (Bhandari and Grant 2007). Furthermore, while no situation was perfect or perfectly functioning (and in reality, this is impossible), the fact that multiple communities were able to sustain their water services since their installation reflects the overall effectiveness of the training programs that community members went through.

4.3 Comparing Responses from Senegal NGO and Community Members

The central themes, which both the Senegal trainers and the community members discussed, were *knowledge*, *management*, *mechanical*, and *profits/finances*. The themes that the community members discussed which trainers did not discuss were *problems encountered* and *sustainability*. The differences of what was emphasized in surveys and focus groups can most likely be attributed to the experiences of time that trainers versus community members experience in terms of the project. Trainers, for the most part, are involved in the project for the community for a relatively short period of time while community members are involved in the project

indefinitely. Thus, the likelihood that community members will be seeing problems with the water point and will talk about the sustainability of the water point (or how it has functioned and maintained over a period of time) is much more likely.

4.4 Limitations

One of the main limitations of this research is that all responses to my surveys and focus group questions were based on convenience sampling. All of my responders were volunteers who wanted to participate in this survey, which could have skewed the kind of responses I received. In the case of the community members, I may not have gotten a crosscutting representation of the community since it is likely that community leaders were chosen or volunteered to participate in my research.

The area of this research is also expansive geographically. Because I wanted to use as many responses that I had received from the survey for this research, I decided to focus on multiple countries in order to make this possible. In the case of the Senegal community member focus groups, three focus groups is not a lot of data. But due to time constraints, those were the focus groups I was able to conduct while doing field research.

Depending on the extent to which NGOs responded to my survey, I had more textual information to analyze for some responses versus others. Some NGOs included many supporting documents while others gave no supporting documents. This makes it difficult to numerically compare the number of theme overlaps with different responses from different NGOs.

Finally, when conducting focus groups in multiple languages, there is the issue of translation. Especially during focus groups, it was difficult for everything that was said to be translated into French for me to understand. Thus, my translator often would summarize the discussion about one question, and then translate the summary for me to understand. This likely took out some details from the responses. Additionally, one question was either mistranslated into Wolof or was misinterpreted by the community members. This was the third question of the community member survey, which asked "How did you find out about trainings?". The community members responded to this question in a way which implied that the question was meant to ask "how did you find the training?" or, "did you like the training"; I kept in the responses to this question because they revealed overall if the community members had liked the trainings or not.

5. Conclusions

Trainings cover a wide variety of overlapping topics and thus cover many of the tenants of sustainability, which are required for making a water point work for a long time in a community (See Figure 19). While participatory methods are considered to be the best by NGOs at training community members, there is a difference between those who participate in the trainings and those who do not because it is unlikely that all community members will be trained. Furthermore, it is possible that participatory methods will not solve all problems facing communities since community-based approaches can leave in place existing power structures,

which keep marginalized groups from being included in decision-making and trainings.

Institutional and legal framework
Support—Adequate legislation—Resource development

Environment
Quality
Quanity
Continuity

Technology
Complexity
Human resources
Service level
Cost of O&M
Spare parts
O&M

RISK

SUSTAIN-ABILITY

BEHAVIOUR AND MANAGEMENT

OWNERSHIP

Community
Capacity to manage
Gender
Sociocultural factors
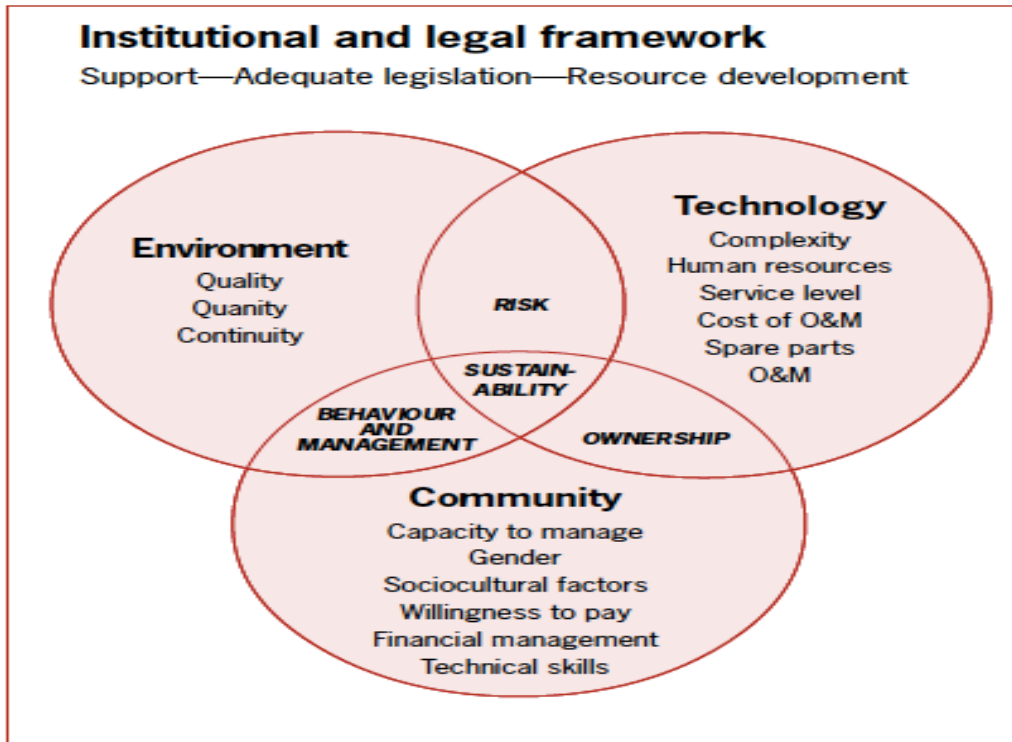Willingness to pay
Financial management
Technical skills

Figure 19: The various factors of sustainability, which are also addressed by trainings (Brikké, 2000)

Looking at the responses from Senegalese community members, there are key aspects of sustainability that are out of the scope of trainings, such as leaders in the community passing down information about the trainings they went through to younger people. Also, it was inconclusive how the community addressed issues with technology. While there were instances where communities were able to fix smaller problems with their water-pump machines, there were other examples where issues of lack of resources limited the communities' abilities to fix problems of the tanks' capacity. Overall however, the villages were good examples of sustainable water points since they had all kept their water points functioning since their construction.

Differences between the Senegal NGO responses and the Senegal community members' responses revealed that sustainability was a central theme for the community members but not the NGO personnel responses. This is likely due to the community members seeing the water point function over a long period of time as well as being invested in the water point even after the water project ends for the NGO. In the case for the NGO personnel, they would likely not see the water point functioning on such a daily basis as the community members.

From the various responses and approaches by NGOs, it is evident that water point development is moving away from "Vaccine Thinking", or a solution that can be mass-produced anywhere and will work in all parts of the world (Shah 2011). In order to address "the water challenge we need to use a different lens—one that allows us to structure the problem differently, to examine many diverse and

partial answers and processes, and to set up new expectations of results" (Shah 2011).

6. Recommendations

NGO personnel should consider expanding their evaluations of the trainings to cover not only the opinions of learners, but the trainers as well. A comparison of perspectives could reveal gaps in content that would improve trainings and make them more attuned to the issues facing communities. This participatory approach to evaluation is difficult for large programs or groups to execute since comparing across geographies becomes difficult with qualitative data (Water and Sanitation Program 2000). The surveys created for this research can be applied to various NGOs across the world, and this is also true for the community member surveys, which can be applicable to all kinds of communities.

Groups working with communities should also consider whom they are training in their programs. The likelihood that all people in the community will be directly addressed or participate in trainings is low and, therefore, trainers should emphasize the greater role that people trained by the NGOs play in their communities. These kinds of social connections that work outside of trainings should also be researched more, and it should be better understood how they contribute to the sustainability of water points. Furthermore, additional research can be conducted to better understand how information gets passed on in a community. Techniques like network mapping and additional focus groups and interviews could reveal how specific communities keep the information they learned during a training within the community and spread information to other people.

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Appendix 1

Columbia University

Monica Carty
1897 Lerner Hall
New York, NY 10027
973-747-4191
mkc2145@columbia.edu

[Insert Date]

Dear_____,

Thank you for agreeing to have personnel from [NGO name here] participate in my research about potable water development and training programs. Please find attached the survey that either you and/or your colleagues can fill out if they desire to participate in this survey. Please try to send me the completed survey after 3 weeks of receiving the survey. I would like to have an apt amount of time to analyze the results of this survey, and thus I would greatly appreciate your cooperation to return this survey as promptly as possible.

I also would like to emphasize again to the participants of this survey: *do not sign your name anywhere on the document*. In order to keep answers anonymous, as desired by my Institutional Review Board (IRB), I do not need that information.

Again, thank you for your help in contributing to my research.

Best,

Monica Carty

Columbia University IRB
IRB-AAAN1168
IRB Exemption Date: 03/10/2014

Appendix 2

SURVEY TO NGO PERSONNEL DISCUSSING TRAINING PROGRAMS AND POTABLE WATER

Thank you for taking the time to fill out this survey for my senior thesis on the effect of training programs on the sustainability of potable water access. This information will help me to better understand and analyze best practices for potable water development. When my senior thesis is completed, I will be happy to provide your organization with my results and findings to be used for future reference.

Please type in your answers below the questions. Do not give your name in this survey!

1. What organization do you work for? And in what country or countries do you work?

2.
    a. How often do you conduct trainings? (bi-annually, every month, ect. ?)

    b. How long do trainings last?

    c. How many people participate in a training session on average (this can be an estimate)?

For the questions below, please answer in one paragraph (~10 sentences) or less.
3. What is your role within the training?

4. How do people find out about trainings?

5. How do you encourage people to attend trainings?

6. How is this training conducted? (This can be supplemented with a manual or framework that is used as a guide to trainings).

7. What would you say are the overall goals of the trainings?

8. How do you evaluate the effectiveness of a training program in a community?

SURVEY TO NGO PERSONNEL DISCUSSING TRAINING PROGRAMS AND POTABLE WATER

9. Do you measure how well people have learned during the training? If so, how?

10. What metrics does your organization use to measure the sustainability (i.e. long-term effectiveness) of water points that have been built?

Appendix 3

Columbia University

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[Insert Date]

Cher _____,

Merci d'avoir accepté que des personnels de [le nom de l'ONG ici] participer à ma recherche sur l'eau potable et les programmes de formation. Trouvez l'enquête en pièce jointe que vous pouvez faire ainsi que vos collègues s'ils veulent participer à l'enquête. Veuillez bien m'envoyer les enquêtes complètes trois semaines après la réception, s'il vous plaît. Je voudrais avoir le temps nécessaire pour analyser les résultats de l'enquête et donc, je vous serais reconnaissante de votre aide, indispensable pour que l'enquête soit possible.

Je voudrais insister auprès des participants à cette enquête : *ne mettez votre nom nullement part sur le document*. Afin que les réponses soient anonymes, comme le veut la Institutional Review Board (IRB), je n'ai pas besoin de cette information.

Merci encore une fois de votre contribution à cette recherche.

Cordialement,

Monica Carty

Appendix 4

UNE SONDAGE QUI DISCUTE LES PROGRAMMES DE FORMATION ET LES L'EAU POTABLE

Merci beaucoup pour prendre les temps de faire cette enquête pour ma thèse sur les liens entre la durabilité et des programmes de formation de l'eau portable. Cette information va m'aider à comprendre mieux et à analyser mieux des meilleures pratiques pour le développement de l'eau potable. Après que j'achève ma thèse, je serai heureuse de partager avec votre organisation les résultats. Vous pouvez les utiliser pour l'info.

Tapez vos réponses sous des questions. Ne donnez pas votre nom pendant cette enquête.

1. Quelle organisation travaillez-vous ? Et dans quels pays travaillez-vous ?

2.
   a. Combien de fois vous dirigez des formations (semestriellement, chaque mois, ect.) ?

   b. Combien de temps prennent-ils les formations ?

   a. En moyenne, combien de personnes participe dans une formation (Estimez si vous voulez) ?

Pour des questions qui suivre, répondez à chaque questions dans un paragraphe (~ 10 phrases) ou moins.

3. Qu'est-ce que votre rôle dans des formations ?

4. Comment des gens apprend des formations ?

5. Comment vous encourage des gens de à suivre des formations ?

6. Comment vous dirigez des formations (Si vous avez un manuel ou un cadre, ajoutez cette réponse avec lui, s'il vous plaît) ?

7. Que diriez-vous les meilleurs buts des formations, en général ?

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IRB Exemption Date: 03/10/2014

UNE SONDAGE QUI DISCUTE LES PROGRAMMES DE FORMATION ET LES L'EAU POTABLE

8. Comment évaluez-vous la efficacité d'une formation dans une population ?

9. Mesurez-vous comment des gens ont appris pendant la formation ? Si oui,
    comment ?

10. Quelles sont les mesures que votre organisation utilise pour mesurer la durabilité
    (c'est à dire : l'efficacité à long terme) de points de l'eau qui ont été construits?

Appendix 5

Columbia University

Monica Carty
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Statement for informed consent:

Hello. I would like to ask you a few questions about your experience in educational programs for water development. I have prepared a questionnaire of 9 questions that should not take very long to answer. I will not write down any personal information regarding your name or where you live. I will only write down the responses you give to the questions I will ask. Knowing this information, would you like to do this questionnaire?

Bonjour. Je voudrais vous poser quelques questions au sujet de votre expérience sur les formations concernant l'eau. J'ai préparé un questionnaire de neuf questions qui ne devrait pas prendre beaucoup de temps pour être renseigné. Ce questionnaire est anonyme, c'est-à-dire que je ne vais écrire aucune information personnalisée sur votre identité telle que votre nom et votre adresse. Je noterai seulement vos réponses aux questions que je vais poser. Sachant cette information, souhaitez-vous remplir la fiche (questionnaire) s'il vous plait ?

Salaamalikum. Dama leen bëgoon na laac ci xam-xam bi ngeen am ci wàllu ndox. Damaa waajal juróom ñeenti laaj tënk ko ci këyit, waaye laaj yi du jël lu bari ci seen jot. Ci këyitu laaj bi, duma ci def tur mbaa santu nit ki, duma ci bind yit fi mu dëkk. Damay bind rek tontu yi nit ñi joxe ci lu jëm ci laaj yi. Bi ngeen xamee loolu, ndax bëgg ngeen ma laaj leen laaj yii ci këyit gi ?

Appendix 6

SURVEY DISCUSSING TRAINING PROGRAMS AND POTABLE WATER

English :
    Thank you for taking the time to take this survey for my senior thesis on sustainability and training programs for potable water development. This information will help me to better understand and analyze best practices for potable water development. I greatly appreciate your help for participating in this research.

French :
    Merci beaucoup pour prendre les temps de faire cette enquête pour ma thèse sur les liens entre la durabilité et des programmes de formation de l'eau portable. Cette information va m'aider à comprendre mieux et à analyser mieux des meilleures pratiques pour le développement de l'eau potable.

Wolof :
    Jërëjëf ci seen jot gi ngeen def ci laac yii jëm si gëstu bu yiteel sama njàng mu kawe jëm ci sukaliku ak saytu ndoxum naan. Xibaar yii ma fiy jële, di na ma jappale ngir ma mëna xam pexe yi gën jëm si saytu ndox.

Questions are listed in the following order : English, French, Wolof

1. What organization gave you trainings?
   De quelle organisation vous avez reçu cette formation
   Ban kureel moo leen indil njàng mi ci wallu saxtu ndox?

2. How many training sessions have you gone to in total?How long did they last?
   Combien de sessions de formation avez-vous bénéficié en tout ? Quelle a été leur durée ?
   Ñaata lël ci njàng moomu ngeen def ? benn bu nekk ñaata fan la ?

3. How did you find out about trainings?
   Comment avez-vous découvert ce type de formation?
   Noo leen gise njàng mi ?

SURVEY DISCUSSING TRAINING PROGRAMS AND POTABLE WATER

4. How many people participated the training sessions you went to (this can be an estimate)?
    Combien de personnes ont participé à ces sessions de formation (une estimation est permise pour cette question) ?
    Ñaata nit ñoo bokkoon ci njàng moomu ? (mënees na xayma ci laaj boobou)

5. What were the three most important things that you learned from the trainings?
    Quelle sont les trois aspects de ces formations qui vous paraissent les plus importants ?
    Limal ñatti fanna yu la ëppal njariñ ci ngàng moomu?

6. Will you continue to use the skills you learned for a long time?
    Envisagez vous de faire usage des compétences acquises de ces formations dans le future ?
    Ndax fasyeene ngaa jëfe li nga jële si xam-xam ci njàng moomu ?

7. What does your organization do to keep potable water programs long lasting?
    Que fait votre organisation pour pérenniser les acquis du programme hydraulique ?
    Seen kureel gui yan pexe lay def ngir gëna dëgëral li ñu am ci wallu ndox ?

SURVEY DISCUSSING TRAINING PROGRAMS AND POTABLE WATER

8. How do you hope to help with the water supply in your community?
   Comment souhaiteriez-vous continuer à faciliter l'accès à l'eau dans la communauté ?
   Nan ngeen di def ngir gënë yombal aminu ndox mu sell ci gox bi ?

9. What did the organization want you to learn from the trainings?
   Qu'est-ce que votre organisation voudrait tirer comme leçon de ces formations ?
   Yan njàngat la seen kureel gi jële ci njàng moonu ?

Appendix 7

Organization and Location	How often do you conduct trainings?	How long to trainings last?	How many people participate in a training of average?
Honduras			
A	(on average) on a bi-weekly basis, depending on how many communities we intervene at a time	Theoretical part- 7 hours; practical part- on average 2 days (7 hrs each day)	around 15
B*	Initial implementation period: 15-20 meetings over a 2-3 month period. After water treatment and supply system is commissioned, semi-regular follow-up visits (financial management, administration, and conflict resolution). These meetings are 10-15 over a period of 1-2 years. (See wiki flowchart for timeline details).	depending on audience and content, last anywhere between 1-5 hours.	5 (water committee training) to hundreds of people (community mobilization).
Senegal			
C	The number of programs depends on the needs expressed by the beneficiaries or identified by the technicians. On average, we conduct one program per semester.	The sessions last between four to five days.	There are approximately 20 to 25 participants.
D1	Every semester	Depending on programs, from 3 to 6 days	20 to 30 people
D2	We lead programs every year	The programs last at most a week	We have approximately 15 to 20 participants
D3	The amount of training programs we run depends on the our water projects	Our training programs usually last 3 to 5 days	10-15 people take part in the programs
India			
E	monthly	education/personality trainings 1-3 days; skill building up to 60 days	around 25
G	• Orientation Training for the Staff of Partner Organization:- Once in a year • Training to strengthen the user committees at schools and community:- Every Month • Training for the Government Officials:- Thrice a year • Training for the School Management Committees and Teachers:- Bi- yearly • Training for the Hand Pump Mechanics:- As per need • Training for the SaaB Entrepreneurs:- Once in a year • Training for internal staff capacity Building:- Once in a year • Hygiene Training for partner staff – Once in a year	• Orientation Training for the Staff of Partner Organization:- Last for 2 days • Training to strengthen the user committees at schools and community:- Two Hours • Training for the Government Officials:- Whole Day (5 Hours) • Training for the School Management Committees and Teachers:- Two Hours • Training for the Hand Pump Mechanics:- Two/Three Days • Training for the SaaB Entrepreneurs:- Whole Day • Training for the Masons:- One Week • Training for internal Staff capacity Building:- 3 days • Hygiene Training for partner staff – 2 days	10 to 50
Malawi			
B*	Initial implementation period: 15-20 meetings over a 2-3 month period. After water treatment and supply system is commissioned, semi-regular follow-up visits (financial management, administration, and conflict resolution). These meetings are 10-15 over a period of 1-2 years. (See wiki flowchart for timeline details).	depending on audience and content, last anywhere between 1-5 hours.	5 (water committee training) to hundreds of people (community mobilization).
G	Can change based on the kind of project being implemented. On average, every 3 months	varies on type of training and content, but average 1 week	average 20

Appendix 8

	capacity building	finances	governance	maintenance	management	mechanical	problem solving	change	community	trained ppl to community relationship	Environment	gender	government/politics	Knowledge	application	measure of effectiveness	motivation	health	quality of life	profit	role of NGO	relationship NGO and community members	Sustainability	trainer learner relationship	participatory learning	total of overlaps numbering >10
participatory learning	10	1	10	2	8	10	9	3	7	5	0	0	1	37	14	9	3	12	0	0	7	8	2	34		4
trainer learner relationship	12	6	6	1	14	16	8	2	5	3	0	0	5	53	16	16	6	1	0	0	24	22	1		34	10
Sustainability	1	4	1	1	7	6	2	1	1	3	1	0	3	16	2	5	2	3	0	3	6	22		1	2	0
relationship NGO and community members	4	6	2	8	13	4	5	1	36	5	0	2	2	13	2	7	12	0	2	0	48		5	22	8	6
role of NGO	5	3	1	3	8	4	2	1	25	1	0	0	2	13	2	7	5	0	0	2		48	6	24	7	4
profit	0	3	0	0	8	1	1	3	5	3	0	0	1	5	3	2	5	0	1		2	0	0	0	0	0
quality of life	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	3	1		1	1	2	1	0	0	0
health	1	1	0	2	3	1	0	3	0	1	0	0	0	13	2	2	8		1	0	2	2	3	1	12	3
motivation	1	1	2	0	3	1	0	2	0	0	1	0	3	8	0	0		8	3	5	5	7	2	6	3	2
measure of effectiveness	7	7	2	5	14	4	2	3	8	0	0	0	0	15	3		0	2	0	2	7	7	5	16	9	3
application	0	1	2	3	3	3	1	1	1	0	0	0	0	4		3	0	2	0	0	2	2	0	16	14	2
Knowledge	12	4	2	7	15	25	5	9	17	0	1	0	0		4	15	8	13	1	5	13	13	16	53	37	10
government/politics	1	0	0	3	0	0	0	3	0	0	0	0		0	0	0	3	0	1	1	2	2	3	5	1	0
gender	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0	0	0	2	2	0	0	0	0
Environment	5	1	0	1	0	1	0	0	0	0		0	0	1	0	0	1	0	0	0	0	1	1	0	0	0
trained ppl to community relationship	5	1	2	0	1	0	0	0	19		0	0	0	0	0	0	3	0	0	3	1	5	3	3	5	1
community	8	6	4	2	24	5	3	9		19	2	0	0	17	1	8	19	11	0	5	25	36	1	5	7	8
change	4	3	2	7	3	5	1		9	1	0	0	3	9	1	3	2	3	0	3	1	1	1	2	3	0
problem solving	6	2	0	1	6	3		1	3	0	0	0	0	5	1	2	0	0	0	1	2	5	2	8	9	0
mechanical	4	6	0	7	12		3	5	5	1	0	0	0	25	3	4	1	3	0	1	4	4	6	16	10	3
management	6	12	7	9		12	6	3	24	10	0	0	0	15	3	14	3	3	0	8	8	13	7	14	8	7
maintenance	2	6	1		9	7	1	0	2	2	0	0	1	7	3	5	0	2	0	1	3	8	1	1	2	0
governance	5	4		1	7	0	1	2	4	2	0	0	0	2	2	4	0	0	0	0	1	2	1	6	10	0
finances	1		4	6	12	6	2	3	6	1	0	0	0	4	1	7	1	1	0	3	3	6	4	6	1	1
capacity building		1	5	2	6	4	6	4	8	5	0	0	1	12	0	7	1	1	0	0	5	4	1	12	10	2
total of overlaps numbering >10	2	1	0	0	7	3	0	0	8	1	0	0	0	10	2	3	2	3	0	0	4	6	0	10	4	4

Appendix 9

	capacity building	finances	governance	maintenance	management	mechanical	problem solving	change	community	trained ppl to community relationship	Environment	gender	government/politics	Knowledge	application	measure of effectiveness	motivation	health	quality of life	profit	role of NGO	relationship NGO and community members	Sustainability	trainer learner relationship	participatory learning	total of overlaps numbering ≥5
capacity building	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
finances	0	2	1	2	2	1	1	0	2	1	0	0	0	0	0	1	0	1	0	2	1	1	1	0	1	0
governance	0	1	0	0	2	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
maintenance	0	2	0	0	2	2	0	0	9	0	0	0	0	8	1	5	2	1	0	2	2	3	5	3	3	3
management	0	2	2	2	5	5	4	1	9	6	0	0	8	18	1	1	0	0	7	5	0	0	5	9	8	3
mechanical	0	1	0	2	5	1	1	0	2	1	0	0	18	0	0	0	0	0	1	4	2	1	4	1	1	0
problem solving	0	1	0	0	4	1	0	0	1	0	0	0	3	0	0	1	0	1	0	1	0	0	0	1	1	0
change	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	1	2	0	0	0
community	0	2	1	9	9	2	1	0	0	9	0	0	3	3	2	12	7	1	5	5	11	11	3	4	4	5
trained ppl to community relationship	0	1	0	0	6	1	0	0	9	0	0	0	2	0	0	1	1	0	3	0	2	0	0	0	2	2
Environment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
gender	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
government/politics	0	0	0	0	8	18	3	0	3	2	0	0	0	22	0	0	0	0	0	1	0	1	4	22	19	5
Knowledge	0	0	0	8	18	0	0	1	3	0	0	0	22	0	1	1	4	6	1	0	0	0	4	19	13	2
application	0	0	0	1	1	0	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	2	13	13	0
measure of effectiveness	0	1	0	5	1	0	0	0	12	1	0	0	0	1	0	0	6	2	0	0	1	8	2	0	0	3
motivation	0	0	0	2	0	0	0	0	7	1	0	0	0	4	0	6	0	6	0	1	0	6	4	6	9	4
health	0	1	0	1	0	0	1	0	1	0	0	0	0	6	0	2	6	0	0	0	0	0	6	6	9	0
quality of life	0	0	0	0	7	1	0	0	5	3	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1
profit	0	2	1	2	5	4	1	0	5	0	0	0	1	0	2	1	1	0	0	0	0	2	4	3	0	1
role of NGO	0	1	0	2	0	2	0	1	11	2	0	0	0	0	2	8	1	1	1	0	0	10	4	4	1	3
relationship NGO and community members	0	1	0	3	0	1	0	1	11	2	0	0	1	0	1	1	8	0	0	2	10	0	3	2	1	0
Sustainability	0	1	0	5	4	4	2	2	3	0	0	0	4	22	13	2	2	6	1	4	4	3	1	1	11	1
trainer learner relationship	0	1	0	3	9	1	1	0	3	1	0	0	22	13	13	0	4	6	0	1	1	2	1	11	11	3
participatory learning	0	1	0	3	8	1	1	0	4	2	0	0	19	13	13	0	9	9	0	1	1	1	11	11	2	1
total of overlaps numbering ≥5	0	0	0	3	3	0	0	0	5	2	0	0	5	2	0	3	4	0	1	1	3	0	1	3	5	5

Appendix 10

The following is a co-occurrence (overlap) matrix in which the same set of categories labels both the rows and the columns. Cells with counts of five or more are highlighted. The final row, "total of overlaps numbering ≥5," summarizes each column.

	capacity building	finances	governance	maintenance	management	mechanical	problem solving	change	community	trained ppl to community relationship	Environment	gender	government/politics	Knowledge	application	measure of effectiveness	motivation	health	quality of life	profit	role of NGO	relationship NGO and community members	Sustainability	trainer learner relationship	participatory learning
capacity building		0	5	1	5	1	3	1	4	3	0	0	4	4	0	5	1	0	0	0	4	2	0	6	7
finances	0		2	3	8	1	1	2	1	0	0	0	2	2	1	6	0	0	1	1	2	4	0	0	4
governance	5	2		1	5	0	2	1	2	1	0	0	1	1	1	3	0	0	1	1	1	2	0	10	6
maintenance	1	3	1		6	3	2	0	1	1	0	0	4	2	2	4	0	1	0	1	1	5	0	2	5
management	5	8	5	6		5	3	0	9	3	0	0	8	8	1	10	0	2	0	7	9	9	2	8	11
mechanical	1	1	0	3	5		2	0	0	0	0	0	12	1	0	2	1	0	0	1	1	2	0	8	10
problem solving	3	0	3	0	2	2		0	2	0	0	0	3	0	0	1	0	0	0	2	2	0	0	6	5
change	1	2	0	0	0	0	0		2	1	0	0	0	1	1	2	0	0	1	0	0	0	0	2	0
community	4	1	2	1	9	0	2	2		6	0	2	6	0	0	4	2	5	0	8	8	10	2	5	5
trained ppl to community relationship	3	0	1	1	3	0	0	1	6		0	0	3	0	0	1	0	2	0	1	1	2	0	1	1
Environment	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
gender	0	0	0	0	0	0	0	0	2	0	0		0	0	0	0	0	0	0	2	0	0	0	0	1
government/politics	0	2	1	4	8	12	3	0	6	3	0	0		0	1	4	1	5	2	8	8	10	1	30	14
Knowledge	4	2	1	2	8	1	0	1	0	0	0	0	0		1	8	3	6	0	10	8	0	1	27	14
application	0	1	1	2	1	0	1	2	0	0	0	0	1	1		1	0	0	0	0	0	0	0	14	7
measure of effectiveness	5	6	3	4	10	2	1	0	4	1	0	0	8	8	1		0	2	1	4	4	5	2	9	7
motivation	1	0	0	1	0	1	0	0	2	0	0	0	3	3	0	0		1	1	1	1	1	0	2	1
health	0	0	0	1	2	0	0	0	5	2	0	0	6	6	0	2	1		0	0	0	1	0	2	5
quality of life	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0		1	1	0	1	0	0
profit	1	1	0	1	7	1	2	0	0	0	0	1	0	0	1	4	1	0	0		0	2	1	5	0
role of NGO	4	2	1	1	9	2	2	0	8	2	0	0	8	8	4	4	1	0	1	0		18	2	14	13
relationship NGO and community members	2	4	5	5	9	2	2	0	10	2	0	1	10	10	5	5	1	1	0	1	18		1	6	6
Sustainability	0	0	0	0	2	0	0	0	2	0	0	0	1	1	0	2	0	0	1	2	2	1		1	1
trainer learner relationship	6	6	5	8	11	10	5	2	5	4	0	2	30	14	14	9	2	2	0	14	13	6	1		15
participatory learning	7	0	10	2	8	8	6	2	4	3	0	1	27	14	7	7	1	5	0	5	6	1	5	15	
total of overlaps numbering ≥5	**5**	**2**	**4**	**3**	**12**	**4**	**2**	**0**	**6**	**1**	**0**	**0**	**9**	**9**	**2**	**8**	**0**	**3**	**0**	**6**	**8**	**13**	**0**	**13**	**12**

Appendix 11

	participatory learning	trainer learner relationship	Sustainability	relationship NGO and community members	role of NGO	profit	quality of life	health	motivation	measure of effectiveness	application	Knowledge	government/politics	gender	Environment	trained ppl to community relationship	community	change	problem solving	mechanical	management	maintenance	governance	finances	capacity building
capacity building	1	3	0	1	1	0	0	0	0	0	0	4	0	0	0	1	0	0	1	0	0	0	0	0	
finances	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0		0
governance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
maintenance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
management	0	2	0	1	1	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0		0	0	0	0
mechanical	0	2	0	2	2	0	0	0	0	1	1	1	0	0	0	0	0	0	0		0	0	0	0	1
problem solving	1	1	0	1	1	0	0	0	0	0	0	3	1	0	1	1	0	0		1	0	0	0	0	1
change	1	1	0	0	0	0	0	0	0	1	0	1	1	2	0	1	0		0	1	0	0	0	0	0
community	0	4	0	11	9	0	0	0	0	0	0	0	0	0	1	0		0	0	0	0	0	0	0	2
trained ppl to community relationship	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1
Environment	0	0	0	2	2	0	0	0	0	0	0	0	0	0		0	2	2	0	0	0	0	0	0	0
gender	0	0	0	2	2	0	0	0	1	0	0	0	0		0	0	1	1	0	0	0	0	0	0	0
government/politics	0	0	0	1	1	0	0	0	0	2	0	0		0	0	0	3	0	1	0	0	0	0	0	4
Knowledge	4	10	0	1	4	0	0	0	0	0	1		0	1	0	0	1	0	1	1	0	0	0	0	0
application	0	1	1	2	1	0	0	0	1	0		1	0	0	0	0	2	0	0	0	0	0	0	0	0
measure of effectiveness	0	2	1	1	2	0	0	0	0		0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
motivation	0	0	0	2	2	0	0	0		0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0
health	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
quality of life	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
profit	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
role of NGO	2	8	1	15		0	0	0	2	2	0	4	2	2	0	0	9	1	1	2	1	0	0	0	1
relationship NGO and community members	0	5	1		15	0	0	0	2	1	1	1	1	2	0	0	11	0	1	2	2	0	0	0	1
Sustainability	0	0		1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
trainer learner relationship	5		0	5	8	0	0	0	0	1	0	10	0	0	0	0	4	1	1	2	2	0	0	0	3
participatory learning		5	0	3	2	0	0	0	0	2	1	4	0	0	0	0	4	0	1	1	0	0	0	0	1
total of overlaps numbering ≥3	2	6	0	3	4	0	0	0	0	0	0	5	0	0	0	0	4	0	0	0	0	0	0	0	2

Appendix 12

	capacity building	finances	governance	maintenance	management	mechanical	problem solving	change	community	trained ppl to community relationship	Environment	gender	government/politics	Knowledge	application	measure of effectiveness	motivation	health	quality of life	profit	role of NGO	relationship NGO and community members	Sustainability	trainer learner relationship	participatory learning	total of overlaps numbering ≥3
capacity building	1	1	0	1	1	3	2	3	2	1	0	0	1	4	0	2	0	1	0	0	0	1	1	3	2	4
finances	1	0	2	0	3	4	0	3	3	0	0	0	2	2	0	0	0	0	0	1	1	1	0	1	0	4
governance	0	0	0	0	2	0	0	0	1	1	1	0	1	0	1	1	0	0	0	1	1	2	1	0	0	0
maintenance	1	2	0	0	1	1	0	0	1	0	0	0	0	2	1	0	0	0	0	2	2	0	1	0	0	0
management	1	3	1	1	0	3	0	3	4	1	0	0	0	2	1	1	3	1	1	0	0	0	2	1	0	4
mechanical	3	4	0	1	3	0	1	4	3	0	1	0	1	2	0	0	1	1	0	0	1	0	2	1	0	5
problem solving	2	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
change	3	3	0	0	3	4	1	0	3	1	0	0	0	5	1	2	2	2	2	1	0	4	0	1	0	5
community	2	3	1	1	4	3	0	3	0	1	0	0	1	5	0	1	3	1	2	0	5	4	1	2	1	8
trained ppl to community relationship	1	0	1	0	1	0	0	1	1	0	0	0	0	2	0	1	0	1	0	0	0	0	0	1	1	0
Environment	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
gender	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
government/politics	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
Knowledge	4	2	0	2	2	2	0	2	5	2	0	0	0	0	1	4	2	1	0	0	1	0	1	5	0	4
application	0	0	1	1	1	0	0	0	1	2	0	0	0	1	0	2	0	0	0	1	0	1	1	0	0	0
measure of effectiveness	2	0	1	0	1	0	0	1	2	1	0	0	0	4	2	0	0	1	0	1	0	0	1	5	2	2
motivation	0	0	0	0	3	1	0	2	3	0	0	0	0	2	0	0	0	1	3	0	0	1	0	0	0	2
health	1	0	0	1	1	1	0	2	1	0	0	0	0	1	0	0	1	0	1	0	1	1	2	0	0	0
quality of life	0	0	0	0	1	0	0	2	2	1	0	0	0	0	0	0	3	0	1	1	1	1	0	0	0	1
profit	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0
role of NGO	0	1	1	2	0	1	0	0	5	0	0	0	0	1	1	0	1	0	1	0	0	7	0	0	0	2
relationship NGO and community members	1	1	0	2	1	1	1	1	4	0	0	0	0	0	0	0	1	1	1	0	7	0	0	2	1	2
Sustainability	1	0	1	1	2	2	1	1	1	1	0	0	0	1	1	1	0	2	0	0	0	0	0	0	0	0
trainer learner relationship	3	1	0	1	1	2	1	1	2	1	0	0	0	5	0	5	0	0	0	0	0	2	0	0	4	4
participatory learning	2	0	0	0	1	0	1	0	1	1	0	0	1	1	0	2	0	0	0	0	0	1	0	4	0	1
total of overlaps numbering ≥3	4	4	0	0	4	5	0	5	8	0	0	0	0	4	0	2	2	0	1	0	2	2	0	4	1	

Appendix 13

	community	environment	gender	knowledge	management	mechanical	politics	problems encountered	profits	role of NGO personnel	sustainability	technology	usefulness
community		0	0	2	1	0	0	1	0	1	0	0	0
environment	0		0	0	0	0	0	0	1	0	0	0	0
gender	0	0		0	0	0	0	0	0	0	0	0	0
knowledge	2	0	0		5	2	0	0	1	1	4	0	2
management	1	0	0	5		2	0	1	2	0	3	0	1
mechanical	0	0	0	2	2		0	1	1	0	3	1	1
politics	0	0	0	0	0	0		0	0	0	0	0	0
problems encountered	1	0	0	0	1	1	0		2	2	0	2	1
profits	0	1	0	1	2	1	0	2		0	0	0	0
role of NGO personnel	1	0	0	1	0	0	0	2	0		0	1	0
sustainability	0	0	0	4	3	3	0	0	0	0		1	1
technology	0	0	0	0	0	1	0	2	0	1	1		0
usefulness	0	0	0	2	1	1	0	1	0	0	1	0	
Overlaps that numbered ≥ 2	1	0	0	5	4	3	0	3	3	1	3	1	1