‘Social capital in rural dry season farming communities and its effect on the use and implementation of small water reservoirs’

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‘Social capital in rural dry season farming communities and its effect on the use and implementation of Small water reservoirs’

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July 2006, Delft, the Netherlands

Masters’ Thesis
Section: Policy Analysis
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‘It’s only a model’

Monty Python and the Holy Grail, 1975
Acknowledgements

In the months March and April of 2006, research was performed in the Upper East region of Ghana on the functioning of the 2 small water reservoirs, Tonde and Tanga. The research was mainly focused on the implementation and the usage of the 2 reservoirs in relations with the social settings described in the framework of social capital.

First of all, I would like to thank Haruna Kumasi for his endless patience. For the late hours on his veranda, explaining me the rather complex society of Ghana. For going the extra mile, adopting me in his family and looking after me. Next to this I would like to thank the people of Tonde and Tanga reservoir for talking to me, allowing me to gain insights in their life and for the back breaking loads of onions that were offered by them, every day, without exception.

Next to this, it goes without saying: the examination committee, people from the Small Reservoirs Project and the IWMI, friends, girlfriend and family,

I.E. van Kinderen
Delft, University of Technology,
2006
LETTER OF APPRECIATION

It is the desire of the whole membership of the above named football club to express our appreciation for the generosity and passion you have displayed by offering the club a brand new football.

It came as a timely intervention since the team had only one old football in use as at the time of your benevolent offer.

“Aye koo” to you says the entire membership and prays that the Almighty guides you in all your endeavors.

May you live to your expectations!

Many thanks.

A.M. Lawal Abagri

(Head Coach)
for management.
Executive Summary

In the past century a wide range of organizations has tried to solve development problems in Africa. The focus of these efforts was often on the third world’s agricultural sector where the impact of drought has severe impacts. In order to fight the consequences of droughts, a variety of organizations started constructing small reservoirs in rural areas such as the Upper East region in Ghana. However, not all water reservoirs proved successful. Often the small reservoirs were not maintained properly and became dysfunctional.

The ‘Small Reservoir Project’, for which this research is performed, does research on these small reservoirs. The objective of the ‘Small Reservoir Project’ is to create a set of tools and procedures. This toolbox aims to support the planning, the development and the management of small reservoirs ensembles and to promote and support the use of these small reservoirs (www.smallreservoirs.org).

A recent study of two reservoirs in the Upper East of Ghana, Tanga and Tonde, shows that the way rural communities manage their reservoirs do differ significantly. Tonde reservoir seems to have reached a more sustainable situation than Tanga. However, for these two communities the geographical, climatologically, formal macro and meso institutional settings are not significantly different. By performing a research in these communities one allows the focus to be on the differences on micro level.

When problem owners are in, or foresee, unwanted situations, policy designs or adjustments can be made so these situations can be changed or avoided. In order to achieve this objective a multi actor analyses is made to gain insight in the system in which the policy will be implemented. However, traditional policy analysis seems to be unable to give a full explanation for certain behavior, mainly in development efforts. Why, for example, do reservoirs which have a central function in life supporting activities for farmers, fall into disrepair while knowledge and means are present to maintain these systems.

Interesting would be to investigate how social aspects in these dry-season farming communities, defined in a framework called ‘social capital’, influences the usage and management of the two reservoirs. In the framework of social capital, social cognitive configurations are used to enable quantitative comparison of the actors’ perception of the structural network characteristics in which they act.
This leads to the following research question:

‘Which explanations can social capital theory provide for the differences in the management and usage of small reservoirs in the rural farming communities of the Tanga and Tonde systems?’

In order to answer this question, a research was performed in the months March and April of 2006 in the Upper East Region of Ghana. The analysis was made in three separate parts. First, a contextual analysis of the farming communities was made in which the findings can be placed. Aspects as decisions cycles, strategies and so on are investigated. Second, an adapted questionnaire of the World Bank is used to determine numerical differences in the social capital of both farming communities. A 10% confidence interval was used to determine whether the numerical differences are significant. Lastly the impact of the differences in social capital on the life cycle of the reservoirs is traced back by means of interviews.

It was concluded that the farming community in the Tonde reservoir has a significant greater social capital compared with Tanga. Tonde and Tanga have distinct and significant differences in at least three aspects of social capital, which played an important role in the implementation and usage of the reservoirs. The most significant differences between the two reservoirs were in trust, networks and social cohesion & inclusion. These differences find their roots in the history of the rural dry season farming communities and are a reason for the differences of the lifecycle of the two reservoirs, measured in earlier research.

Social cohesion and inclusion possibly created the greatest difference between the Tonde and Tanga reservoirs. Whereas in the farming community of the Tonde reservoir, no history of violence or conflict is recorded, the history in Tanga contains several incidents between two groups in the farming communities. These partly ethnic based incidents are significant as these two groups are the current users of the dam. The incidents created tension and mistrust between the networks. These tensions and mistrust caused a lack of central coordination and communication.

Groups and networks play an important role in the differences between Tonde and Tanga as well. In Tonde, a cohesive, gender and ethnic homogenous group functioned was the initiator of the coming of the dam. It provided a fundamental success factor that was lacking in Tanga. The already acknowledged and existing power structure of this network formed a basis for the WUA to function. In Tanga the networks characteristics were different. Multiple loosely connected
networks were present in Tanga. Each of the networks had their own objectives and conflicting perspectives. Due to the lack of an overall connecting network, the mutual dependency was limited and individual actions ruled over coordinated actions.

The limited maintenance, the weak management, the individual walls in Tanga and the differences in water distribution can partially be explained by the differences in social capital. For these aspects coordination and cooperation are needed. Strong cohesive networks form a basis for this. The differences between the reservoirs find a more likely reason in the differences in social capital, rather than the different water availabilities as was suggested by Faulkner (2006).

It is worth investing time and money in choosing the community for whom the reservoir will be built. It will determine a very essential part of the future sustainability of the dam. Corrections afterwards will be very hard to implement and will mostly lack prosperity of success.

It was recommended to use existing, strong cohesive, ethnic & gender (female) homogenous groups as a basis for implementations of reservoirs. Reasons for locating proper sites for building a dam should not only be based on technical reasons but on social factors as well. Social capital is a good start to examine these factors that will influence the implementation of a reservoir, yet it is a start only. Additional research on social issues is therefore recommended. When one wants to implement reservoirs, solve the land (property) issues before constructing the dam and involve all stakeholders in this process.

A lack of social capital or other forms of social inappropriate circumstances in a community is a sensible reason to abandon, or to postpone, the idea to implement a small reservoir.
Tonede
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Notice

In order to avoid further confusion:

During the research in the Upper East region of Ghana there was confusion created when there was referred to the Weega reservoir. This was because in the report of Joshua Faulkner two reservoirs were studied under the names ‘Weega and Tanga reservoirs’. Yet, the ‘Weega reservoir’ is called ‘Tonde reservoir’ by the locals. The assembly man reckoned as well, although he was hesitant to confirm this and afraid of solely being responsible for possibly changes, that the reservoir is referred as the Tonde reservoir in official documents. The Tonde reservoir is mostly used by four villages of which two of them are Weega and Tonde, closely located from each other, which may created the confusion.

In the coming report, the name ‘Tonde’ will be used and when there are references to the report of Joshua Faulkner, the name ‘Weega’ is replaced by ‘Tonde’.
Introduction
1 Introduction

In the past century a wide range of organizations has tried to solve development problems in Africa. The focus of these efforts is often on the third world’s agricultural sector where the impact of drought has severe impacts.

In order to fight the consequences of droughts, a variety of organizations started constructing small reservoirs in rural areas such as the Upper East region in Ghana (Fig. 1). These reservoirs can be seen as small lakes where water is stored during the rainy seasons in order to use it later on in the dry season. These reservoirs have a wide variety of functions. ‘The reservoirs are a widely used form of infrastructure in the Upper East Region for the provision of water mainly for irrigation and for livestock watering, fishing, and domestic-use. But also serve a purpose for wildlife watering, harbouring crocodiles, recreational purposes and for contracting purposes (Poolman, 2005: 4).’

![Figure 1: Ghana and location of study sites. Adjusted picture from worldswitch.com](image-url)

However, not all water reservoirs proved successful. Often the small reservoirs were not maintained properly and fell in disrepair. In order to restore these reservoirs many initiatives were undertaken. Often with little success and a familiar claim heard in the field is that ‘Despite concerted efforts by both state agencies and private-sector firms to discover a secret recipe for economic
success in the countryside, rural areas continue to follow their own stubborn logics of change and stasis’ (Murdoch, 2000: 407). It seems that in some sort of way, the rural communities do not follow the paths of the western theoretical rationality, on which traditional policy analyses is based. Rather, they have their own rationality which is distinctly different than the western rationality.

‘During the 1980s it was realized that the problems were not due to incompetent farmers per se, but were caused by the fact that the knowledge of the farmers had not been used and that local economic, social and cultural contexts had not been taken into account in designing the systems’ (Poolman, 2005: 5). And because of this, the technology introduced to many villages was inappropriate for the (social) circumstances and equipment deteriorated fast without having any, or at least not as much, of the initial intended effects.

Despite these new insights and the understanding that part of the success of small reservoirs does depend on social aspects, many of these reservoirs nowadays do still not function optimally, possibly due to reasons described above. ‘That a significant number are functioning sub-optimally and/or are falling into disrepair indicates that there is room for improvement in the planning, operation, and maintenance of small reservoirs’ (www.smallreservoirs.org).

A change of strategy may interfere with this course and improve the situation. The intended improvements by the Small reservoir project might find important policy design aspects or changes within this social field in which the stakeholders are studied. ‘Typically, stakeholder analyses are undertaken as part of policy, plan or strategy change exercises; or organizational development efforts’ (Bryson, 2004: 27). ‘The general purpose of stakeholder analyses may be seen as providing a methodology for better understanding environmental and development problems and interactions through comparative analysis of the different perspectives and sets of interest of stakeholders at various levels’ (Grimble, 1997: 177). And because the sustainability of introduced technology in rural contexts is based on the socio-environmental networking of local stakeholders, a point generally ignored (Campbell, 2005: 367) it is worthwhile to get a better view on these aspects.

One way of analyzing these social aspects of the communities, is the concept of ‘social capital’. Social scientists developed the concept as a way to measure relationships qualitatively and quantitatively and it was first introduced by Putman in 1990-ties. It combines the frameworks of ‘social networks analysis’ and ‘configuration analysis’. By combining these 2 frameworks one can quantify the actors’ perception of structural characteristics of the network in which these actors act.
‘Social capital refers to the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded. Social capital is the glue that holds societies together’ (Serageldin: foreword of Grootaert, 2001).

The World Bank attempts with the help of a standardized questionnaire to measure the social capital of communities. The framework in which it is measured contains the following 6 sections:

1. Groups and Networks
2. Trust and Solidarity
3. Collective Action and Cooperation
4. Information and Communication
5. Social Cohesion and Inclusion
6. Empowerment and Political Action

(Source: Grootaert et al, 2004)

The theory of social capital might provide additional insights that can be used in the context of multi actor analyses. A quantitative comparison of the actors’ perception of the structural characteristics of the network in which they act might form an explanation why certain reservoirs fall into disrepair while other reservoirs are well maintained.
Problem description
2 Problem description

In a recent report of the Small reservoir project written by Faulkner (2006), two reservoirs were investigated: Tanga and Tonde located in the upper east part of Ghana nearby Zebilla (Fig. 1).

The way these small reservoirs function are quite straight forward. Rain is captured in the wet season so it can be used in the dry season. This is done with a dam that is placed in a valley. Pipelines, with valves on the end, are constructed through the dam. By opening these valves, the main channels are filled with water. With the use of holes in these main channels, water can be directed to the plots of the farmers who use this to water their crops.

Figure 2: the Tonde reservoir

The Tonde Reservoir (fig. 2), is a stand alone system (not connected to other reservoirs), and has a surface area of 11.9 ha. The total area under cultivation is 6.0 ha and had 241 farmers in 2005 (Faulkner, 2006). Inhabitants of the four villages Tonde, Weega, Ganide and Atolombisi, are using the reservoir. The villages are closely located to the Tonde reservoir. The inhabitants are mostly Kusaasis. A distinct characteristic of Tonde is that about half of the irrigation field, the half closest to the dam, is mostly used by women only.
The Tanga reservoir (fig. 3), which is part of a cascading reservoir system, is 10.6 ha in surface area and the total area under cultivation is 1.6 ha. In 2005, 73 farmers maintained plots at this study site (Faulkner, 2006). The ethnical background of the majority of farmers is Kusaasi. But farmers of ethnical minorities, such as Moshis and Fra Fras, can be founds in the reservoir as well. In the village Gunga lives a big Mamprusi family. Apart from this, the Tonde reservoir has upstream farmers. These farmers are mainly inhabitants of the village Tang Dabot.

The two reservoirs are located about three km from each other and are roughly the same size. The same crops are grown on the fields and supply the same market on which it is sold. Macro and meso settings such as climatologically and formal institutional characteristics do not differ significantly. The time of construction of the reservoirs does differ about 5 years and both dams fall under the same regional and national institutional settings.

Yet, the systems have remarkably differences in the management and the usage of the reservoirs. Some of these differences were measured in the report of Faulkner (2006) and showed in aspects such as the inputs and outputs of the system, the efficiency, the profit and the maintenance.
One aspect the reservoirs differ is the usage of fertilizer, seeds and pesticides. Per hectare, Tanga farmers spent 110% more on fertilizer, 67% more on pesticide, and 52% more on seeds than did Tonde farmers. All other costs per hectare were very similar between the two systems' (Faulkner, 2006: 22). These differences lead to remarkable difference in output in favour of Tanga which enjoyed a 60% better crop yield per hectare compared with Tonde. But because of the high investments in Tanga, (marginal) profit could only be made when the market prices of the crop were favourable too.

As the output was measured only once, it is difficult to determine whether these differences are structural as harvests are known to fluctuate over the years. Next to this, output mainly affects individual benefit and is based on individual decisions made in the beginning of the dry farming season. Possibly more interesting are the more structural differences mentioned by Faulkner in the (general/maintenance/water) management of the two reservoirs as it directly affects the sustainability of the reservoirs.

While Tanga has two leaking valves, deteriorated canals, and very limited maintenance, the Tonde reservoir shows opposite characteristics. It is well maintained and seems to have reached a more sustainable situation as one compares the situation with Tanga. More visual evident is the difference in the way the enclosure is arranged. Where Tonde managed to build a common mud wall around the irrigation field, Tanga consists of plots surrounded by individual walls. For the maintenance, significant differences are mentioned.

Another point is how farmers distribute the water in their fields. While Tanga uses buckets/calabashes which can be filled in a sort of wells to spread the water over their land, Tonde uses a system of channels and plugs to irrigate their plots. Apart from this, the punctuality of opening the valves in order to let the water reach the irrigation fields differed a lot. 'As an example, the opening and closing of the canals at the Tanga system was not always performed by the caretaker. Farmers wanting water would sometimes open when they desired, finding the valve key near the head of the canal. This has resulted in massive canal failure and water wastage, due to the failure to close the release valve at the end of the day. The management and organizational structure at the Tonde system was strong, and the opening and closing of the canals was only performed by the caretaker and was fairly punctual' (Faulkner, 2006: 26).

As a result, Tanga uses about triple the amount of water per surface area compared with Tonde, which comes down to just under 6 times the associated demand of the crops grown on the field. A suggestion was made to locate the cause of this difference. 'At the Tanga site, (…), the high water availability allows the farmers to choose a less efficient irrigation method. It can be speculated that
the basin and bucket irrigation method was chosen because water scarcity was not an issue, and there was no incentive to choose a more efficient method’ (Faulkner, 2006: 25).

Scarcity of water however doesn’t seem to be a full explanation of the differences because Tonde uses about 2.4 times the associated amount of water for the crops on the fields and the differences between the reservoirs are much bigger than can be attributed to differences in the irrigation method only. Therefore it will be very interesting to investigate what the causes are of these very different (management) strategies and use these two reservoirs as study cases to explain why some reservoirs fall into disrepair.

Because the sustainability of introduced technology in rural contexts is based on the socio-environmental networking of local stakeholders, a point generally ignored (Campbell, 2005: 367) a possible cause may be found from this perspective. With the framework of social capital, explained in chapter ‘theoretical framework’ of this report, to describe the social contexts of the two farming communities, the following research question can be formulated:

‘Which explanations can social capital theory provide for the differences in the management and usage of small reservoirs in the rural farming communities of the Tanga and Tonde systems?’

Sub-questions that will be answered in the research are:

- What is social capital?
- How does social capital form an addition in the current knowledge of network analysis?
- What are the influences of social capital in the different phases of existence of the reservoirs in Tonde and Tanga?
- Which additional explanations, other than social capital, might be a causing the differences between the two reservoirs?

When one determines essential factors that determine the successful utilization of small reservoirs, recommendations can be made on those insights. Analyses of the actors will be made based on standardized questionnaires, adapted to the local circumstances, provided by the World Bank.
Theoretical framework
3 Theoretical framework

3.1 Policy analyses and developmental efforts

When problem owners are in, or foresee, unwanted situations, policy designs or adjustments can be made so these situations can be changed or avoided. In order to achieve this objective a policy analyses is made to gain insight in the system in which the policy will be implemented. ‘Every (system engineering) policy analyses problem occurs within a network of actors (…), the term actors is a generic indication of individuals or groups that play an important role within a problem case’ (Bots, 1999: 11). ‘A policy problem is the gap between an existing or expected situation and a criterion’ (Enserink, 2004: 9). Because the pluriformity of actors in a network, the perspective of what a favorable future situation (that sets the criterion) might be, can be very different among actors in one system.

Within the field of developmental and poverty problems, these gaps between the current and the wanted situation within the policy area are relatively easy to clarify from a western perspective. But the past decades proved that finding and implementing possible solutions, suggested by donors, policy makers, target groups and development organizations, is much more difficult. Without any doubt, this is partly caused by the differences of criteria and perception of the target group and the policy makers.

One of the reasons different parties have different perspectives and perceptions are the different frames of references. ‘Stakeholders are likely to be from diverse institutional backgrounds; have dissimilar frames of reference; use disparate vernacular vocabularies and knowledge bases; and aspire to different agendas’ (Alsop and Farrington, 1998).

An important aspect of ‘traditional’ policy analysis is that it assumes that all actors behave rational. ‘Rationality assumes a logical consistent relation between the objectives that an actor wants to achieve and the things he does. Each action contributes to, directly or indirectly, the achievement of an objective (Bots, 2002: 26)’

When looking into developmental problems, behavior of the population in developing counties did not follow the ideas of rational behavior where traditional western policy analysis is based on. A lack of cultural and societal insights was often the grassroots’ cause of this course of action (Poolman, 2005). This has often led to mal-functional policies that lacked to achieve the objectives of the policy makers. Creating more insight in the rationality used by the actors, one
can adapt the policies more efficient and the chance of success will significantly improve.

3.2 Stakeholder and network analyses

So in order to get to a good analysis and implementation of the problem, one needs to know who is involved within the problem area, their perception, means, interests and objectives and how the actors are interlinked. 'It is of vital importance that a problem analyses provides an understanding of the range of involved actors and their network (Enserink, 2004: 105)'. In order to get a better view on these aspects, policy analyses developed a framework in which these aspects can be investigated.

'Typically, stakeholder analyses are undertaken as part of policy, plan or strategy change exercises; or organizational development efforts' (Bryson, 2004: 27) such as can be seen in the small reservoir projects. ‘The general purpose of stakeholder or actor analyses may be seen as providing a methodology for better understanding environmental and development problems and interactions through comparative analysis of the different perspectives and sets of interest of stakeholders at various levels’ (Grimble, 1997: 177). The actor and network analysis is seen as a powerful tool to get more insight in the complexity of the environment. ‘One reason social problems are so complex is because they involve different parties, each of whom is affected by the problem situation in their own way. Moreover, they each have their own perspective of the problem and are intent on their own solutions’ (Enserink, 2004: 105).

Policy analysis analyses complex worlds with the help of multi-perspective, actor and multi-objective analyses. It is a way to analyze and structure the views and needs of all different actors while those actors often dependent on each other. The interests of actors and their perceptions of reality determine their objectives – that is, the outcomes they want to achieve (O. van de Riet, 2003, p.23). The more actors, the more complex the situation becomes. ‘A multi-actor setting is characterized by both single-actor complexity and multi actor complexity. The single actor complexity exists within each actor, possibly in a unique form.’ (O. van de Riet 2003: 24).

With each action of an actor to try to achieve its objectives, the situation changes and this affects the other actors within the system. ‘Given that organizations and societies live in a complex and highly interconnected world, independent actions from each can produce non-anticipated, and uncontrollable consequences for all’ (Bouwen et al, 2004). So for successful policy implementations, one will have to investigate this interconnected and complex world to improve the chances of success.
So the more actors, the more objectives and perspectives the system contains and the less clear the outcome of certain interventions becomes. And often, with a growing number of actors in a system, the more relational factors will play part in the game in which the objectives are tried to be achieved.

Within the field of developmental problems the differences in perspectives even get an extra dimension. Relatively often, NGO and other development organisations will have a significant impact on the policy making. These policies are made from the perspective of, what are often foreign investigators and donors that will view the problem area from within their own perspective. Examples can be found in the earlier stated differences in criteria and perception for example. These perspectives are often different and sometimes even opposing from the perspectives of the people that will be affected by the policy.

A wide range of examples can be found in the field. A very concrete situation, not related to the research but serves as a good example to show the difference in perspectives, is the way some rural farmers in the Upper East deal with mentally disabled children. In some (not all!) cases, when the child is too much a burden to the mother/family instead of an asset, the child is poisoned. Where westerns see this as very unethical, for farmers this is sometimes necessary to survive. (This story was verified by multiple local sources).

A better documented example of misplaced western intervention is the Gambaga Witch camp. In this camp, witches find refuges when they are found guilty of witchcraft (Bradt travel guide, 2004). Western feminist and human activists however saw this camp, from their perspective, as a prison where the women faced a life long sentence for an imaginary crime. With the 'help' of foreign force, the women were released in 1997 but most of them refused to leave. The ones who left to their original villages had to flee back to the camp due to violence (such as ears that were cut off) from the local villagers. Misplaced perceptions and difference of criteria, whether a person is guilty or not, were clearly the cause of this incident.

So being aware of these fundamental differences of frames of references and being cultural sensitive are essential within development of policies in settings as such.

3.3 Characterization of networks and its implications

Within the current knowledge of a network it is stated that a network has basically four characteristics that separate a network from a hierarchical structure: pluriformity, interdependency, closedness and dynamic of structure dominate.
These characteristics are often used in order to determine policies and policy changes and a short description will be given in the following paragraphs.

3.3.1 Pluriformity

Pluriformity is the diversity in the network. Every actor has its own objective, resources and so on. In any society these characteristics can be seen as well. Every household or individual has its own characteristics, knowledge, power, financial resources, and objectives and so on. More African oriented are the differences in ethnics and tribes and for example the great variety of linguistic background one can find on a relative small area.

When implementing a new policy, one will need to take the pluriformity into account. The more diversity, the more likely opposite or conflicting objectives there are in the network. And the more pluriform the network, the more likely actors will act differently due to unique characteristics these actors have that they will use strategically. Next to this, not all actors will respond equally to the policy and different actor will reinterpret policies differently.

This is the case in societies in Africa, where inventions such as small reservoirs are tried to be implemented, as well. Some actors will happily accept certain interventions while others will try to avoid or even disturb such interventions. Social structures, knowledge, financial power, background and so on, determine the position of a person within the network and the assets the actor can use in order to obtain his objective.

3.3.2 Closedness

Closedness of the network is a characteristics that is easily been recognised in the societies. In African villages, often rivalry between different ethnic groups exists and kinship is a crucial factor of being part of the group or not. ‘The closedness of an organisation (read: village/community) is the result of its frame of reference which is formed by core values deeply rooted in the organisation and which determine its action to a large degree. Organisations are usually sensitive to interventions that fit their own frame of reference’ (de Bruijn and Heuvelhof, 2000: 27). So being able to determine that frame of reference will, partly, determine the successfulness of the intervention.

3.3.3 Interdependency

Interdependency exists in every group or society between actors. The amount of interdependency is partly dependent on the amount of connections made with
those groups. The more bonding ties, the more interdependency will exist in a network. Inter dependencies are what make the network hard to predict.

Often interdependencies are very hard to oversee which makes it very difficult in a society to oversee the consequences of an intervention or action by one of the actors within the system boundary. Some actors will take advantage of the dependency other actors have and use a hit and run tactic. Multiple objectives and multiple relations make a non-transparent situation which is hard to measure and as information is used tactically.

Different types of interdependency exist. Single/multiple, multilateral/bilateral, synchronically /a-synchronously, simultaneously/sequential, dynamic/static, each with their own consequences on the network (de Bruijn and Heuvelhof, 2000)

3.3.4 Dynamics

The dynamics of a network, such as a society/community, can be seen as power shifts, people die or come into the society, people loose or gain power/resources/etc and this affects the network. The more dynamic the network is, the harder it will be to predict certain consequences of interference. Policies may be adjusted to this characteristic as well by making the policy more adaptable or, possibly, loosely defined.

3.4 Steps of network and actor analyses

In order to investigate these networks and the actors involved, Enserink (2004, page 105) suggest there are 5 steps to do so:

1. Formulating a problem as a basic principle
2. Listing the involved actors
3. Determining their problem perceptions, objectives and interests
4. Charting dependencies between actors based on the list of means or means and the subjective commitment of actors to the problem
5. Examining the structure and culture of the network by charting formal and informal relationships
6. Estimating the dynamics within the network
7. Determining the consequences of these findings for the formulations of the problem

On the fifth point, the structural and cultural characteristics of the network are being investigated. Both formal and informal relations are analyzed by interviews, articles, observations and by other means.
Within dealing in this aspect, policy analysis does get into social sciences. By pointing out the ‘relational tasks’ it becomes clear for the different parties how the contributions of social and engineering science can be distinguished but also that they are dealing with the same problem domains, albeit from a different angle. (Bouwen et al, 2004)

3.5 Formal and informal networks

Policy analysis is seen as a social as well as a technical discipline. It analyses the formal and informal efforts of actors to improve policy outcomes by applying systematic evaluative rationality (Howlett, 2005). Therefore concepts in the field of social sciences are possible useful additions for the field of policy analyses and the characteristics of networks given by the Bruijn and Heuvelhof (2000).

Nevertheless, there are distinct differences between policy analyses and social sciences. ‘Where the engineering perspective concentrates on the progress of the task, the social science perspective focuses on the relational renegotiation through interpersonal conversations, creating new roles and identities’ (Bouwen et al, 2004: 141). This characteristic possibly might be helpful as the description by de Bruijn and Heuvelhof (2000) appear rather generally descriptive, unquantifiable and leave little concrete points to measure the nature of the network.

Informal and formal relationships prove to be very important within systems. It can explain, partially, why it sometimes appears that actors behave irrational. This is of great importance due to the fact that policy analysis has the assumption that an actor acts rationally.

Actors act in complex and multiple relationships, accept responsible memberships and a proper role and contribution in continuous negotiations with other members. This implies that actors no longer want to ‘solve’ social dilemmas but are able and willing to live with imbalances and inequalities in a flexible and evolving way of giving and taking, towards lasting and sustainable interaction patterns (Wilber, 1981). So it could be really worthwhile for policy analysts to look more into these relations. Informal and formal networking may partly explain why developmental organizations struggle to effectively implement policies while rural areas continue to follow their own stubborn logics of change and stasis as stated by Murdoch (2000).

3.6 Current knowledge Network and actor analyses

The difference between network and actor analyses is that network analyses focuses on how actors are interrelated and which rules apply within the system
boundary. Actor analysis focuses on the level where the perceptions, objectives and resources of the actors are analyzed. ‘When combined, the three concepts of perceptions, objectives and resources lead to actions: recourses can be used to act, objectives are used to determine if the resulting actions are indeed useful to an actor, whereas perceptions are used to indicate whether an actor also recognizes this link between the use of resources and realizing its objectives’ (Hermans, 2005, p:17). So the difference between network and actor analyses is the aggregation level.

One of the more basic approaches to analyze actors, is the stakeholder analysis: tables and matrixes are used to list the key characteristics of the stakeholders and are used to structure the data. ‘Stakeholder analysis contains fairly abstract factors such as interests, resources or influences that are difficult of an analyst of assess in practice. They float around and are not clearly connected to each other, to underlying theory or to real world observations.’ (Hermans, 2005, p:24). Depending on time and effort used for the analysis, listing the involved actors combined with their characteristics and examining those, does not always meet the requirements for analytical soundness. The usage of theoretical frameworks from which models can be derived is likely to improve the quality of the actor and network analysis (Hermans, 2005).

There are a range of different network and actor analyses based on models. On the basis of the criteria that models should have explanatory power, should be scientifically valid and accessible for future use, Hermans (2005) located different analytical models for policy making that are focusing on different characteristics of models gaining different insights:

- **Network analysis:** Models are used for structuring networks in which actors act; they are creating insights in the influence of actors, the decision making, the linkages between actors, the interaction patterns and so on. Social network analysis, dynamic access models and configuration analysis are examples of network analyses. Mathematical graph models and algebraic models are used within these analyses to predict behavior.

- **Discourse analysis:** These models are used for policy making through exchanging arguments; it creates insights in the perception of actors, the perceived roles of actors, underlying values, incompatible believes, and disagreements and so on. Argumentative, narrative policy analysis and Q-methodology are forms of discourse analyses. Coding input information and questionnaires are used in these types of analyses.

- **Cognitive mapping:** These models are used for problem solving based on the problem perceptions of the individual actors.: The model create insights in the potential conflicts, shared problem(s), perception(s), the
instruments and objectives of the actors and so on. DANA, SODA and self Q-interviews are examples of cognitive mapping models.

- **Conflict analysis**: These types of models are used for policy making through strategic games; they generate insights in strategic behavior, power and positions of actors, coalitions of actors, bargaining, and so on. Analyses of options, meta-game analysis, GMCR are examples of conflict analyses models.

- **Transactional analysis**: These models are used for policy making through exchanging control; they give insights in interest in issues of actors, voting outcomes and so on. Transaction process models and vote exchange models are examples of this type of analyses.

Transactional-, conflict-, discourse- and cognitive mapping- analysis focuses on the actors and the processes that will influence the implementations of policies. With means of games, exchanging control, locating possible conflicts, exchanging arguments and other tools, analyses are made of the system in which the policies will be implemented. With the help of these insights, policies and processes related to the implementation are adjusted (if needed) to increase the success-rate of such implementations.

Part of the differences between the two reservoirs Tonde and Tanga might be explained with insights that will be created by transactional-, conflict-, discourse- and cognitive mapping- analyses. The aim of the research on Tonde and Tanga, however, is to explain the differences in usage and management of the two reservoirs from the organizational and network perspective of the 2 communities. Did the differences in the existing networks in the two farming communities cause the differences in the two reservoirs, as ‘sustainability of introduced technology in rural contexts is based on the socio-environmental networking of local stakeholders’ (Campbell, 2005, p:367)?

The most applicable analyses are therefore the network analyses. Social network analysis and configuration analysis seem the most promising approaches. Dynamic access modeling seems less appropriate for the purpose of the research on Tanga and Tonde due to the focus on formal decision making process rather than on network characteristics. Dynamic access models emphasize the concept of access to actors and decision making centers where algebraic equations are used in models to explain or predict formalized decision making processes where voting power plays a central role (Hermans, 2005). Therefore theoretical frameworks and models used in social network analyses and configuration analyses will be examined in the coming chapters.
3.7 Configuration analysis and cognition

Configuration analysis has the (scientific) philosophical position that the ‘social reality’ is considered to be ‘the reality’. This reality is constructed and reconstructed by the people through interactions. It therefore rejects the position in which objective realities or different interpretations of reality are used (Termeer, 1993, p25-26). Related to these realities is cognition: ‘Cognition is a general term referring to awareness and thinking as well as to specific mental acts such as perceiving, interpreting, remembering, believing, and anticipating’ (Larsen, 2005, p:377).

So there is not one reality but a constant range of realities which are created from a range of social contexts. These realities are exchanged, developed and, negotiated, and so opposing views are created as such. The main focus of the analysis is on the interactions of actors in these processes. These processes determine the structure of the networks rather than that the structure of the networks determines the interactions. Configuration analysis creates a method to examine these dynamic and complex organisational processes (Termeer, 1993, p28).

Central themes of the analysis are (Termeer, 1993, p.29-35)

- Ongoing interaction: Double-interaction is the basis of interaction were an act of an entity leads to a reaction of another entity. This reaction creates a learning process for the first entity that acted and allows him to react on the reaction caused by his action. For change, a third facet in the form of an actor, an interaction rule or a reality definition is needed.
- The definition of the reality is the result of these (inter)-actions in which the different realities are exchanged between the actors. Examples of attempts to define these realities are for example the frames of reference described by Rein and Schon (1993).
- With the interactions, the actors create a collective structure. This structure depends on the perception of the actors towards interdependency and interaction rules. These rules will determine who will be involved in the process, who will fulfil which role, how conflicts will be handled and so on. These rules are dynamic.
- Social-cognitive configurations are a central theme in the configuration analysis. The social cognitive configuration is a ‘snapshot’ of the social process in the construction of reality. In this configuration one determines the interaction patterns, the interaction rules and shared cognitions: who, how and what. These who, how and what are so interrelated and depending on each other that analysis that focus on one aspect will be incomplete without integrating the other parts. Actors will be part of or feel
attached to multiple configurations and will never be fully attached to one configuration only.

The configuration analysis uses standardized statements on a policy issue to enable a quantitative comparison of actors’ perception. The results of this analysis are combined with a statistical analysis of the interactions among actors and form a combination of Q-methodology and social network analysis (Hermans, 2005, p.29). The Q-methodology is used to quantify the reality definitions (Termeer, 2005, p 48-49) to obtain an impression on the cognitive configurations (who thinks what) and how actors thinks about the policy issues. With the help of in-depth interview interaction patterns are constructed and quantified. Matrixes are made that contain the frequency of actor interactions for example.

3.8 Social networks analysis

‘Social network analysis is an interdisciplinary methodology developed mainly by sociologists and researchers in social psychology, further developed in collaboration with mathematics, statistics, and computing that led to a rapid development of formal analyzing techniques which made it an attractive tool for other disciplines like economics, marketing or industrial engineering.’ (Uwe Cantner and Holger Graf, 2006, p: 465) ‘It is based on an assumption of the importance of relationships among interacting units relations defined by linkages among units are a fundamental component of network theories.’ (Wassermann and Faust, 1994, p. 4)

Instead of analyzing individual behaviors, attitudes, and beliefs, social network analysis focuses its attention on social entities or actors in interaction with one another and on how these interactions constitute a framework or structure that can be studied and analyzed in its own right (Galaskiewicz, 1994). The concept has a range of other assumption such as (Wasserman and Faust, 1994, p.7):

- Actors and their actions are viewed as interdependent rather than independent autonomous units
- Relational ties between actors are channels for transfer of resources such as money, material, information and so on)
- Network models conceptualize structure as enduring patterns of relations among actors

Network analysis begins with data that describes the set of relationships among the members of a system. The goal of analysis is to obtain from the low-level relational data a higher-level description of the structure of the system which identifies various kinds of patterns in the set of relationships. These patterns will
be based on the way individuals are related to other individuals in the network (Seary and Richards, 2003).

Networks are a form of ‘relational data’. Relational data that arise in many social science fields and graph models are a natural approach to representing the structure of these relations. In these applications, the nodes usually represent people and the edges represent a specified relationship between the people (Handcock, 2003, p: 229).

Relational data are rooted in cultural values and symbols. (Scott, 2005, p2): they are the contacts, ties and connections, the group attachment and meetings, which relate one agent to another and so cannot be reduced to the properties of the individual agents themselves: they are the property of the systems rather than the individuals.

Other type of data, such as attribute data (attitudes, opinions and behavior) are more for variable analysis. Techniques for the analysis of this type of data are less well developed than those or relational data. Ideational data (meanings, motives, definitions and typifications) are more for typological analysis (Scott, 2000).

Relational data is modeled in matrices and sociograms. The networks are represented as graph of points and lines and concepts such as distance, direction and density are used. Centrality and sub groups in networks (named cliques and circles) are modeled in these representations. With the help of computer multidimensional those maps can be analyzed and predictions can be made (Scott, 2000)

3.9 Cognition and social networks analysis

Social network analysis recognises the importance of social cognition and tries to explain social cognition processes by the insights created with the help of social network analysis models. ‘Although many of social cognition processes have been argued to depend on the context of social relationship in which they occur, relatively little systematic examination has been undertaken of the relationship between social cognitions and the social context. (...) No doubt the difficulty of specifying and measuring relevant aspects of social context have contributed to its status as an acknowledged but rarely studied component of social cognition’ (Pattison, 1994, p. 79).

With the help of social contextual models Pattison (1994, p 93-103) argues that cognition is influenced by the social contexts in at least 3 different ways:
1. The specific information individuals are exposed to, is determined by the social context in which these individuals are located. Social relations serve as information channels in social processes. Information is communicated through these channels and as a result the position or the setup of the network will determine the information the individual gets.

2. Social contexts are related to patterns of social interaction. These patterns are likely to be associated with particular associations about future social events and may lead to types of cognitive bias.

3. An individual’s social context frames social cognition because cognitive processes may directly involve the individual’s perception of his or her role. It is based on the observation that a person’s cognitions occur within a context of evaluations of the situations of others in the social environment.

Recent developments in network analysis offer a useful contribution to the investigation of the role of social context in social cognition (Pattison, 1994, p:104). So social network analysis examines the structuring of the networks and handles cognition as applications of the insights created by these analyses.

3.10 Cognition and networks: Social Capital

Cognition and reality are handled fundamentally different in social network analysis compared to configuration analysis. Social network analysis looks at cognition from the perspective that ‘many of social cognition processes have been argued to depend on the context of social relationship in which they occur’ (Pattison, 1994, p. 79). The networks are seen as the reality (and) in which actors are influenced. However, configuration analysis sees this the other way around. The reality is seen as the result of interaction. Even the network in which the actor acts can be the discussion of the definition of reality (Termeer, 1993). Or to summarize it: social network analysis states that actors’ cognition is influenced by the network in which they are in and configuration analysis says that networks are determined by the cognition of actors.

Apart from the differences in approach of reality and cognition, policy issues are handled differently as well. The focus of social network analysis is limited to structural network characteristics, but unlike the other actor- and network-models, no assumptions are modelled as to how policies are made. Configuration analysis is used to analyse the social cognitive configurations, based on standardized statements on a policy issue to enable a quantitative comparison of actors’ perception (Hermans, 2005, p28-29)

A more recent framework, compared to social network analysis, combines these 2 approaches in a way that social cognitive configurations are used to enable
quantitative comparison of the actors’ perception of the structural network characteristics in which they act. It includes a range of perceptions and investigates these perceptions with the help of a questionnaire. The analysis deals with the most important network in the system in the perception of the actors, the trust in the individuals within the system, the perception whether people are taking advantage of one another and whether people are willing to the help, and the perception of what important information sources are and so on. The questionnaire used for this research can be found in the appendix.

The framework was first introduced by Putman in 1990 and was called ‘social capital’. Using the lens of the social capital framework provides new insights into policy design (Narayan, 1999, p:43).

3.11 Definition of Social capital

Social capital has many ways in which it is described and even used. Yet, for this purpose, the following description is used within the report: ‘Social capital can be defined as the web of groups, associations, networks, and norms of trust at the community level that form the social underpinnings of poverty and prosperity’ (Putnam 1993). It does not only analyze the perception of the actors but also the activity of the network such as jointly writing petitions.

The intention of social capital as introduced by Putman (1990) is not to use the framework of social capital as a network analysis as it is used in this report. The intention is to measure the amount and strength of social networks which are seen as an asset for the community and individuals. By measuring social capital with the help of questionnaire and the use of indexes, one can relate amount of social capital to other community characteristics such as financial prosperity.

‘It is a useful metaphor that suggests that a society with a rich web of relationships and widespread participation in community organizations will flourish, and that individuals who hold large accumulations of social capital will be at an advantage over others with less’ (White, 2002: 1). Both for individuals as for the society, social capital is an asset which pays of to invest in. As with other forms of capital, one will need to invest time, effort and sometimes money in it. To create networks, one will need to take time to make contact, make them valuable and maintain these. The more time, effort, money and so on will be put in these aspects, the more likely it is that one will create a bigger amount of social capital.
3.12 Impact of social capital

In social sciences and beyond, social capital proved itself valuable to explain and predict certain facets of society. ‘A range of social problems—crime, health, poverty, unemployment—have been linked empirically to a community’s endowment of social capital (or lack thereof)’ (Grooteart, 2004: 3). And the amount of social capital in a community influences the efficiency of production, happiness, life satisfaction and wellbeing (Helliwell and Putnam, 2004).

To get a grasp of the impact of it, ‘one standard deviation increase in village social capital increases household expenditures per person (a proxy for income) by at least 20 to 30 percent. This impact is as large as an equivalent increase in non-farming assets or tripling the level of education’ (Narayan, 1997: 1).

Social capital is often, relative to the other types of capital, the most powerful and abundant sort of capital that exists in the communities of third world countries. ‘Social ties are now viewed as important assets, a form of capital on a par with natural, physical, financial, human, and political capital, and a potential instrument for building these other forms of capital’ (Meinzen-Dick et al, 2004: 202).

Because social capital can be of importance for policy design, it is important to know how social capital can be influenced. Social capital is interlinked with often aspired aspects of developmental programs: community driven development and self empowerment. Social capital, community driven development (CDD), and empowerment are related but not equivalent concepts. ‘Success in enhancing the level of any one of these concepts will have the tendency as well of improving the prospects for the other two concepts’ (Anirudh Krishna, 2003: p1).

‘Community Driven Development is a process that recognizes that poor people are prime actors in the development process, not targets of externally-designed poverty reduction efforts. In CDD, control of decisions and resources rests with community groups who may often work in partnership with demand-responsive support organizations and service providers, including elected local governments, the private sector, NGOs, and central government agencies.’ (Gillespie Stuart, 2003: 4). Empowerment will later on be discussed in the report.

3.12.1 Cons of social capital

It must be understood that in the scope of development, social capital can be positive as well as negative. Clubs, coalitions, movements, organizations, and other forms of networks can include individuals which may lead to improvements for the individual. But the other way around, when excluded from these
organizations, the individual may be exposed to more poverty. This exclusion can be on various aspects -political, social, cultural, emotional, and economical- and can have severe impact on an individual’s life.

Another downside of a high social capital is when networks tend to feel threatened by other strong networks. This may lead to side effect that threatens both sides of the networks. ‘Not all the externalities of social capital are positive. Some networks have been used to finance and conduct terrorism, for example’ (Helliwell, 2004, p1437). Or more to the African context: ethnic groups that are very cohesive may start to clash as more than 1 network wants a scarce resource, such as chieftaincy or land.

How communities gain social capital, is uncertain, which makes social capital hard to implement in policy making when the objective is to increase the capital in order to let certain implementations of technology function. The origins of social capital are shrouded in uncertainty; no one knows as yet for sure why some communities have a higher stock of social capital than other communities. (Anirudh Krishna, 2003). Yet, social capital can be used in policy making in multiple ways.

3.13 Different types of ties within social capital

One can distinguish three different types of ties within social capital: bonding, bridging and cross cutting ties. ‘Social capital includes both horizontal ties among a group, referred to as “bonding social capital” as well as vertical ties between different groups referred to as “bridging social capital”’ (Meinzen-Dick, 2004: 201). Bonding ties reflect the cohesiveness of the group and the intensity of the usage of the network.

More recently it was realized that a third, the vertical ties, was missing. These are called the cross cutting ties. On the subject of cross-cutting ties, several writers have pointed to the importance of ties outside the primary network as a means to access resources and power outside the group (Narayan, 1999: 15). It basically comes down to linkages that are established to higher social levels. To know somebody important can help to bring one higher up as well. One can argue that these ties are organized differently in third world countries in some cases than in western countries. Usage of some of those ties will be described as corruption in western countries while in third world countries these are, at least informally, accepted. Having a family member in certain organisation, for example the government, can bring externalities that are not accepted in many western countries.
3.14 Aspects of social capital

One can measure and evaluate social capital on a range of aspects. However, to measure a concept such as social capital, which is vague and difficult to define, is inherently problematic, partly because it is very dependent on the definition one will give to it and the different weights one will give to the different aspects of it.

The attempts, such as the standardized questionnaires of the World Bank to quantify it are increasingly seen as an over-ambitious endeavor (White, 2002). The World Bank made such an attempt with the help of a standardized questionnaire containing the following 6 sections:

1. Groups and Networks
2. Trust and Solidarity
3. Collective Action and Cooperation
4. Information and Communication
5. Social Cohesion and Inclusion
6. Empowerment and Political Action

(Source: Grootaert et al, 2004)

The social capital in a community increases when one or more of the 6 aspects increases and the other aspects stay constant. More extended are these aspects discussed in the following chapters.

The adapted questionnaire used for the research can be found in the appendix. The majority of the answers that can be given to the questions are either ‘open questions’ or based on a rating system. This rating system, depending on the question, mainly goes from 1 to 5 (such as question 19: In general, how safe from crime and violence do you feel when you are alone at home?: 1. Very safe, 2. Moderately safe…to 5. Very unsafe)

3.14.1 Groups and Networks

The Groups and Networks section forms the most recognisable link with the network and actor analyse of policy analyses. ‘Social networks could be defined as a web of social relations or resources that surround individuals, groups or organizations and the characteristics of their ties. Analysis of the networks focuses on the patterns of the ties between actors as a social system, or connections, where the unit of the entity in some way relates to other units’ (White, 2002:261).
This section investigates the social networks and is therefore sometimes described as the structural part of social capital (Grootaert et al, 2004). The questions in the questionnaire focus on the number and the size of the networks in a community, the perception of importance of networks and the homogeneity of them. The ethnic, linguistic, gender, occupational and educational characteristics and constellations are examined. With question 5: ‘does this group (the most important group of which the family is part of) work with or interact with groups outside the reservoir?’ the bridging ties of the groups are examined. It enables to get more insight into the actual formal and informal networks that are existent in the society and how they are used.

3.14.2 Trust and solidarity

Social trust—that is, the belief that others around you can be trusted—is itself a strong empirical index of social capital at the aggregate level. High levels of social trust in settings of dense social networks often provide the crucial mechanism through which social capital affects aggregate outcomes. (Helliwell and Putnam, 2004: 1436). Solidarity is the unity and agreement resulting from shared interests, feelings, actions, sympathies etc (Source: Oxford advanced learners dictionary, 1989).

Trust is an important aspect of cognition. The questions in the questionnaire focus at the trust towards neighbours and strangers, government and the trust one needs to join a collective action. For the collective action, which is the next part of the analyses, one will need to trust the other that they will add their part of the effort into the project as well. If not, the initial effort by the individual would be lost or the project is not as effective as wished for.

Trust is a feeling that individuals have often due to feedback on experiences of themselves or other actors. The perception of trust comes forward in statements such as question 9b: ‘In this village, one has to be alert or someone is likely to take advantage of you in the dry season’ (1: agree strongly,…, 5: disagree strongly). When a lot of people have the perception that people will take advantage of him or her, during farming activities for example, collective action is less likely.

Trust comes down to whether an actor is willing to accept and give information, services, material and so on to another actor. It is a measure on how eager one is to rely on the other. One could see it as the strength of a connection when a connection is already established and the willingness to make such a connection when it is not there. Nevertheless, trust is not deterministic for this; many other factors play a role in this. For example, what the other actor has to offer.
3.14.3 Collective Action and Cooperation

This category explores whether and how household members have worked with others in their community on joint projects and/or in response to a crisis (Grootaert et al, 2004)). ‘Cooperation has always been fundamental for human society, and plays a particularly prominent role in rural development programs’ (Meinzen-dick, 2004:198) mainly because NGO’s or other organisations active in the field assume certain cooperation from the target group.

‘Although not often mentioned, this action should be voluntary, to distinguish collective action from hired or corvee labour’ (Meinzen-dick, 2004:200). Collective action requires the involvement of a group of people, a shared interest within the group and some kind of common action that works in pursuit of that shared interest.

Much of the willingness of farmers to participate in collective action will depend on the perception whether other farmers will help as well. These facets come forward in the questionnaire, for example in question 14: ‘If there was a water supply problem, such as in the reservoir, in this community, how likely is it that people will cooperate to try to solve the problem?’

Solving community problems effectively will be influenced by the response from within the network and the amount of actors that will respond effectively. Consequences of not participating will have effect on the objectives from each actor.

3.14.4 Information and Communication

The way one communicates, is partly culturally determined. ‘Theories of communication, which posit that the medium upon which a message is transmitted is itself an integral part of the communication process, clarify the analytical utility of the culture concept in ways that account for empirical data.’ (Lyon, 2005: 1)

This category of questions explores the ways and means by which poor households receive information and the extent of their access to communications infrastructure in the rural communities. With the use of open questions, such as question 16: ‘what are your three main sources of information about what the government is doing (such as the agricultural extension)?’, biased -ness towards cultural elements is avoided.

3.14.5 Social Cohesion and Inclusion
Social cohesion refers to networks and institutions that combat inequalities and enhance social solidarity and shared identity (Berman and Philips, 2001: 183). It looks into whether the community experienced violence in the past based on inequalities or differences based on ethnic, linguistic, social or educational background. Whether individuals feel safe in their direct environment and how the social interaction with friends and family takes place. So this goes into the perception of farmers whether differences in the network form a threat or a problem.

The questionnaire was partly adapted by removing some of the questions. The questions regarding the violence based on ethnic difference for example were removed. These questions could be an unwanted catalyst of feelings which could lead to a heated situation.

3.14.6 Empowerment and Political Action

This section explores a rather wide range of concepts as the personal sense of happiness and the feeling of being able to change the course of life. Most of these concepts are based on the perception of the individual. For example question 20: ‘how happy do you consider yourself now?’ is examining this perception. However, not all questions go into the perception of the farmers. For example, political activeness and whether the community was able to organise themselves in order to benefit the community as a whole are examined.

Much of these aspects however have links with perceptions as awareness forms a cognitive aspect. Empowerment can be seen as the awareness of the power of the network and the performed action as a result of the awareness. ‘Empowerment can be either understood as an internalized attitude or as an observable behaviour. The goal of empowerment processes is to change the cognitive, social, and/or political conditions by an intervention in the form of personal cognitive and emotional change. Empowerment presupposes that many competencies are already present or possible and that there are given opportunities to act. In a state of cognitive, personal, or social discontent, a group of involved persons discovers its own strength by coming together and cooperating with other individuals being in a similar situation’ (Schaurhofer and Peschl, 2003: 261).

3.15 Analyses of frame of reference

Yet another improvement in the actor and network analyses can come from improving the insight in the frame of reference of the different actors. As suggested in the list of network and actor analyses by Enserink, in step 3: ‘Determining their problem perceptions, objectives and interests'
These new insights can come from the side of anthropologists. Using local knowledge and transform this in knowledge that is helpful in the policy planning, could help and avoid problematic situations. It is the local people that will have to adopt certain solutions. And in order to be successful in this, the local needs will have to be known and possible adaptations will have to be made to the system, rather than try to let the local people adapt.

As stated before, policy analysis analyses complex worlds with the help of multi-perspective and multi-objective analyses. It is a way to analyze and structure the views and needs of all different actors while those actors often depend on each other. The interests of actors and their perceptions of reality determine their objectives – that is, the outcomes they want to achieve (O. van de Riet, 2003, p.23). This perception of reality is determined by the frame on which situations are reflected on and referenced to: their frame of reference.

Each individual within the problem area as well as the policy makers that try to solve the problem view the problem from within their frame of reference. 'Framing is a way of selecting, organizing, interpreting and making sense of a complex reality to provide guideposts for knowing, analyzing, persuading and acting. A frame is a perspective from which an amorphous, ill-defined, problematic situation can be made sense of and acted on (Rein and Schon, 1993).’ These differences in frames do not only exist within the system to be analyzed, but also on the side of the researchers.

So any firmly analysis will have to include a well analyzed and thought through frame of reference of the actors. Within these frames, local knowledge is embedded. Yet, this is not done in many cases. Ineffective implementations of (technical) systems in third world countries are often also part of a certain groupthink that existed and still exists within the field of researchers that were involved in developmental problems. This is exacerbated by the lack of opportunity that a farmer may have to either use or challenge a scientist’s views or knowledge and that the scientist mainly look into traditional objectives such as yield increase (Alsop and Farrington 1998). This increased the un-sustainability of the suggested solutions and new insights are needed to break through this impasse.

3.16 Policies in the local context

But a firm analysis of the actors, their network and their frame of references will not be fully adequate to obtain appropriate policies. Local circumstances, cultural characteristics and a wide range of other different aspects should try to be
combined in the design of policies. Including this, yet from another angle of approach, possible new and better policies can be made.

With the coming of Hofstede and Trompenaars, the field of engineers was confronted with the usefulness of cultural anthropology due to its attractiveness of the quantitative approach. In the world of anthropology the approach by the two writers was received with scepticism. Nevertheless it proved its usefulness in management and policy making by giving insight in cultural characteristics of societies. And so an attempt will be made to take this into account with the analysis. Yet, the approach taken by the two writers will not be of much use with the making of policies towards management of water reservoirs for various reasons. A more, vaguely, but possible useful way is described by the anthropologist named Geertz.

The approach used is described by Geertz as the following: ‘to cling-as, in my opinion, we must- to the injunction to see things from the native’s point of view’. But with the note: ‘we had been taught to believe, through some sort of extraordinary sensibility, an almost preternatural capacity to think, feel, and perceive like native, how is anthropological knowledge of the way natives think, feel and perceive possible?’ (Geertz, 1983:56)

He does not give a straight answer to this, but he gives a sensible clue of an approach to describe the natives point of view: ‘The trick is to figure out what the devil they think they are up to’ (Geertz, 1983: 58).

Using this insight given as a parallel approach to social capital could give new insights and improve the success rate of policy implementations. It will be used to give the framework of social capital a context in which the outcomes can be placed and interpreted.
4 Research methodology

The analysis is split in three parts:

1. The contextual analyses
2. The measurement of social capital
3. The analyses of the lifecycle of the reservoir

The contextual analysis is a broadly defined analysis in which local characteristics such as social facets, the impact of seasonality, religious systems, and governmental institutions and so on are described. The second part of the analyses focuses on the social capital in the two farming communities after which, in the 3rd part, the impact of the differences of social capital on the lifecycle of the reservoirs is analyzed.

For the communication with the two farming communities a local translator will be used.

4.1 Contextual research approach

The first step of the analyses is to determine the context in which the networks and communities are analyzed. In order to determine contextual aspects, no preset framework is used. These contextual aspects can be related to the history, traditions, culture, their value systems toward water and so on; the frame of reference of the local people. These aspects can be so diverse that a preset framework possibly could exclude factors that are of importance in the local context. By means of interviews with local farmers and the help of common sense it will be tried to get more insights on these facets.

The approach that will be taken will be from an anthropologist names ‘Geertz’ who wrote articles on how to use local knowledge as a basis on which the society should be studied on. This approach focuses on the usage of common sense as a manner in which to approach the local culture/society. Hereby an important aspect is understanding local common sense in order to understand the local frame of reference.” He states ‘treating common sense as a relatively organized body of considered thought, rather than just what anyone clothed and in his right mind knows, should lead on to some useful conclusions; but perhaps the most important is that it is an inherent characteristic of common sense thought precisely to deny this and to affirm that its tenets are immediate deliverances of experience, not deliberated reflections upon it. (...) Religion rests its case on revelation, science on method, ideology on moral passion, but commonsense
rests it is on the assertion that it is not a case at all, just life in a nutshell. The world is its authority’ (Geertz, 1983: 75).

The usage of common sense is in line with frame of reference. It basically comes down to how the actor relates problems, ideas and so on to his frame of reference in such way that it does not contradict itself and will be, when behaving rationally, done consistently.

When one wants to know how information is used when it is stored, one will have to know what information is stored (and, as said before, of less importance is how it is stored). So being able to know how an actor acts involves understanding, or knowing, what he knows as well. One could see this as local knowledge and is therefore of essential value as well.

Clearly it can be seen that this approach doesn’t have any concrete framework. Therefore by means of in-depth interviews, more insight in the frames of references of the local people will be tried to be gathered. Ideas of decision cycles, the reasoning behind tactic decision regarding the use of fertilizer, water and seeds, position of women and so on will be tried to be investigated. Or as a summary, with the use of common sense it will by tried to figure out what the devil the communities they think are up to.

4.2 Determination of social capital in the Tonde and Tanga

The World Bank developed a standardized questionnaire to measure social capital. This questionnaire examines the framework that is described in chapter 4.9. The questionnaire itself can be found in the appendix. In this research, this framework and questionnaire of the World Bank will be taken to determine the different aspects of social capital in the two different farming communities.

This choice has been made due to a limited time for the research and the assumption that 10 years of research of the World Bank and other organizations will be at least a more valuable approach than this research could create. And the fact that the World Bank made the questionnaire in the scope of development work makes it applicable for the purpose. Yet, the definition of social capital is still developing and should not be seen as a final definition.

The shortened version of the questionnaire, containing only the core questions, is used to measure the social capital in the villages. The reason for this is the limited time and resources. In perspective: the core questions contain four pages of questions, the extended version 20 pages.
With the use of the questionnaire, social capital can be measured and compared between the two villages. Data analysis will be used to locate the numerical differences. A 10% confidence interval will be used. This interval is chosen because the target group, described in the following paragraph, is relatively small and the scale on which could be replied (often, scale 1 to 5) is rather limited.

Differences in these factors of social capital are expected to give better insight in the way these communities organize themselves and how this is reflected in the management of small reservoirs. The questionnaire, that has been adapted to local needs and circumstances, can be found in the appendix. Questions changed so they relate more to the farming activities and make a clear link with the water management and maintenance activities. As an example of such an adjustment is the addition of seasonality within the questionnaire. A data analyses program will be used to analyze the information gathered with the help of these questionnaires.

4.2.1 The target group of the measurement

The focus will be on the farmers using the reservoirs in Tanga and Tonde. The reason for this is because very limited research data is available regarding the efficiency of the reservoirs for the purpose of irrigation. Both Tanga and Tonde were analyzed very recently by Faulkner (2006) and data regarding these reservoirs and their efficiency is generated within this research.

When measuring social capital with the questionnaires, the main focus will be on the downstream farming communities. This target group is chosen as such because the published results of the report by Faulkner (2006) only give insight in the results generated by these farmers. These downstream farmers are responsible for the maintenance of the valves and channels, the way they distribute the water and will be the main players in the differences that were located in the research (Faulkner, 2006) between the reservoirs.

Nevertheless, it is also understood that small reservoirs are multifunctional. Important therefore is also to integrate, if possible, aspects of other functions, such as fishing, in the analyses described in paragraph 4.1 and 4.3.

4.3 The lifecycle of the reservoirs

The third part of the research will be the analyses of the influence of the findings in the lifecycle of the reservoir. This lifecycle starts with the initiation of the reservoir, followed by the adoption and the usage of the reservoir. Future scenarios are not described in this report. A more extended explanation of this
lifecycle can be found in the chapter 'Influence of the social capital in the life cycle of the reservoirs'.

The existence of social capital, or the lack of it, will have different effects in the initiation of the reservoirs. The same can be said of the other stages in which the communities made decisions how the use the reservoir, for example the choice of the irrigation setup, and the current way the communities are using the reservoir.

By means of in-depth interviews it will be tried to track the histories of the reservoirs and the processes the communities went through.
5 Contextual Analyses

In order to determine what differences within societies could exist, other than the factors from social capital, a general description of the societies is given. The seasonality, religious systems, ethnic characteristics, an overview of the characteristics of the two reservoirs and the local institutional systems will be described.

These aspects can and, in some cases, will determine the success of the reservoirs. Differences in religious and ethnic characteristics can mean a difference in reference framing and create such a pluriformity that the functioning of the system can be affected. Differences in the characteristics of the reservoirs can determine the effective use of water, inputs, and outputs and so on. Seasonality, on its turn, will be the same for both groups, but is greatly determining the pace of living in the Upper East Region and is of importance for understanding certain aspects of life.

A main source for the information in this chapter is the translator (Haruna Kumasi) used for this research. His knowledge was assumed to be up to date and relevant as he lived his whole life in the upper part of Ghana. He spoke the local language fluently and was involved in farming activities in the past. He is comparatively well educated and socially active as a supervisor in schooling activities of illiterates.

5.1 Seasonality and its impact

Within the upper east of Ghana, seasonality plays a big part in the usage of the reservoirs. The seasonality divides the year in dry and wet season. The reservoirs have the most important function in the dry season when it enables the farmers to grow crops, mainly onions, while before the usage/existence of the reservoirs most of the farmers were forced to move down south. In the wet season, the rain provides enough moisture to farm outside the boundaries of the small reservoirs, which was traditionally done before the coming of the dams.

With the change of seasons, the crops that the farmers grow change as well. While in the rainy season the focus is mainly on rice and corn and other crops such as ground nuts, sweet potatoes, cassava, shear nut, the focus in the dry season shifts mostly to onions, tomatoes and some other small crops.

The main difference in these crops is that onions and tomatoes are grown with the focus on selling it with the idea of a profit. This is the case as well with the rice and corn, yet, these crops can provide the farmers community with the
needed food supply for the whole year. Onions and tomatoes have a limited function in this respect and form more of an addition to food than the main dish.

Due to this, dry and wet seasons have different characteristics in the life of the farmers, which could be of influence on the social capital. As an example, the trust is likely to change when food becomes scarce. It is therefore important to include these aspects in the questionnaire or be specific about the time frame in which the question is placed.

With the cycles of seasons, the differences of farming and so on, the hunger, price and budget cycle are determined for the farmers. Strategic decision of the farmers are partly based on these cycles and are therefore of importance to be understood. First of all the hunger and than the price and the budget cycles are described. After that a decision line is made in which decision points are marked.

5.1.1 Hunger cycles

Hunger is undoubtedly related in the mind of most people with Africa. It has clearly its impact on the societies in the continent and will have its influence on the social aspects. In order to understand how these cycles of hunger are created the following diagram (fig. 4) is made:

![Hunger cycle diagram]

**Figure 4: hunger cycle diagram**

The diagram represents the cycle of hunger that is experienced by the farmers. The horizontal axis represents time, divided in dry and wet seasons. The vertical axis represents hunger. Where the line comes under the horizontal axis, it means that there is abundant food. When the line comes above the horizontal line, this means that food gets scarce. And for some families, this means hunger.

The hunger is directly related to the food availability on the market. This availability is mainly created by the farmers themselves. During the first harvest
in the wet season, approximately, three months after the planting of the seeds, the hunger that is build up during the dry season comes to an abrupt end. However, as the year progresses, the food available will slowly decrease and the hunger will grow.

When the hunger is at its most fierce and reaches its peak, the load of work experienced by the farmers is at its peak as well. It is the period on which the physical demand labour activities have to be done on the farming fields mainly containing corn or rice. The perceived hunger in that period will be even more intense due to this.

Important is to understand that the amplitude and the time line are not exact. When some families will suffer from hunger other families are well off and will not face any hunger. Hunger will depend on the harvest, which is dependant on rainfall, plant disease, quality of seeds, fertilizer, irrigations, and successfullness of the farmers and so on. The wet season starts with the first heavy showers, yet these showers, the time of arrival and the amount, differ from one year to another. This will have direct impact on the hunger cycle.

These diagrams should therefore be seen as schematic representation of the cycles but not taken too exact. The time of the wet and dry season can easily differ more than a month. In some years families will face hunger very early in the year and in some years food is (relatively) abundant.

5.1.2 Funerals

Another factor that plays a role in the hunger cycle as well as in the working cycles, are the funerals. Funerals are expected to be combined with an abundance of food in such extend that it has a big impact on the amount of stored food and take such a long time that farming activities are heavily interrupted by it. The ceremonies are a very distinct aspect of the culture and can differ from one place in Ghana with the other. Ethnic and religious background determines the way ceremonies are performed.

The funerals and the burial ceremony are two time-independent happenings and often the funerals are delayed until there is enough time and money to perform the ceremony. It can happen that these funerals happen even 10 years after the person died and will only happen after a good harvest/season. Multiple persons can be buried in one ceremony.

For traditional worshippers the funeral ceremonies take the longest: 12 days. However, this period fluctuates depending on the region. Muslims and Christians have considerable shorter ceremonies that are around two or three days. It can
happen that different religions are present in a family and two or more ceremonies are held for each religion.

The greatest abundance of food is created in the first period of the funeral and can take up to 6 months of food supply for a family. This abundance depends on the size of the family (this includes in-laws and can easily reach up to 100) because family has to bring food as well. For relatively large sized family around 150 animals can be slaughtered to give blood to the ancestors in the first ceremony alone. Where mainly sheep, goats, chicken and guinea fowls are slaughtered in the first ceremony, pork is the main meat in the second ceremony. Other ceremonies include lots of drinks, tizzet (local porridge) and other local dishes. The family that is host of the ceremonies is obliged to supply food for all the visitors during the 12 days.

It may seem cultural insensitive but Muslim and Christian locals often scolded the worshippers and told them they were fools to waste food in such extend and suffer the next moment. For the traditional worshippers it is a matter of the more food, the more pride the family has. Independent of which perspective is taken, the ceremonies have a large impact on the food stock of families and therefore the hunger cycles.

5.1.3 Price cycle

As with all market forces, the availability of the products on the market combined with the need determine the price. This is the case on the markets in Ghana as well, and so, the following diagram (fig. 5) for the food prices (this means: rice, corn and so on, not so much the onions) can be constructed:

![Fig. 5: Price cycle diagram]
The first thing that becomes clear is how the hunger seasons are created. When the harvests in the wet season start, the market prices of the food drop due to the increase of food on the market. It brings an abrupt end to the hunger, but it brings an abrupt end to the favourable prices for the farmers as well. Yet, the amount of hunger that a farmer will experience will partly be determined by price it will get for his crops. Every harvest will cause an increase of the budget of the farmers. Yet, it also means the start of a new cycle in which he will have to invest in seeds, fertilizer and other inputs.

The price cycle of the onions has the same wave characteristic only reaches its minimum just after the harvest in the dry season, which is around April. A bag of onions will cost around 160,000 Cedis (around 16 euros). Onions have roughly a three month storage capacity when it comes to the rotting and so the price will increase even more rapidly after that period. A bag of onions after three months will cost around 500,000. During wet season some farmers are able to grow onions and a price peak of, around, 800,000 Cedis is reached.

5.1.4 Decision and work cycles

Within these cycles, the farming and maintenance work of the farmers is performed (fig. 6). The seasons change but the work is roughly the same. The biggest difference is the independency of the reservoir, yet sowing, weeding, harvesting and so on are repetitive activities that come with every season. Some big maintenance activities often happen in the beginning of the dry season. Examples were proper cleaning and repair of the water channels. Small repairs were made during the season.

There is a possibility as well for the farmers to have a second harvest after the onions are harvested. This harvest consists of vegetables other than onions. Only limited farmers could be seen doing this, mostly at Tanga.
Fig. 6: the decision cycle

5.2 Religious systems

The farmer communities can roughly be divided into four religious groups: Muslims, Christians, traditional worshippers and non-believers. The four types of believes live relatively peaceful next to one another and the freedom of religion is highly appreciated and well respected freedom in Ghana.

The Christian belief does not differ that much from the European way of believing. The same can be said for the Muslims, although it is often seen as less strict compared with the Middle East: burka's, stoning and other extreme forms are rejected. Sex before marriage, as an example, is often not seen as a major problem. This of course is within the perception of individuals and cannot be generalized.

Traditional worshippers are, as the word says, the traditional way of believing that exists in Africa, and in this case the Upper East Region. The religion finds its roots before the coming of Christianity and the Muslim religion and forms therefore a very old aspect of the culture. A cloud of mystery hangs above this type of believing, especially for Western foreigners, because one finds it hard to relate this type of religion to anything that is present in their religious traditions. Muslims, non believers and even Christian priests that were encountered on the
subject didn’t deny the ‘effectiveness’ of the belief. Yet they were hesitant to be named ‘traditional worshipper’, partly because it is not inline with their other believes. But it gives the importance and the fundamentally importance of this religious believe in African societies.

It is not a strict and well defined religion and is very open to ones own interpretation: some believe in one god, some in more. The use of ‘Juju’ is however general. Objects, often in forms of rings, bracelets, necklaces often made from animals and containing some other objects, are believed to have special powers and protects individuals from bad spirits, knifes, bullets, evil forces and so on. Yet when used by a weak person or used in the wrong way, these objects will not help but harm the person.

The gods/spirits are reached through offers. These offers are offered to shrines on the ground: often a sort of pot close to the family compounds. By offering animals, food and so on, the will please the god(s). They do not believe in predestination: they can alter the future by pleasing the gods. If in case of failing worship and non fulfilled prayers, they will go to ‘Sooth-sayer’: not a religious leader, yet, someone gifted by god and will be able to work out why it went wrong.

In front of many houses one can see the gods of the traditional worshippers. These are often stones, trees or other objects. Often they are covered with feathers as part of the worshipping. Example of these gods can be seen on the pictures below (Fig. 7).

*Figure 7: examples of gods*
So, the big difference between the traditional worshippers and the Muslims and Christians is, on one perspective, the fact that both Muslims and Christians believe in some sort of predestination: ‘It is Gods will’. The external factors are ruled by God and by nobody else than by him. The traditional worshippers believe they can influence these external factors by offering and performing rituals. For example, traditional worshippers do believe they can call for rain while Christian and Muslims do believe that is lost effort.

5.3 Chiefs, Tindana’s, government, conflicts and ethnic background

In the culture in the upper east, one can detect three parallel and relatively independent power structures. When one asks about it the local people refer to the sentence: ‘the chief is for the people, the Tindana for the ground’. These structures are historically determined and go back to the beginning of the settlements and still cause heavy conflicts most visible in Bawku, close to the study sites. Next to the chieftaincy and the Tindana’s the third power is the local government.

One could state that for traditional matters, one goes to the chief; anything related to the government, one has to go to the assembly man. And when some unexplainable, out of the ordinary happenings take place, one will go to the Tindana.

5.3.1 Tindana’s

The conflicts in Bawku are mainly dominated by the conflict of chieftaincy yet, the Tindana’s have an, probably fundamentally more important role. Where power, in the form of chieftaincy is fundamental, the right of landowning and the dividing of land, possibly even more. In the history expanding kingdoms/states/etc was often not to rule yet another group of people but to get land and its resources that come with this. Because, nowadays, most landowning problems are solved and by law it is clear who own what, land issues are now somewhat settled, but still the Tindana’s impact is still there but arguably less. They still fulfil a central position in the societies.

Although most people that were spoken with, were hesitant to confirm the historically accuracy of the story and very open to ones interpretation, the outline of the story goes that when the first settlers, the Kusaasis came, now seen as the originally inhabitants of the Upper East, they ‘opened up the earth’. This was performed by a shrine, often a tree and a stone. The Tindana is seen as the representative of the ancestors and the group that came first. The land that they were living on was not only from the people that were living on it, but from the ancestors and the people to be born as well.
These Tindana’s were not centrally coordinated and were independent and autonomic. The living communities and their tindana’s throughout the upper east formed a horizontal structure: there were no super Tindana’s and there was no central coordination. When one wanted to settle or start to cultivate a piece of land, one would go to the Tindana for such issues and the Tindana would open up the earth again. Normally one would inherit the function of Tindana but conquering was possible as well. With this a structure of land owning was created that was not very clear and definite (who owns what, did the past Tindana give the inhabitant the land or was this not the case, etc).

Next to less controversial matter of land the Tindana can be seen as the traditional worshipper that is closest to the spirits. Worshippers don’t come together like Muslims and Christians who gather every week for their ceremonies. All worshippers perform their own rituals individually. So the Tindana cannot be seen as a representative of the worshippers, like a priest is of the Christians. When extraordinary things take place that are unexplainable by common sense or technology, that excludes sickness with a clear cause such as malaria, aids and so on, the Tindana will be approached to solve this. One can think for example of a child found dead in the river without any clear cause. The Tindana will, on his turn, ask the sooth-sayer for advice and which rituals to perform to calm down the matters.

5.3.2 The cause of conflicts

The structure of these autonomous groups, lead by the Tindana’s, ended when the Mamprusis, today’s greatest minority in the Upper East, came to expand their territory. The Mamprusis were warriors and had, in contrast with the Kusaasis, hierarchical structures with chiefs. The Mamprusis managed to conquer the land and imposed the hierarchical structures on the indigenous tribe. Due to this course of history, a situation was created in which a minority, the Mamprusis, ruled over the majority, the Kusaasis.

This abruptly came to an end after the military coup of Rawlings in the 70ties. Rawlings, still seen as a living legend and hero by many, had the philosophy that the indigenous people should have the chieftaincy as they formed the majority. With this philosophy, he made sure that the Mamprusi chieftaincy, with the paramount chief in Bawku, was replaced by a Kusaasi. This intervention proved more of an extra trouble than a solution.

The change of power causes troubles till today. It is the struggle between the original inhabitants and the Mamprusis, referred to as the new comers by the Kusaasis. The riots mainly take place in Bawku where heavily armed fights take place every now and then. Military intervention often takes place but only solves
the conflict for the time being. The conflict however is so fundamental that long term solutions are hard to find and so the conflict is likely to continue for a long while.

Mamprusis are not the only minority in the Upper East, but the most prominent. Other tribes such as the Fra Fra, Whombes, Moshi and others can be found in today’s population.

5.3.3 The chiefs

The chiefs, after the coming of the Mamprusis are the traditional leaders of the villages. For anything related to traditions, such as marriage, divorces, struggles in the village and other matters within those spheres, the Chief is the ruling power.

Above the chief, there is a paramount chief, who, in this case, is located in Bawku. The paramount chief represents all the chiefs. Under each chief a subchief is representing the chief in each village. All functions are based on heritage. In the case of the reservoirs, both reservoirs are on the territory of one chief, the chief of Tanga. Tanga, in this case is the territory. Tanga reservoir, to avoid confusion again, is located in the Tanga area but is next to the village Gunga. So Weega, Gunga, Tonde and some other, roughly 13 in total are under the control of the chief.

5.3.4 The assembly man

The assembly man is elected by the people of the villages and is the representative of the people in the villages in the local government. Next to this there are the unit committees in every village that are elected by the people as well but are there for organising purposes such as tax inning, bush fires and other practical related matter. When individuals have complaints or wanted to get things done, one would go the assembly man, rather than the unit committee.

The local governmental setup is very complex. For additional information the report of Poolman (2005) is recommended.

5.3.5 The WUA

The water users associations are the lowest institutional level and are responsible for the following tasks (Poolman, 2005):

- Protection of the dam and reservoir
- Maintaining the reservoir and irrigation facilities
- Efficient water use for the dry season
- Crop production

WUA consist of at least a treasurer, chairman and secretary. In the cases of Tonde and Tanga these structures are slightly different, as will be discussed later on. WUA are not only created in case of small reservoirs but for all types of water related structures, such as boreholes.

Small maintenance is the responsibility of the WUA; failure by external factors is often handled by the government or the NGO’s.

5.3.6 Agricultural extension agents

Agricultural Extension Agents (AEAs). The Agricultural Extension Agents are responsible for identifying the problems that are affecting the communities surrounding the small reservoirs, which is done through observations made in the small reservoir communities, but also through communication with the Water Users Associations at the small reservoirs. (Poolman 2005).

Apart from this function they communicate and advice the farmers on how to appropriately use the reservoirs. Advice is given for maintenance of the reservoir, the usage of fertilizer, seeds, water, fighting of diseases and how to recognise certain diseases, strategic advices such as pointing a few individuals in the reservoir for growing seeds that will benefit the whole farming community. Next to this, the officers are often present or even initiate meetings of the farmers. For example, in Tanga, several attempts with meetings were made to convince the upstream farmers to farm downstream.

The function of adviser goes without any formal power. The initiative to change or adapt certain practices is up to the farming community itself. The community itself is, in the end, fully responsible for the well being and usage of the reservoir. Reservoirs, such as Tonde and Tanga are handed over, officially, after construction to the communities and from there on, the responsibility is theirs.

5.3.7 Political parties

The politics is very polarized in Ghana, the two most important groups can be seen as NDC, the party of Rawlings, and NPP, new patriotic party. There are other parties, such as the PNC, but they have little impact in the Upper East compared to the other two.

Either you are in favour of them or you are against them and villagers know exactly who supports who. Violence during election time is relatively normal due
to the polarisation. Different causes can be named for this. First of all, the
democracy in Ghana is relatively young and past political activities were mainly
characterised with violence, military action and coups. Secondly, the political
system has some ethnical loading in the region as Rawlings changed the
chieftaincy from the Mamprusis to the Kusaasis. This, as described in the chapter
‘the cause of conflicts’, still creates serious tensions. As mostly Mamprusis do
support the NPP, as NDC was the party of Rawlings, and Kusaasis mostly
support the NDC, this political division is mostly an ethnic division as well. This
however, is not absolute; the assembly man of the Tanga district for example is a
Mamprusi and supports the NDC. He, however, is one of the few of the whole
Mamprusi community that does so.

Thirdly the privileges that come with supporting a specific party increase stakes.
Schools, initiated by former governments, are not finished because current
governments want to start their own projects; farmers of the year are only
supporters of current governments; poverty relieve funds are only given to party
supporters and so on. At least, that is what is said in several occasions. Farmers
reckon that applying for loans at certain sources is wasted effort because they
are supporting another party than the institution supports. However, the research
was on this point limited and incomplete and should be handled with care.

5.4 Position of women in Ghanese society

Although the government of Ghana is actively trying to support and improve the
status of the women, the women are still considered less important than the man.
This has partly to do with the ‘Dowry’, the traditions that one pays for a wife. It
gives the impression that a wife it a type of trade ware although this is not seen
as such in many cases. Muslims, for example do not follow this habit although
they accept polygamy, some up to four or more wives, something that the
Christians reject. Traditional worshippers can marry up to 10 wives.

A Kusaasi wife is worth four cows, three goats and two chickens. She becomes
worth more when she possesses exceptional beauty: this is worth an extra cow.
Once the lady is paid for with 5 cows, automatically the first born will be worth the
same as well. A cow can be bought on the local market between 700 000 Cedis
(roughly 70 Euro) for a local cow. When a woman wants to divorce, she has to
pay the family the dowry back minus 1 cow for every child.

At the moment the Kusaasi chiefs are negotiating with each other to lower the
price of a wife to two cows, to make it possible for every person to buy a wife. To
put it in perspective: with a good harvest a farmer that works with the help of the
reservoir, a farmer can roughly buy two cows. In some cases the family is happy
to let the girl go to a proper household without payment. These rates differ from
tribe to tribe and for example, the Moshis do not have the dowry systems. When a Kusaasi marries a Moshi woman, he doesn’t pay the dowry. And for his children he will not be able to ask dowry as well which forms a block for some of the Kusaasi men.

The idea of dowry is possibly strengthened by the setup of the family compounds. Families live often together in one big house existing of more compartments. When a man marries a wife it is the tradition that the woman leaves her family compound and moves to the family compound of the man. The idea of seeing a wife as an asset to the family has therefore another perspective than, for example, the western way of marriage where the tradition is that after or even before marriage the couple moves into its own house so both families ‘loose’ equal assets.

The status of a wife in the household is very traditional. The women is responsible for the cooking, washing, clearing, the children and all other aspects that come with the household, the man is responsible for generating income. With the lack of social security the women as individuals become a vulnerable group. Without the possibility of generating income, many, often older women, are forced to beg. Next to this, more women are illiterate than man which makes the position of the women even more vulnerable.

During the interviews, mostly in Tonde, women were complaining in some cases that most men at the moment were wicked. While the women group arranged the dam the man often tried to take over with the help of his position. The man, in these cases, was controlling the budget and used it as a constraint for the women. When the women needed to buy fertilizer and seeds, the man used its position to control the situation and often this lead to a situation that the man decided the course of action of the plot.

In Tanga, a woman complained about her family in law: plots were taken from her that were inherited by her, yet the family in law took over most land and as a woman, she had no say in it. Because her husband died, there was no one to stand up for her and a man’s word is more important than the word of a woman. Due to the illiteracy and low education rate, wills are not often made and therefore do not form a proper protection against such practices. Tindana’s, chiefs and other high ranked individuals are not able or do not want to form a counter weight in such practices as it is part of the tradition and culture.

That a man’s word is more important comes forward in cross-religious marriages as well. A woman will need to take the religion of her new husband as her new religion. The women that were spoken to however didn’t perceive this as a problem and found it easy to switch from religion.
5.5 Farming activities

5.5.1 Before the coming of the reservoirs

Before the coming of the reservoirs, dry season farming already existed. Yet, it was on very small scale and was more labour intensive. The water gathering was done by creating a hole in a soaky area and due to the moisture in the ground, the water would gather in the holes and by means of calabashes or buckets water would be spread on the field.

Because it was on smaller scale, often this method was experienced as not worthwhile and relatively more people decided to go down south in the dry season in order to generate income there. Next to this, externalities that come with the coming of the reservoirs were not there: the farming fields were fenced with mud walls as can be seen in the current reservoirs so, for example, cattle could not reach the water to drink, crocodiles could not be harboured and it was too small for recreational purposes.

The farmers were independent and did not form water users associations. Not clear formal structure between different farmers was in place.

5.5.2 Common Strategies

Farmers have to make a range of strategic decisions throughout the year. With strategies, it is meant choices that affect future developments of the crop, the usage of the soil and the reservoir, the choice of seeds, fertilizer, and pesticide and so on. It has a great, if not critical, impact on the success of the farming.

The strategies of farmers in both reservoirs had some commonalities and at some points there were some great differences. All strategies of dry season farmers start off with the choice between going to the south to find work there or to start their farming plot with the help of the small reservoirs. If the choice is to farm with the irrigation system a variety of choices will determine the successfulness of the farmer. First of all the choice of crops will have to be made, the next step is to determine the right time of planting the seeds. During the season, the choice to use fertilizer or pesticide comes up.

When diseases come up, pesticides are used. Most common is DDT, used in the south with the coconuts. It is illegal due to its great impact on the environment and health; still most farmers use it and can get it relatively easily on the local markets. No government agents are on the fields to fine or stop these practices so it is of common use.
When asked to the farmers how they decided to determine their strategy the main response was that their strategy didn't change in the past years. Some tried some different crops but, mainly, onions proved a crop that was able to provide a stable income and used little pesticide and fertilizer compared with tomatoes. Yet, some patches of earth proved less successful for the onions and often tomatoes were planted there. This could be seen as the main strategy of most farmers in both reservoirs.

The amount of fertilizer and seeds used did not change for the past times. Either the farmers determined the amount with the help of other farmers, relatives, learned it from elderly people such as parents, very few named the agricultural extension officer. If the chosen amount of input proved successful than this amount was seen as good, or at least sufficient, and did not change over time. No communication between farmers or in meetings of the WUA's was reported. It was mainly up to the farmers themselves.

The agricultural extension officer tried to explain the local farmers that optimizing strategies could save a lot of money. Research was done by them and data were available for the right amount of inputs. These advices were of little use as most farmers used their own logic. According to the extension officer, these logics were mainly based on ignorance.

Due to the individual characteristic of the usage of fertilizer, seeds and pesticide, it is hard to explain the big differences between two collectives of the reservoirs from this perspective. The only common characteristic difference between the reservoirs, apart from soil conditions, was the amount of experience, partly passed down from elderly or more experienced. As Tonde farmers were mainly new in the field of farming, the farmers of Tanga had considerably more experience. These farmers were active before the coming of the dam, mostly from the early beginning of their lifes. A knowledge/experience difference within the intellectual capital of the Tonde and Tanga farmers may be an explanation of the difference.

The farmers apply two different types of artificial fertilizer: ammonia or 15-15-15. The 15-15-15 is used in the begin stadium of the process, ammonia is used in a later stadium, roughly two weeks after the fertilizer is used, to absorb the moisture and gives, as farmers reckon, the plants a greener appearance.

The choice between the two main crops, tomatoes and onions, was mainly made on past experience. Most farmers in the area that were planting tomatoes started planting onions. Less fertilizer is used for these crops (so financial risks and investments costs are less) and the main advantage of onions is that one can store them longer (roughly three months) than tomatoes. Tomatoes will have to
be sold in less than two weeks after harvesting. Anticipation on possible price changes on the markets is therefore a more delicate, if not impossible task.

5.5.3 Storage of onions

When one examines the price, hunger and budget cycle, the storing of the onions seems like a very reasonable solution. When properly stored, onions can be stored up to three months. Due to rotting about 1/10th of the onions will be rotten. Where a bag of onions during the time of studying (harvest time) would generate 160,000 Cedis on the local market, in three months time this easily would reach 500,000 in three months.

The majority of the farmers tried to sell their onions as fast as possible to gain immediate profit from the harvest. Institutions and individuals, such as the agricultural extension officer that was in function of both Tonde and Tanga, tried to convince farmers to store at least a part of the harvest. Meetings in Tanga were held to show how self made storage facilities could provide them with the needs and at minimal cost (around 400,000 Cedis) if one compares this with the extra profit. But the example storage facility in Tanga fell in disrepair because nobody was using it.

All attempts from the side of the extension officer failed to convince the people in Tanga. In Tonde no attempts were made. Most heard comments from the side of the farmers were that they were hungry now and wanted the money now. When the reply was that the hunger would even become worse in the three months ahead in which vast labour had to be done on the fields, the people mainly replied that no matter what, they needed the money now.

Another point was that for the usage of fertilizer, seeds and pesticides, loans were used that had to be repaid after harvest. For some this meant that a delay of money was therefore not possible.

Some of the farmers of Tanga and Tonde were trying to store onions in their own houses on the concrete floors. Due to the heat in the concrete and inability of the air to go through the layer of onions, up to 1/3rd was spoiled this way. With the help of the self made facilities this rotting could mostly be avoided as the racks allowed the wind to cool the onions. Farmers approached in Tonde on the subject didn’t know such facilities existed while about 10km away in other reservoirs, such facilities could be found. Farmers in Tanga mainly replied they didn’t have the money to invest in it.

The whole situation in Tanga however didn’t fit with the last comment while a common storage facility was made. This building however collapsed due to low
maintenance as a result of limited usage. More likely stubborn logics seem to be more of the fundamentals of the approaches of the farmers.

Common facilities in other reservoirs to store onions could be seen as well, mainly sponsored by NGO’s. These were in function yet had little impact as only around three farmers could use the facility. These facilities didn’t use the racks to cool the onions but used the system other farmers used as well: the onions were stored on the ground.

5.5.4 Common wall

In Tanga and Tonde, two different strategies for building the walls around the plots were chosen. In Tanga, every farmer builds his or her own wall and in Tonde there was a common wall build. A common wall has some advantages and some disadvantages.

The advantage of a common wall is that the wall takes space on plots that otherwise could have been used for farming and the topsoil, needed for building the wall, is lost for this purpose as well. Levelling the ground, as many farmers said, was much easier with a common wall compared with separate enclosures. With a proper levelled plot, irrigation becomes less of a time and physical demanding job.

Apart from this, animals breaking through walls are less of a problem because it becomes from an individual responsibility a common responsibility. However, it was reported that often young boys were used to chase the cattle away and this job took the whole day so they had no time to go to school. A proper maintained and build wall is therefore essential to be an advantage.

The problem with a common wall as well is that norms of individuals regarding the height and steadiness of the wall differ. Apart from this, people are less willing to maintain the wall in the end of the season when the harvest is done. Farmers that started late in the season have a disadvantage because of this. Next to this, the part of the wall located near or in the water-lock area forms an unstable part of the wall. Because the wall is made of mud, water weakens it and animals find their way through this weak spot.

A few old men told that they really wanted to farm; yet, they were too old to build their own wall and hoped for a common wall in Tanga, so they could start farming as well. Where farmers in Tonde were happy with their solution, many farmers in Tanga admired the wall of Tonde.
5.6 Descriptions reservoirs

5.6.1 Local geographical and ethnical setup

In the analyses different groups will come forward which either are geographical separate or separated ethnically. Tonde is relatively homogenous when it comes to ethnical background and is used by four villages: Tonde, Weega, Ganide and Atolombisi, which are closely located to the Tonde reservoir. The inhabitants are mostly Kusaasis.

Tanga has more diversity when it comes to ethnical backgrounds. The groups that can and could be found can roughly be separated in four parts. On the site of Gunga along the reservoir there is a group of Kusaasis mixed with Mamprusis. The mix was estimated by locals to be between 50% and 30% Mamprusis and the rest mostly Kusaasis. On the upstream part of the Dam there is a group of Kusaasis as well but geographically separated as they live in Tang Dabot. On the other side, downstream a group of Fra Fra is located and some Kusaasis. Downstream, but on the site of Tanga, there is a group of Moshis located. This separation is not absolute and the ethnical groups are mixed. However, the Fra Fra group was distinctly recognisable because they own the only farming plot of Tanga that is surrounded by a common wall in which about 8 farmers have their activities.

5.6.2 General description of the Tanga reservoir

The Tanga reservoir, which is part of a cascading reservoir system, is 10.6 ha in surface area and the total area under cultivation is 1.6 ha. During the study period, 73 farmers maintained plots at this study site (Faulkner, 2006). According to management, the number of farmers grew with the year so a small increase in the number of farmers can be expected.
The impression of the field was mixed. Many different plots, some well maintained, some abandoned could be seen and every plot had its own mud wall around it. Next to this, the field was long stretched and had large areas where no dry season farming activities could be seen. Some channels were well looked after, some clearly were deteriorated (Fig. 8, left). Most farmers had a hand dug well in the, unevenly shaped, mud enclosure (Fig. 8, right). These hand dug wells were fed by the water of the reservoir by means of small channels.

The usage of hand dug wells created a situation in which they were less dependent on water supply from the reservoir that was experienced as highly unpredictable and unreliable: the further the plots were located from the dam, the more complaints were made about water availability. When water was supplied to the farmers, some of the farmers with the ground holes still had the trench system which they used to water their crops.

Respondents in interviews were asked to give their idea of what the difference between Tanga and Tonde is. A wide variety of answers came, yet one distinct difference of setup of the irrigation system was addressed. Farmers in Tanga addressed the difficulties due to the bad location of the construction of the valves: they were placed too close together and made it impossible to locate all the farmers between the two channels. Some farmers were forced to farm uphill (relative to the main channels).

Another difference addressed by the farmers was the type of topsoil. The topsoil on the Tanga side was more clayish, which doesn’t allow the water to run into the ground properly although opposite stories in the field could be heard about this aspect. Combined with the shape of the farm ground, which could be described as steeper compared with Tonde and the fact that the farm field was shaped as sort of cup with the deep side in the middle, leads to a situation that the middle of the farm ground is underwater the whole year through. This area was relatively big compared to Tonde. Because of this and the bad location of the valves farmers are able to use less ground in between the two water channels compared with Tonde.

The shape of the field is partly a result of the actions of the farmers. The uncoordinated way of distributing land which resulted in single mud walls didn’t allow the farmers to level the ground. The background of the reasons why this uncoordinated distribution happened will be discussed in the third part of the report where the lifecycle and the history of the dams will be discussed.

A possible explanation of the measured differences by Faulkner (2006) of the use of fertilizer can be found in these characteristics of the field. The abundance
of water is one reason why farmers use ammonia for their crops. The more abundant water, as could be seen close to the water lock area, the more ammonia is used. Next to this, the more clayish, the more fertilizer the crop needs. However, in the report of Faulkner, little detail is given about the usage of fertilizer. Only averages and not the standard deviation, was given. Farmers were asked to give an idea of the difference the main reply was that the yield of the field was asked in the interview and many people tend to lie about the data. Yet another explanation can be found in the usage of manure. The usage of local manure, which was heavily promoted by the Agricultural extension officer due to the effectiveness and decrease in diseases, could be a more adopted method in Tonde as compared in Tanga.

The Tanga reservoir is located on two different assembly man election areas. The border roughly runs through the middle of the reservoir (so the lake itself) and the irrigated fields. The site is also located on two different Tindana properties. Roughly, the lake part belongs to one Tindana and the irrigated fields belong to another Tindana. The exact property boundaries were not clear as different people, including the Tindana’s, pointed out different borders. How the property rights were exactly handled regarding the Tindana issues is unclear.

A community of upstream farmers can be found in the Tanga reservoir. Those farmers belong mostly to the Tang Dabot village. Little incentives could be found for the upstream farmers to come downstream as these plots, upstream, were said to be and appeared more fertile than the land downstream. More detailed description of the problems of the upstream farmers and the reasons why those farmers were located there will be discussed later on in the report.

Figure 9: left: unused plots, right: the basin

Another distinct, visual, difference could be noticed in Tanga as well. Different plots that were used in the dry season were separated from each other as big dry plots were lying between these used plots (fig. 9, left). One small basin
downstream (fig. 9, right), relatively far away from the dam, could be seen as well. This basin was fed by the reservoir by means of hand dug channels. From this basin, little channels ran to the hand dug wells from the farmers there.

5.6.3 General description of the Tonde reservoir

The Tonde Reservoir, which is a stand alone system not connected to other reservoirs, has a surface area of 11.9 ha and the total area under cultivation is 6.0 ha and had 241 farmers in 2005 (Faulkner, 2005). The number of farmers was relatively stable according to the management. The angle of the field is in a steady slope and the water lock area in the middle of the field is relatively small compared with the Tanga reservoir. It had a straight line in the middle to the back.

The most distinct difference with the Tanga reservoir is the single mud wall that is around the Tonde field. (Fig. 10, left and right) Roughly three individual walls can be seen on the site. The majority of the fields are irrigated with the trench method: small channels that have an input from a main channel (Fig. 10, middle) that is connected to the reservoir. By removing or adding mud plugs, water is distributed over the plots.

Figure 10: left and right: the common-wall fenced field, middle: the main channel

Relative few plots are abandoned and the place has an overall organised impression. Channels are well maintained, the plots looked after.

During the study period a rush harvest happened. This was, according to the farmers on the field, mainly due to the many funerals at that moment. The wet season had brought a good harvest and loud bangs for the funerals could be heard during the whole day as part of these funerals. The amount of funerals didn’t allow the farmers to maintain the mud wall properly. Cattle came in and
young boys found their daily task in chasing it away. This was seen as a common
task and people would rush through the fields to chase it away from plots not
belonging to them.

5.6.4 Crops planted

Compared with the Tonde reservoir, more vegetables could be seen in the fields
of Tanga. This was mostly visible near the end of the dry season when the Tanga
farmers made use of the farming fields a second time after the onion harvest by
growing different types of vegetables such as sweet potatoes and okro. The
farmers in Tanga reckoned there was good profit in the second harvest. This
second harvest might be a partial explanation of the yield difference measured by
Faulkner.

The reason given by the farmers in Tonde for not growing a second harvest in
the dry season was the fact that the cattle could come in after the onion harvest
because the mud walls would deteriorate. The animals would destroy the crops
so it was of no use. Mainly the walls near the water lock area were an easy target
for the cattle to break through as the water would weaken the wall. Some of the
farmers in Tanga reasoned differently why farmers didn’t do the second harvest.
They reckoned that the farmers in Tonde just started or started a few seasons
ago and it was a lack of knowledge on the side of Tonde. The farmers in Tanga
learned the farming from their parents and had therefore more knowledge of
farming.

5.7 Knowledge

All the strategy towards the usage of seeds, fertilizer and pesticide is based on
past experience. The choice of crop was based on the same reasoning. Once a
successful harvest was completed, the same amount that was used as input for
this successful harvest was used for next year input as well.

The choice of onions, as the farmers said, proved to be the most stable income.
Yet, in case of a fatal disease specific to onions, the whole harvest will be lost.
Choosing one tactic means ruling out the others and makes the farmer more
vulnerable when this strategy does not work out well. Growing more than one
crop could reduce the risk and would keep the soil in better condition.

In Tonde, where the group is so cohesive that initial knowledge is the baseline on
which decisions are made, yet improvements or adjustments to this baseline are
limited if not non existing: improvements can be made on this aspects.
Knowledge generation can be established on three different ways: first of all,
enhancing cross-cutting ties by actively searching for NGO’s, offices, or other
institutions with funds and knowledge that could help to update, improve and extend information. A second way is bridging links: actively search and participate in meetings/gatherings with other reservoirs. Relevant and probably very practical information can be found within these societies. Reinventing the wheel can be avoided in this way and the information flow will be increased by this.

A third way, and possibly rather unusual way, could be that the group in Tanga make use of its own cohesiveness by starting its own ‘small scale knowledge’ field that is maintained or possibly financed by other group members. Relatively easy to measure experiments, such as an optimum of fertilizer or different ways of applying different types of pesticide, could create insights with which the intellectual capital could be improved. In the chapter ‘mentality’ it is described that this knowledge already exists at the agricultural extension office. Yet, this type of information is not adopted in the community. The generation of knowledge in such a community itself might help with the acceptance of such information. This idea however, seems nice on paper and in theory but will certainly face some serious difficulties in practice.

The social cohesive group of Tonde can become or is already its own burden. Any bridging links with other reservoirs have not been made since the beginning of the farming at the dam. The cohesiveness of the group can be the cause of a certain group think within the farmers’ community. Possible inventions, improvements and solutions for possible problems at Tonde do not reach the field through those channels whilst these reservoirs are yet a very great potential knowledge asset. This is also partly the case at Tanga, yet due to the less cohesiveness of this group, individuals are tempted to find solutions outside the reservoir.

Where these initiatives can be seen as too risky for individuals due to the poor financial circumstances of the farmers and the high dependency of the successfullness of the harvest, the community could together fund such initiatives and spread the risk of such activities. If successful, it could benefit the community as a whole. Yet another initiative, as suggested in past research, could be the building of a common storage building.

5.8 The mentality

One could see this strategy of choosing the type of crops and the amount of input as an approach based on satisfaction rather than optimizing. Improvements in the usage of the reservoir can, possibly, made on this aspect. The intellectual capital of the group was formed in the beginning of the adoption of the reservoir and sees limited updates. It is well possible that new insights or techniques came
up and did not reach the Tonde reservoir due to its limited communication with other reservoirs.

New knowledge however is hardly adopted by the local farmers. The agricultural extension officer told of many occasions in which new knowledge was presented to the farmers but the farmers kept following their own reasoning. Examples could be found in the amount of fertilizer and seeds where optimal amounts were presented, the usage of local manure, the usage of amount of water, the storage of onions, the diversification of crops in the fields in order to let the soil recover and spread the risk, the centralized way of growing onion seeds for the community as a whole and so on. The extension officer, who gave the impression to be very devoted to his job explained many aspects in several occasions but hardly any advice that would lead to optimisation would be used in the field. Advice regarding the use of pesticide however was used in the field, but this had more the purpose of saving the harvest and making it optimal.

The mentality of the farmers can be seen in the way they strive for satisfaction. This strategy could be seen in more occasions. In many interviews the farmers in Tanga were telling that they didn’t get water in the past three days. Still, on the question whether they thought how the WUA and the valve-openers were functioning, the answer was that they had no complaints. Due to their hand dug wells, they were sure of water anyway, and if the valve-opener was so friendly to open the valves, it was handy. It saved them from dragging with calabashes.

The statement on the small reservoir project homepage (www.smallreservoirs.org) that some reservoirs are functioning sub-optimally and that because of this, there is room for improvement should be dealt with care. Any efforts made to reach an optimum will easily be left aside, as western ideas of optimums are not recognised as such by the local farmers.
6 Measurements social capital

6.1 Social capital in Tanga and Tonde

Part of the events happened in Tanga and Tonde can be explained within the framework of social capital. A sound analysis of these factors can lead to insights that can partly determine the successful adoption of future dams.

The significance level will be taken as 10% because of the limited number of questionnaires, 35 for Tanga and 38 for Tonde, and the rather limited scale on which could be replied (often, scale 1 to 5). The zero hypotheses will be that there is no relation between answers of the farmers and the location of the farmers: Tanga and Tonde.

The farmers upstream were not taken into the sample; most of them didn’t participate in the WUA, didn’t pay the fees and often they were not even interested in a plot downstream. In order to understand the impact of social capital on the management and usage of the reservoir, this group had to be excluded. Fishers were excluded from the sample as well because they too had no hand in the maintenance of the plots and the water usage, apart from their fee contribution.

It was attempted to interview the farmers who make the decisions on the farming plots. This could be either male or female farmers. The questionnaire that was used can be found in the appendix. The relevance of the different aspects and an explanation of the framework of social capital can be found in the chapter ‘theoretical framework’.

6.2 Religion, gender and ethnics in the reservoirs

First of all, the ethnic backgrounds, the amount of men and women and the different religions were mapped that were interviewed in the reservoirs. These characteristics are independent of any groups or other forms of networks, other than the general farming community.

In the compilation of religions among the Tanga and Tonde communities, characteristics do differ (Fig. 11). Whereas in Tonde most people are Christians (52.6%), followed by traditional worshippers (42.1%) and a small group of Muslims (5.3%), Tanga has mostly traditional worshippers (51.4%), followed by Christians (25.7%), again a small group of Muslims (20.0%) and with one individual that believed in none of the religions. She called herself a free-thinker.
The differences in men-women ratio in Tonde and Tanga are not significant. The ratio is roughly 2/3 man and 1/3 women for both reservoirs.

The difference for Tonde and Tanga regarding ethnic background is that Tonde has only Kusaasis (100%), Tanga has about 74.3% Kusaasis, 17.1% Fra Fra, that could be found mostly united in the middle of the farming field, united by a common wall, and a minority of 8.6% Mushi’s. It is known that Mamprusis are farming there as well; however, they were not encountered in the field.

So overall speaking, there are no significant differences between the farmers of the reservoirs Tonde and Tanga on the aspect of gender. Any differences between the reservoirs cannot be explained by this aspect. For the aspect of ethnics, Tonde is homogenous and consists only out of Kusaasis whereas about a quarter of Tanga exists of minorities.

In Tonde the Christians form the majority while in Tanga the traditional worshippers create the majority. Both reservoirs share the characteristic that none of the two are religious homogenous.

6.3 Groups and Networks

6.3.1 The amount and type of groups

First of all, the amount of memberships in the family of the interviewee was asked. It was explained that with family, direct family was meant. So this means children, wife, and possible adopted children and so on, but not the grandfather/mother, niece or uncle. The memberships can be of formal or informal organised groups. The type of groups can be very diverse: organisations
or associations, a group of people that comes together regularly to talk about things and so on.

It was measured that the amount of memberships of individuals in a family is significant higher in Tonde, with an average group number of 2.6 per household compared with Tanga, with an average of 1.4 groups per household.

6.3.1.1 Most important groups in Tonde

The second question was to name the most important group/network in the family when it comes to farming activities in the dry season. In Tonde, three important groups were mentioned by the farmers (fig. 12). First of all the WUA, second and third two NGO’s: Red Cross Society and a women group called ‘A Song Taba’ that is organised by the NGO ‘Yelwoko’. The WUA was seen as the most important group for farming by 28.9% of the farmers.

‘A song Taba’, which means ‘help one another’ is a women group that is restricted to one village. Yet many villages have these groups, called ‘A song Taba’ and are organised by Yelwoko. Yelwoko is a Christian NGO that focuses solely on women and helps them with cheap loans for seeds, fertilizer, and cash and so on. They meet regularly and a wide variety of women do join the meetings: different social status, different occupations, yet mostly farmers. 10% of the farmers found this the group of people that had the greatest impact on their farming life.

**Fig. 12: Groups named in Tonde**

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The third group is the Red Cross Mothers group. They meet regularly and were active before the coming of the dam. Its members are women of different social status, different religions and different occupations. For example, traders are within the group yet the main part is, or rather, became farmer. Discussions about dealing with health, education, solving problems and where to go to for help are topics. It was this group that lobbied at the Red Cross Swiss for a dam and was together before the coming of the dam for more than 5 years, according to the former Red Cross Executive. 60.5% of all the farmers found this group the most important in their farming life.

Percentage-wise, men and women have the same perception of which of the group is the most important in their household. The biggest percentage difference in the answers was 4.6% between the gender types. The amount of men that think the Red Cross Mothers group is the most important group in their household, when it comes to farming activities, is surprisingly high. It outnumbers the amount of men that see the WUA as the most important group. This underlines the importance of the Red Cross Mothers group and the externalities that come with the use of such group. A group that only contains women benefits the men in the community as well.

6.3.1.2 Most important groups in Tanga

In Tanga, the number of networks is very limited. 100% of the interviewed stated that the WUA is the most important group when it comes to farming activities. It held meetings a few times per year and discussed issues such as maintenance. Some meetings were with the top of the WUA only, some with all the farmers.

Surprisingly, none of the interviewees mentioned the NGO ‘Action Aid’ as an organisation that played an important role in the farming for them. The NGO was only important for building the dam yet had no big role in any other form, not now, not in the past. Only a very few could remember to have received some hardware as a shuffle in the past.

Action Aid, which had left the region about four years ago, left the responsibility to another NGO, called ‘CODI’. It also focuses only on women and gives loans and advice to women of different religions, occupations and status and is active in both Tonde and Tanga. However, none of the interviewees ever heard of this NGO, let alone reckoned that they got support of them. Even more surprisingly, the representatives from ‘CODI’ reckoned in interviews performed during the research that a huge amount of loans was supplied to the women. And if needed, they could supply the lists of names as well. However it may be, it clearly had such little impact or left so little impression that none of the men or women mentioned the NGO.
The number of groups was also influenced by the religious composition. Where in Tonde, more than half of the people joined a Christian church; in Tanga the traditional worshippers were the biggest group. The Christians meet regularly, not only on Sundays, but they go to seminars of other churches as well. It does not only bring the people of Tonde together, but creates bridging ties as well. Compared with the Traditional worshippers this can be seen as an advantage; the traditional worshippers do not have a common meetings place nor do they meet other groups regularly.

6.3.2 Homogeneity of the groups

The number of groups in Tonde that are gender homogenous is higher than in Tanga. This is because of the two gender homogenous groups in Tonde. The number of homogenous groups regarding occupation, educational background, religion and ethnic background is not significant different.

In all of the groups in both of the reservoirs, the groups do have mainly farmers in the groups, which is not surprisingly, and are religious heterogeneous with Christians and traditional worshippers as the majorities. Regarding social status, all the groups are heterogeneous according to the interviewees. The same was said about the educational backgrounds. Well educated and illiterate people could be found in the same group.

6.3.3 Friends and borrowing money

The amount of friends that the farmers have differs over the two reservoirs. The farmer in Tonde has on average 4.5 friends whereas a farmer in Tanga has on average 3.4 friends. One could state that the intimate-networks of the Tonde farmer are significantly bigger than in Tanga. The cause of this is hard to trace and any significant conclusion is hard to draw except that the network of friends of the farmers in Tonde is more extensive in comparison with the network of Tanga farmers.

The trust in these friends and close relatives are not less in Tanga compared with Tonde. In 94.7% of the cases in Tonde and in 91.4% of the cases in Tanga, the farmers were definitely sure that they could borrow small amounts of money in their direct environment. Only a few were hesitant about it.

So in Tanga and Tonde there is no difference between the trusts among friends when it comes down to borrowing money, yet, the size of the network of close friends is bigger in Tonde in comparison with Tanga. Clear causes for the difference were not found.
6.4 Trust and Solidarity

6.4.1 Common trust

The zero hypotheses that the common trust (trust not only restricted to farming activities) in Tanga and Tonde is not different, can be rejected with the 10% confidence interval. The common trust is significantly lower in Tanga compared with Tonde. As a response to the question ‘generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?’, 92.1% of the farmers in Tonde gave the answer ‘People can be trusted’. In Tanga only 77.1% of the farmers reckon that people can be trusted.

6.4.2 Willingness to help

There is no difference found in the willingness to help in the dry season with activities such as harvesting. Most people agreed that most other people were willing to help. In Tonde 100% agreed strongly to the statement whereas in Tanga 85.7% agreed strongly. Nobody disagreed somewhat or strongly. Most answers came with the addition that it is likely that people will help due to the interdependency: often with harvesting the farmers help one another to be able to cope with the amount of work.

An unwritten agreement is that when one helps, he or she expects to be helped as well by the farmers that he or she helped. Only circumstances, such as funerals, could be a reason to do not so and if so, a small amount of money could be paid instead of work. More interestingly therefore is the statement whether people take advantage in the dry and the wet season.

6.4.3 Taking advantage in dry and wet season

The statement ‘In this village, one has to be alert or someone is likely to take advantage of you in the dry/wet season’ is split in two with the focus of seasonality: wet and dry season. A common way of taking advantage of one another, stated by the farmers, was mostly the agreement that an individual would borrow (money for) fertilizer to a farmer with the agreement that part of the harvest due to this borrowing would be given the person that supplied (part) of the farming input. In many cases, this agreement was not fulfilled in the end of the season. This form of taking advantage happens in both dry and wet season.

The difference between the dry and wet season and the (perception of the) chance that one takes advantage of one another is very visible in both reservoirs (Fig. 13). The hypothesis that both seasons have the same characteristics regarding this aspect is rejected. In Tonde 55.3% of the farmers agree that it is
very likely that one will take advantage of him/her in the wet season, compared with 10.5% in the dry season. In Tanga the difference is from 77.1% in the wet season, compared with 28.6% is the dry season.

Interesting to see that the general trust and the trust in each other for not taking advantage of each other shows roughly the same characteristics in the reservoirs. In Tanga, where common trust relatively low is, a cumulative (so that is the sum of the replies from farmers who stated ‘agree strongly and agree somewhat’) 88.5% of the farmers agrees it is likely that one will take advantage of him or her in the wet season and a cumulative 40% in the dry season. Whereas in Tonde, 65.8% of the farmers agrees strongly or somewhat that it is likely that some people will take advantage in the wet season and only 18.4% of the farmers agrees strongly or somewhat that it is likely to happen in the dry season.

![Figure 13: Statement ‘people take advantage in dry/wet season’](image)

In the dry season, a surprisingly low cumulative percentage of Tanga, 25.7% of the farmers compared to the 60.5% of the farmers in Tonde disagrees somewhat or strongly that it is likely that one will take advantage of him. The farmers in Tonde clearly have more trust in one another. Mostly it was stated by the farmer in Tonde that due to the low amount of people, relative to the amount of people farming in the wet season, it was harder to take advantage of one another. Another explanation is that the social interaction and control is higher in Tonde, which decreases the incentives to take advantage of one another.
6.4.4 Trust in institutions

The hypothesis that the trust in the local district officials (in general) is the same among the two reservoirs cannot be rejected. The trust in this institution is very low, compared to the, by the people elected, assembly man (fig. 14). A cumulative 37.1% of the farmers in Tanga and a cumulative 42.2% of the farmers in Tonde have little or very little trust in the officials. This compared to the people that do trust them, 35.2 and 44.7%, is low. A rather great amount of people gave a neutral answer to the statement, mainly because they never heard of them or they never interacted with them. Reasons given by farmers for not dealing with the local government were mostly the impressions that when one is not among the current party represented by the officials, very little to no chance exists that those officials will favour the individual in any way.

Figure 14: trust in local governmental institutions

The trust in the assembly man is high (fig. 14) in both reservoirs and no significant difference could be found. Only one individual responded with the answer that he/she had very little trust in the assembly man. In Tanga, 82.9% has very great trust in him and 17.1% great trust. In Tonde, 92.1% to a very great extent, 2.6% to a great extend. A possible reason for the popularity of the assembly man compared with the district officials is that the function of assembly man is based on elections.
The trust in the top of the WUA (Fig. 15) is significantly different in the two reservoirs. The amount of people that distrust the WUA in Tanga to a great extent is 42.9% and together with the people that distrust the WUA to a small extend, more than 50% is reached. In comparison, the cumulative percentage of the people that distrust the WUA in Tonde is 2.6 percent. The sample taken in Tanga is without the upstream farmers, so results could possibly have even been more polarized than the current results.

The trust in the WUA in Tonde is very high. 94.7% of the farmers have very great trust in the WUA. Only two individuals thought different. Trust in leadership for the Mothers group of the Red Cross had an interesting aspect which possibly has its impact in the trust of the WUA now. In the past, a conflict between the women group and the initial chairman took place. He was the leader for the women group, before and in the beginning of the dam, and was accused of corruption. He left with the excuse that he was too busy to still maintain his position. In an interview held with him, he was not open about it and changed language, from the English to the local language, when he stated there was indeed a financial conflict in the past and disturbed relations. He holds a reputation of not being spotless. Yet, the group was able to ’internally clean’ itself; it can be argued that this was due to the cohesiveness of the group which finds it reflection in the current WUA now.

The reason that the top of the WUA in Tanga is not trusted can be called rather diverse and will be looked into in more depth in the coming part of the report in which the impact of social capital on the lifecycle of the reservoir is described. Quite a few farmers were met that would have liked to change the top of the WUA. Until now they were only able to change the valve-opener. This change

![Figure 15: trust in the WUA](image-url)
was possible because the valve opener was one of the farmers as well, with the same status. Overthrowing the top of the WUA was seen as impossible due to the power differences; trying it would be seen as creating serious problems and little support could be found for this.

6.4.5 Importance of trust

Trust and solidarity are without any doubt essential for the successful implementation of small reservoirs. It plays an essential role from the beginning of the coming of the reservoir when individuals need to trust one another to accept dependency from one another. Such dependency can be found in the common responsibility to maintain the reservoir. In Tanga such dependency is clearly less and had probably its influence throughout the lifecycle of the reservoir. Causes of the differences will later on be discussed.

The forming of a common wall needs even more trust and solidarity: the group as a whole has to trust on other individuals performing their part of the duty. But once established enhances the solidarity due to mutual dependency. Examples of the mutual dependency can be found in the chasing of the cattle when it enters the enclosures. It is in the interest of all to chase away the cattle.

6.5 Collective Action and Cooperation

On the side of collective action hardly any differences could be found between the two reservoirs by means of the questionnaire. If there is a problem in one of the two reservoirs, both reservoirs use a whistle to notice the people that there is help needed. Almost all interviewee reckoned people would come rushing in, but that was mostly due to the dependency all these people have regarding the reservoir. People that had harvested and lost their dependency on the system for the season were expected to lose their incentive to come to help; only in emergencies they would come. Only two people in the Tanga reservoir replied that they thought it was somewhat likely that people came down to help, the rest of the people thought, mainly due to the dependency that is was very likely people would come and help.

This pattern could be seen in the communal activities; due to the dependency people come out for such activities and a wide range of examples was given. Mostly the activities are related to the dam such as cleaning the trenches, building the common wall (in the case of Tonde), transplanting elephant grass against erosion, collecting stones for the enforcement of the dam and filling potholes in the road on the dam. Some individuals named building a school, drilling a borehole for water supply of the village and cleaning hospitals. Time
and money was spent in each of the two reservoirs on the projects. Only two people in each reservoir said due to a lack of money they wouldn’t give money.

### 6.6 Information and Communication

With the open question where the information, regarding actions of the government for example related to the agricultural extension office, was gathered, the 3 most important sources of information proved to be significantly different between the two reservoirs (fig. 16). Interviewees were allowed to give more than one answer, up to three.

![Information sources](image)

**Figure 16: information sources**

In Tanga, the importance of the radio and the market as an information source is equal: 34.0% of respondents named these two sources as the most important sources. Friends and relatives came third with 21%, followed by 4.2% that represents the assembly man. Than the sound car, the WUA and the agricultural extension officer follow: they were named once. The fact that only one person, responsible for the 2.1%, named the agricultural extension office as the main source of what that office is doing, is surprisingly low.

However in Tonde, the radio has a much more prominent place with 50.1% of the respondents that named the radio as one of the main sources. This was followed by friends and relatives with 26% and the market with 16%. The assembly man,
the phone and the chief followed with less than 4%. Again, surprisingly, none of the respondents named the agricultural extension office.

The results give the importance of the three main sources: radio, market and friends/relatives. The hypothesis that there is no relation between a farmer in Tanga or in Tonde and the usage of the three main information sources is rejected. The reason however is less clear.

The hypothesis that there is no relation between the reservoirs and the chance that a farmer used a telephone at least once in the past month cannot be rejected. In Tonde 65.8% never used a telephone, in Tanga 60.0%.

So generally speaking the source of information regarding the actions of the government, and in this case the agricultural extension office, is the only significant difference between Tonde and Tanga regarding the measured aspect of information and communication. However, the cause of the difference is not very clear so limited conclusions can be drawn from this. One could argue that the networks in Tanga on the market are bigger compared with Tonde.

6.7 Social Cohesion and Inclusion

Most of the questions regarding social cohesion and inclusion were not asked in the questionnaire so no numerical evidence can be given. It was recommended by Eva Schiffer (an IFPRI researcher) that this part could lead to heated situations and it was better if this information was gathered differently. Questions regarding possible violence due to differences in the community were removed. By means of in-depth interviews it was attempted to get insight in the history and backgrounds of these facets.

Social cohesion and inclusion proved one of the essential aspects where the Tonde and the Tanga reservoir had some fundamental differences that had its impact throughout the history of the reservoir. What is important is that two of the three incidents that will be discussed in this paragraph had direct links with the farming communities in Tanga. The incidents happened before the coming of the dam. They were about farming activities and created tensions within the communities that later on would share the Tanga reservoir.

The first and most fierce incidents were the riots reported in 1984, initiated in Bawku. These incidents were caused years before by the shift of chieftaincy earlier described in the paragraph 'the cause of conflicts'. The incident in '84 caused casualties in Gunga, yet neither in Tonde nor Weega. In Tanga, it created a situation in which some of the Mamprusi men of Gunga had to flee the village after two or three casualties on the side of the minorities. They only could
return after a few months when the situation became less tense. The riots were reported as very severe and had a big impact on the community. It was unclear who caused the casualties.

It was reported that most of the threat for the Mamprusi community came from the Zebilla site, a village nearby. Nevertheless, it was clear that within the farming community in the Tanga reservoir tensions were present based on the ethnic conflict too. During interviews this tension was noticeable and for example the Tindana for Tang Dabot was making statements as ‘that the Mampruis no longer ruled them but that they ruled the Mamprusis’. The assembly man, who is in a more vulnerable position and function, didn’t use such terms but it was clear he was not flattered by the actions (later on discussed in this chapter) of the Tang Dabot farmers.

The fact that ethnic differences caused troubles in Gunga and not in the Tonde reservoir can be related to the amount of and the percentages of the different groups. The communities that use the Tonde reservoir have an estimated 90-10 ratio of Kusaasi-Mamprusi. The village ratio of Kusaasi-Mamprusi in Gunga will be between 70-30 and 50-50. Intermarrriages between the ethnic groups do happen and according to the (Mamprusi) assembly man the differences in ethnics do not cause any problems on this date.

The assembly man who lobbied for the dam is a member of a big Mamprusi family that holds many organisational/governmental functions and was victim of the violence of the ’84 riots. Within the family the executive director of NFED is present, a regional minister and many women of the family are married to high ranked individuals. The tension must have had its impact and most probably still has.

After the ’84 riots, violence between mainly the Gunga and the Tang Dabot villagers, in which these tensions were manifested, happened in at least two occasions. Contradictory stories were told about it by both parties but further investigation was ended as the feeling of growing tension was present and a clear idea of the cause of the tension between the two parties was clear enough. Only after countless visits and interviews these incidents came forward. The impression was that both parties still had some issues with each other that were not brought forward and that it was sensitive information as emotions could run high.

The first occasion was about the silting of the lake that was there before the coming of the reservoir that is in place now. According to the Tang Dabot Tindana it was a proper lake with loads of fish and crocodiles, according to the assembly man it was not more than a pond. However it may be, some
Mamprusis were farming nearby that pond which was on the property of the Tindana of Tang Dabot. The farming activities caused silting of the pond/lake.

The Tang Dabot people were not happy with the situation and organised themselves. With the organised group they started throwing mud into the rice fields of the Mamprusis and driving cattle into the farming fields to cause serious damage to the fields. When the Mamprusis noticed what was going on, they themselves organised them and came out with shuffles, other farming tools and even guns.

It never came to such an extent that casualties were reported but in the end, armed police was brought to the scenery. They arrested a rather big group of Tang Dabot farmers. An estimated 50 farmers were kept in custody for a while. The rest of the story is rather contradictory and each story told by the different actors in favour of the actor himself: the Tang Dabot farmers reckoned that they went to the court and that the Tang Dabot farmers won the case. According to the assembly man it never came to a case. He claims he went to the police station to settle the case and redraw the complaint in order to settle the case within the village itself without the interference of a court.

A side note must be placed in this story as well. Although the impression and general explanation of farmers was that the incidents were mainly based on ethnic differences, these separations were not absolute. Ethnic separation was the basis of the conflict and mainly due to the Tang Dabot side. Most Kusaasi farmers from the Gunga side however were referring to the Tang Dabot farmers as ‘troublemakers’ and were clearly choosing the side of the Gunga Mamprusis. Generalisation of the Kusaasis regarding the opinions towards the Mamprusis should therefore be avoided. Apart from this, no Mamprusi was encountered in the irrigation fields during the interviews.

The impression that was left after the research was that what started as an ethnic conflict created more or less a separation between the villages Gunga and Tang Dabot. For several reasons its impact is not fully clear. The most important reason was that the parties only were willing to talk about the issue in a late stage of the research. Therefore only the stories and opinions of the leaders of the two groups (the Tindana of Tang Dabot and the assembly man, who lives in Gunga) were heard. Interesting would be to hear the opinions on the subject of other farmers in the field. However, it was felt such questions could have the effect of a catalyst of tension. Apart from this, it is very likely it takes a lot of effort to get to the core of the problem as not a lot of farmers were willing to talk on the issue. Several attempts were made to locate any ethnic based tensions in the area before the knowledge on the incidents but mostly avoiding answers were given by the farmers.
The second known incident was related to a pig and had less impact but clearly shows how the relations between the two villages evolved. A pig, of which the owner was an inhabitant of Gunga, took a drink in the pool of one of the Tang Dabot villagers and started eating the rice that was located near it. The farmer was not happy with the situation and decided to kill the pig. With the killing of the pig, it appeared that the pig was pregnant and had 9 piglets. When the owner of the pig found out that his pig was killed, he on his turn was not amused and a clash of words between the two villages was the result. Again, the case was reported to the police and an agreement was made that the farmers that killed the pig had to pay the pig and 9 piglets.

Clearly, without any numerical evidence, the situation between the Gunga inhabitants and the Tang Dabot farmers can be called disturbed and had and will have its impact on the reservoir.

In Tonde and Weega, these incidents didn’t happen. Probably partly because the Mamprusis are less represented in the villages, as could be seen in the percentages minorities in the dry-season farming communities: none of the farmers belonged to an ethnic minority, opposed to the situation in Tanga.

Tension could be found in the meetings of the WUA in Tanga. No violence or other forms as such have ever been reported. Nevertheless, during the time of study it was recommended by some individuals that when meetings of the WUA would heat up, it would be favourable to leave the scene. Mostly the concern was about the upstream farmers. This heating up never happened and all meetings were experienced as relaxed and friendly.

The other minority that was encountered in the fields mostly were the Fra Fras, who formed an island with a common wall in the middle of the plots. Clearly it was a cohesive group that lived closely together. It seemed they included only Fra Fras in their farming activities.

It was reported that mostly the Fra Fra group caused troubles in the beginning of the dam. After the construction of the dam the ground was levelled for farming. This meant that boundaries of farmland that was used before faded. The Fra Fra group was so annoyed that the boundaries were gone and reckoned their land was spoiled. Because of this, they refused to pay the fees to the WUA that in his turn didn’t allow the water from the dam to go to the Fra Fra group. After a few meetings, the case was settled and only a few individuals remembered this incident.
Yet another group, in the back of the farm field consisted out of Mushi’s. They formed a living community close to their plots. Most of the farmers that were talked to reckoned that this group didn’t form a separate group but was integrated in the community as a whole. This could be said about the Fra Fra as well when it came down to other activities than farming. Funerals, WUA meetings and so on were common activities in which every minority was represented.

When one compares the situation in Tonde and Tanga on this aspect, one could say that Tonde was a more homogenous cohesive group compared with the social groups that were smaller and more diverse in Tanga. In Tonde there was no history of violence; Tanga has a rather dynamic history when it came to that..

With the help of the questionnaire no difference regarding safety was measured. All of the farmers felt no threat from the direct environment: 100% of the respondents felt very safe in both locations, so no differences were found between Tonde and Tanga. Farmers on both locations said if they had to do a lot of work, they could easily sleep on the field without the feeling of being threatened by any form of violence. According to the assembly man the riots have lost their impact by now and no serious threat comes from the Tang Dabot villagers. The findings from the questionnaire do not prove the opposite. But again, it must be stated that the Tang Dabot farmers were not included in the sample.

6.8 Empowerment and Political Action

No numerical difference could be found for the difference of Tanga and Tonde in all of the aspects of empowerment and political action. The majority (85.7 and 88.6%) of the people thought they were very happy and roughly the same figures can be given for the ability to make important decisions in life (92.1 and 88.6%). The note must be made that possibly the setting was not appropriate to fully go into details about the personal life of people. A lady reckoned that she considered herself very happy but in the same interview she told that she buried her husband a few days ago. These results should be handled with care and limited conclusions should be drawn from it.

For both reservoirs, the amount of people that were voting was 100%. Mostly the response of the interviewees was that they would use wheel barrows to carry the old people to the voting location if needed. The political awareness and participation can be considered very high. None of the people in the reservoirs got together to jointly petition government officials or political leaders in the past years. Some said that, vocally and individually, leaders were approached yet never in a group.
The fact that the question regarding empowerment was time-limited, in the sense that it asked acts of empowerments in the past 12 months, lead to the impression that there was no difference between the reservoirs regarding empowerment. However, later on in the report, it will be argued that there is a difference in this aspect as the initiation of the Tonde reservoir was through an act of empowerment and the initiation of the Tanga reservoir was not.

6.9 Conclusion Social capital survey

Tonde and Tanga have distinct and significant differences on most of the aspects of social capital, in some aspects there was no difference found. In none of the aspects Tonde scored lower than Tanga. It can be concluded that the social capital is significantly higher in Tonde compared with Tanga mainly caused by the significant differences in trust, the networks and the social cohesion & inclusion.

The most significant differences were made when it came to trust in the WUA, trust in general and trust in other farmers in the field. There are more memberships to gender and ethnic homogenous groups in Tonde compared to Tanga. On social cohesion and inclusion Tanga scored less due to the riots between Kusaasis and Mamprusis in '84 over chieftaincy that came down from Bawku. Apart from this, some serious disagreements between two farming communities took place in Tanga.
7 Influence of the social capital in the life cycle of the reservoirs

In order to place the differences in the context of the reservoirs, part of the events that lead to the current situation traced back. This is mainly done by in depth interviews or based on stories told by the farmers while filling in the questionnaires. The lifecycle of the reservoir will be used as a timeline (fig. 17).

Figure 17: the lifecycle

The lifecycle that started with the initiation, followed by the adoption and the use of the reservoir, are sketched and the influences of social capital as well as other factors are described. The future states, such as the breaking down of the reservoirs, are not looked at. Within the initiation phase the time of the trigger that started off the process of lobbying for the reservoir to the end of the building, or the beginning of the adoption is described. With the adoption is meant the period that determined and contained aspects of the way the farmers decided to use the reservoir and the process of building the reservoir. From the end of the adoption phase, the usage phase starts; when the reservoirs are used by the farmers as decided in the adoption phase.

During those phases, it is likely that the social capital has changed. The measurements given in the chapter ‘measurement of social capital’ are taken in the usage stage. Nevertheless, due to events passed, for example the self empowerment act of the Red Cross mothers group that will be discussed, it is possible to make an educated guess of the social capital and its influences in the periods before the initiation.

Stories told in interviews, mainly on the side of the Tanga reservoir, sometimes lacked consistency. Conflicting stories were mainly told at the Gunga and the Tang Dabot sides. At times, stories were even self contradictory. As these two sides seem to have a past in which conflicts were present, both sides tried to tell their story in favor of them. It was tried to construct the course of history as accurate as possible and stories told that seemed most likely will be taken as the guideline.
Not only interviews were used as an information source. During the research just ‘small talk’ to local farmers, the translator, extension officers, people in the street and so on, were used as an information source to create an impression of what happened.

7.1 The initiation

The initiation may be the most interesting phase for institutes to look at when implementing the reservoirs. The choice of certain groups or community has a big impact on the sustainability of the reservoirs. It will determine the main actor in the following stages in which the reservoir proofs successful or a failure. Therefore, it may be considered the main field of interest for policy makers interested in implementing small reservoirs.

7.1.1 Situation before the coming of the dam in Tanga

On the site of the dam, where it is located now, dry season farmers were already active. This was partly with the help of hand dug wells for the dry season farming and many plots were only used for rainy season farming to grow mainly rice and corn. Other than that, there was a small lake that didn't always dry up in the dry season on the location where the dam is now. Local habitants used it for fishing and water supply. In the water pool crocodiles were located that were worshipped as their water gods by some of the local worshippers mainly located in Tang Dabot. A stone located near the lake was functioning as a shrine.

Apart from this, around 150 mango trees were located on the site as well. This provided the local community with an income and food. The trees were planted there by the inhabitants themselves and often by the generations before them. Around, a rough estimate, 70 can still be seen on the site and are used by the people.

7.1.2 The initiation of Tanga

The creation of Tanga reservoir is initiated by Action Aid and forms a relatively different story compared to Tonde. It is one additional explanation for the individuality of the individuals farming on the plots and the rather reluctant adoption of the dam.

In a meeting of the village initiated by ‘Action Aid’, the current assembly man asked to rank the problems people faced in the communities. All the groups, including the group of the Tang Dabot village, that fall under the responsibility of another assembly man, were represented. Within the ranking process, the
people ranked water as first. As water came first, a dam and two boreholes were a possible solution, ‘Action Aid’ was willing to provide them.

The big difference compared with the coming of Tonde, is that the coming of the dam was not in a process of empowerment but in a process of community driven development. It was an option given by Action Aid that wanted to help the poor, but didn’t know in what form and decided to let the community become the prime actor in the decision process. The help in the form of the dam was chosen by the people, yet it wasn’t an initiative created by them.

7.1.2.1 Distribution of properties

In the process of this all, more than one problem was created that still have its influence till today. Different groups had to give up different properties for the coming of the dam which were unevenly distributed among the groups (fig 18). In the process, some groups, mainly in the adoption phase tried to take advantage of the situation and increased their properties compared to the other groups or individuals. These properties were mainly land, mango trees and the religious shrine of the traditional worshipper. An overview sketch is made to give a rough idea of the distribution of the properties before the coming of the dam. This sketch is very rough and the separation between the groups that may appear in the sketch as absolute is less absolute in reality.
The location of the water reservoir was chosen on the area left of the lake, mostly on the property of the Tang Dabot people.

The reservoir came roughly left of the lake on the property, mainly of the Tang Dabot villagers who are also the owner of the shrine. According to the Tindana of Tang Dabot, the whole area where the water reservoir is located is his territory. According to the assembly man, only half is in the territory of the Tindana that is located in Tang Dabot. Other sides for the reservoir were put forward by the villagers of Tang Dabot in an attempt to safe the properties, however, Action Aid insisted on the location because of its favourable geographical conditions.

The boreholes would come on both sides of the lake. The process of the choice of the site was not without distortion and the main problems were caused by the separation of decisions, the shrine, the mango trees and, arguably, the assembly man.
7.1.2.2 The problem of the shrine

The problem of the shrine was mainly the problem of the Tang Dabot villagers. The location of the dam was exactly on the site of a shrine of traditional worshippers. The worshippers heavily protested against the coming of the dam because their gods would be disturbed by the machinery and the water.

Their protest was of no use; the assembly man talked to the people and convinced them if their god was a water god, it would probably not harm the god if a water reservoir was build. The meeting in which the assembly man tried to convince the worshipper was said to be accompanied with some tense conversations.

An additional problem was, according to the assembly man, that part of the Tang Dabot villagers mistrusted the assembly man based on his political background. He reckoned that the feeling at that time in Tang Dabot was that he tried to use his political powers to implementation of the dam. The assembly man is a member of the NDC, which had the majority in the government at that time, while part of the worshippers were supporters of PNC. The people of Tang Dabot however don’t agree with that point because, as they say, many, including the Tindana, are NDC as well.

In the end, the traditional worshippers reluctantly accepted the reasoning of the assembly man and went to a sooth-sayer. He told them to relocate the god uphill and a tree was planted above the stone.

7.1.2.3 The problem of the Mango Trees and the house(s)

Yet another point was that in the valley there were the mango trees. Some of them had to be demolished for the coming of the dam. The owners protested heavily but again without success. The need for the community and the development of the area was considered more important than the individual needs and the chance of a new dam should not have been let for some mango trees that could be transplanted somewhere else, according to the assembly man.

The sum of individual losses was smaller than the total benefit for the society that would benefit by the development of the area. This reasoning was the main line that justified the loss of properties held by individuals. This was the case as well with some small houses that had to move due to the rising of the water. The owners however, felt this as a smaller loss compared with the mango trees. The
houses were easily rebuild and were not in such great numbers as the mango
trees.

This way of reasoning is based on the ‘Kaldor-Hicks efficiency’. ‘The outcome is
more efficient if those that are made better off could in theory compensate those
that are made worse off and lead to a Pareto optimal outcome. Thus, a more
efficient outcome can in fact leave some people worse off’ (http://en.wikipedia.org/wiki/Kaldor-Hicks_efficiency). The Pareto optimal is when
at least one person is better off and nobody is worse off.

The key difference between Pareto and Kaldor-Hicks is the question of
compensation. ‘Kaldor-Hicks does not require compensation actually be paid, merely that the possibility for compensation exists, and thus does not necessarily
make each party better off (or neutral). Pareto efficiency does require making
each party better off (or at least no worse off)’ (http://en.wikipedia.org/wiki/Kaldor-
Hicks_efficiency).

The farming community of the Tanga reservoir used the Kaldor-Hicks efficiency
and didn’t compensate anybody. The owners of the trees and the houses didn’t
get anything as compensation. With the rising of the water soon it became clear
that more than the already cut down trees wouldn’t survive and would die as well.

According to the Tindana, it was not known that where the reservoir would come
it would threaten the shrine and the mango trees. But only with the rise of the
water it became clear that the shrine had to be moved. They saw the situation as
they were tricked. This seems unlikely and a more likely explanation came from
the assembly man that said that during the decision period in which was decided
to create the dam, it was not clear where it would be located. The decisions
whether and where the reservoir would be located were two different decisions.

7.1.2.4 The assembly man

The assembly man cannot be seen as fully independent in the process. This
idea, based on his political background, was not only supported by the mistrust of
the worshippers. At the time of the decision to construct the dam, the assembly
man (who is still in function) was a former employee of Action Aid and his uncle
was the deputy director of Action Aid. It was due to the lobbying of the assembly
man that ‘Action Aid’ offered help to the area.

According to some, the assembly man was still in function of Action Aid;
according to himself he was not. However it is very likely that the lobbying for the
dam served more than one interest. The dam served as development project of
the area and was used as promotion for his coming re-election that easily could
be combined with the influence he, or rather his uncle, had in Action Aid.
The people of Tang Dabot, however, do not fall into the electoral area of the assembly man. The dam is located on the border of two election areas and so without harming his popularity in his electoral area he could force the dam into place. The people of his electoral area were given important assets with giving up less assets compared with Tang Dabot. A side note must be placed that both sides reckon that the location of the border of the electoral area had no influence on the process. The election that followed was not even held: the people agreed that the assembly man, due to his good services, didn’t have to stand up against competition and was re-elected without any opposition. At the moment he is in power for 12 years.

7.1.2.5 The separation of decisions and the process

The process in which was decided to build a dam and the process, in which the location of the dam was decided, were separate. At the time when the villagers as a collective decided to ask for a dam, it was unknown where the dam would be located and this lead before and during the construction of the dam to confusion.

Mainly the Tang Dabot people felt mistreated or even tricked by the process with the same reasoning as with the mango trees. During the decision to create a reservoir, it was unknown that the location of the dam would mainly be on the property of the Tang Dabot people and that they had to give up most property privileges. The Tang Dabot villagers said that they didn’t know, even when engineers of Action Aid came, that the water would raise so high that their shrine would be threatened and that most of the mango trees would die. And only during the rising of the water after the construction of the dam, the impact to these properties became clear.

However, this statement of the Tang Dabot people seems unlikely, as the shrine was close to the dam and it was clear from the beginning that many mango trees had to be sacrificed. More likely was the statement of the assembly man that the Tang Dabot villagers were mainly interested in the benefits of the reservoir but when it came to the point of giving up some of the properties the group became less enthusiastic.

Limited communication and tension between the assembly man that lobbied for the dam and the group of the Tang Dabot can be seen as causes for this. The assembly man stated that he gave special attention within the decision process to the side of Tang Dabot village. He and a brother of him went, after the meeting in which was decided to create a reservoir, to Tang Dabot with the main interest to hear the opinions of the elderly of that side as he felt these were
underrepresented in the process. In this meeting, he stated, tension had risen as well. However, on the side of the Tang Dabot people, this meeting was said never to have happened. When this statement was fed back to the assembly man, he stated that he would call for a meeting with all the villages to let the real story be heard. This offer was thanked for.

More likely, whether the meeting was there or not was that the communication between the groups was distorted by past tensions. The decision making power was mainly on the side of the assembly man who was seen as a representative of Gunga and many of the sacrifices had to be made on the side of Tang Dabot. Limited communication, due to mistrust and tensions created the feeling on the side of the Tang Dabot villagers that the reservoir was imposed on them by the assembly man. On the side of the assembly man, who tried to develop the land in favour of all villagers, saw the Tang Dabot people as troublemakers and a hurdle in the process to be taken.

7.1.3 The initiation of Tonde

The creation of the Tonde dam was initiated by the women group of the Red Cross. The Red Cross mother group was formed as an initiative of Red Cross. They organised regular meetings in order to share ideas and problems and find mutual support from one another. The group consisted of women from four different villages: Tonde, Weega, Ganide and Atolombisi.

During the years before the construction of the dam the group was already organized and the Red Cross provided the women with clothes, food and other goods. The philosophy of the Red Cross was to focus only on women as they are the most stable part of the families, responsible for the wellbeing of children, while it is the most vulnerable group as well. Next to this, alcohol consumption and the focus on men, as compared with the focus of men towards women, is considerably less and the women are limited to one man.

Over time it was realized that this way of handling, giving help in the form of goods, was unsustainable. First a hand dug well was created but soon it appeared that this well was not sufficient for the need. When representatives of the Red Cross Swiss paid a visit to the area, the Tonde side was visited as well. Within the visit, the women took the opportunity and lobbied for a dam. The lobby proved successful.

The land chosen to build the reservoir was already used by some farmers, yet their number was limited. It was agreed with the chief that the land used for the reservoir and irrigation would belong to the community after the construction and
no individual claims could be made. One farmer however tried to make a claim but found opposition from the chief and the claim proved unsuccessful.

The success of the group could be seen as empowerment. The process before the coming of the dam could be seen as empowerment. 'Empowerment presupposes that many competencies are already present or possible and that there are given opportunities to act' (Schaurhofer and Peschl, 2003: 261). This opportunity came when the Red Cross paid a visit and the women took advantage from this.

In this case the Red Cross funded the construction of the dam and the dam was given to the people: plots were for free yet, fees had to be paid. The women group received priority: they first got the ground and still the division can be seen in the reservoir. All the plots close to the dam till roughly halfway of the full farmers site is occupied by women only. Some men can be seen on those plots; mostly they are relatives of one of the women who are not able to farm anymore, often due to age. The women still create a strong and united group that clearly enjoys respect with all the farmers using the reservoir.

7.2 Conclusion influence of social capital on initiation

The main difference between Tonde and Tanga in the initiation was the trigger that started the process.

Empowerment, which is a part of social capital, was the trigger of the start of the construction of the dam at Tonde. An already consisted group that was relative cohesive due to the similar situation where they were in, came regularly together to discuss problems and possible solutions. This group therefore could be seen as a voluntary network in which communication was used to, if possible, improve their situation.

The effect, apart from the idea of empowerment, that a group found a possibility to change their situation, increased in later stages the idea of common responsibility of a common asset. Individual actions that would be counter beneficial for the dam as well as the farmers as a whole, such as reluctant payments or water wastage would create resistance of the group as a whole. Trust that an individual action to correct such unwanted behaviour would have the support of the group enabled social control.

The trigger that initiated the coming of the reservoir in Tanga was mainly the assembly man that lobbied for the dam. No effort or initiative from the groups that would later benefit from the dam was made. The foundations of mistrust were laid by unevenly distributed assets among the different groups that would later on
benefit equally by the reservoir. Already existing mistrust due to tensions increased the feeling in Tang Dabot that the reservoir was imposed, this limited communication. It can be argued that the reservoir would have never existed if the trigger to lobby for the dam was left to the farmers by means of empowerment.

In the framework of social capital, not only the bridging capital was bigger in Tonde than in Tanga but the bonding capital as well. The cross cutting ties were used in different ways. Tonde used the connection of the Red Cross to get access to resources that the group itself didn’t have. This created a bottom up situation where a clear preset network could take care of the reservoir.

In Tanga however the cross cutting ties were used and created by an individual, the assembly man, to get access to the mainly financial resource. A top down situation was created. This created a situation where a scare resource was given to a divided group that existed of multiple, loosely connected networks.

7.3 The adoption

Within the adoption of the reservoir, critical decisions are often made that determine the usage of the reservoir. One can think of the election of the WUA, sharing of the plots, the strategy of water supply, the decision of building a common wall and so on. Social capital will have its influence in at least part of the events within this phase which determines for a great deal the future functioning of the reservoir.

7.3.1 The adoption of Tanga

When the construction started of the dam the commitment was asked to the locals in the form of help with the construction of the dam. The agreement was made in a meeting from the locals, that the work would be split in half. The Tang Dabot inhabitants and the Fra Fra would construct the channel plus the borehole on the side of their compounds and the Gunga inhabitants and the Moshis would construct the borehole and the channel on their side. It was reported, by the assembly man, that the work performed on the side of Tang Dabot was done very reluctantly and took a long time. It was stated in Tang Dabot that the work of construction of the channels was not divided in half but only the maintenance of it. Again, this was not fully clear but as most farmers stated the first statement, the second seemed unlikely.

After the dam was constructed and before the distribution of the land, the ground was levelled so a proper ground was formed to be distributed among the farmers.
It was agreed that any property rights that were in function before the coming of the dam would be expelled. A meeting was organised in order to divide the land.

On the date of the meeting, only half of the people showed up, namely the Tang Dabot people were missing. The meeting was expelled for two hours and after the Tang Dabot didn’t show up, the assembly man blamed it on the fact that they felt mistreated and were trouble makers anyway, it was agreed to start the sharing of the land. Because, so was reasoned, the work was divided into two; the land division would be done the same. A line through the water lock area was drawn and it was stated that each half was for the people living on that side of the half. Some of the Tang Dabot people held up another story and reckoned they were there in the meeting on time. This version of the story was denied by multiple sources and seems unlikely.

When some of the Tang Dabot people came in and saw what was happening, they strongly disagreed. According to their believes the land should have been divided according to the number of people, which was not more than reasonable if one looks at the property division before the coming of the dam into account. The meeting became tense and the parties each took their own route. Any form from communication, on the issues regarding the reservoir, was either not attempted or one-sided rejected.

As no agreements were made, or agreed on, the division of land became lawless. People started to claim land randomly and some based their claims on the ownership before the coming of the dam. Some claimed their land only for wet season farming. The Fra Fra community saw that there was limited chance of a common wall with every group included and decided to build their own common wall on the place where they had their plots before. The Moshi community took the plots, close to their compounds, where they were farming before as well and were more concerned with the water supply to their grounds than with the efficiency of it. The small basin described in the common description of Tanga was the result of it.

Mostly on the side of the Tang Dabot, people were very reluctant to claim land downstream. As fertile grounds were available upstream, tensions were present with the farmers downstream and quite a few farmers were there already before the coming of the dam, they preferred to choose that side. A rather ironical choice as the upstream farming was a reason for them to start a riot in the past.

This individual run for land that caused the building of individual walls and the option to create hand dug wells that were fed with water from the reservoir. A common wall and the trench method that can be seen at Tonde clearly need coordination and a form of trust in the group as a whole. Other additional reasons
that explain the well and the individual walls, when one compares the situations with the Tonde site, can be thought of as well. For example, because the farmers on the Tanga site were used to build individual walls and used hand dug wells, the hurdle to build a common wall compared to Tonde was bigger as a tradition had to be broken. However, these hurdles were not barriers and with proper communication within the group this situation could have been prevented. The methods 'chosen' by the farmers clearly gives an additional explanation for the inefficient water usage.

7.3.2 The adoption of Tonde

The adoption of Tonde is less of a complex story. For the building of the dam the Mothers group as well as the rest of the community was asked, as a sort of a commitment, to help with the construction. Stones and sand were collected and the workers were fed by the community. A commitment fee of 500 cedis of the women and 1000 cedis of the man was asked. Whereas the coming of the dam was initiated by the women, the dam was not restricted to this group and was build as help for the community as a whole. The women, however, had a privileged position. This came forward, for example, when only one channel was constructed and the women were allowed as the first to use this channel to water their crops.

By the time that the dam was fully constructed land was divided for who that wanted to farm. In order to avoid jealousy and possible separation within the strong cohesive group the executive at that time proposed that the land, that had some more fertile and some more rocky area’s, should be divided under the farmers on basis of luck. This system he proposed was that the land patches first was divided under the women based on their village: each village had to choose a number without knowing which plots that number contained. Once the plots were divided for the villages, each village had to perform the same for each person within the group: each woman got their plots based on luck. Land was not given permanently but as a sort of borrowing basis. Once a farmer stops or refuses to pay, the plot is given to another farmer.

The women were trained by the Red Cross society and were taken regularly to other, closely, reservoirs. This happened only in the beginning. When the funding was exhausted and once the women were able to fulfill their farming activities on their own, the training was stopped. If there are problems now, often mostly regarding diseases, this is solved with the internal knowledge: if this is not sufficient the top of the WUA or other representatives are send to the Agricultural extension office, located in Zebilla.
Next to this, one person that plays another central role of the successful adoption of the reservoir is an individual called ‘Isaac’ that had experience with the dry season farming. If help needed, he could give the support that was needed. As women proved that dry season farming with the help of the reservoir was profitable the amount of men, as well as women, rose. Still patches of land are given away to both men and women on the back of the fields.

7.4 Conclusion of the influence of social capital on the adoption

Different aspects of social capital, can be argued, could have prevented the situation created in Tanga. Or, due to the lack of social capital, the situation as such was created. A lack of an overall connecting network between different groups was the basis of mistrust and a troubled adoption of the reservoir.

With the top down approach a critical resource had to be implemented with the help of multiple networks. These networks were very pluriform. The pluriformity came forward in ethnic backgrounds, politically believes, possession held and so on. This created a situation in which each network tried to achieve its own objective, sometimes at cost of other networks.

Communication came to a hold and due to limited interdependency the situation was created that individual needs overruled the need of the community. Again, limited bridging capital can be named as one of the causes. Mistrust between the groups, mainly based in Tang Dabot, lead to a sort of self exclusion which opened a window of opportunity for other groups to take advantage of the situation. This mistrust and exclusion created a situation in which incentives to initiate proper or even restore communication were lacking. Due to the lack of an overall network the mutual dependency was limited and individual actions ruled over coordinated actions that could benefit the community as a whole.

In Tonde, however, the opposite situation was created due to the use of a strong cohesive group that had bridging capital in each of the villages as the mothers group consisted out of women from four different villages that were the future users of the reservoir. The pluriformity that possibly existed among the villages was equally represented in the group which allowed creating a relative large bonding capital. Acceptance of decisions of this group would therefore enjoy the support of each of the different villages or groups within those villages.

The usage of this group created a situation in which unwanted courses of action could be avoided as each group had representatives that formed the group. Individual actions or actions of groups, other than the Mother group, that could have harmed the collective adoption of the reservoir could easily be blocked by the group. Due to its cohesiveness, exclusion of unwanted behaviour was
possible and because of this, incentives for attempts to strive for individual gain decreased.

7.5 The usage

The usage of the reservoir is the stage in which actions and decisions made in the adoption and initiation phase come into practice and show it effectiveness. As the report of Faulkner (2006) and the measurement of the social capital were made in this stage, explanations that make clear the different observations and measurements will have the most numerical significance. The common (miss)-trust that was to be assumed to be constant or at least similar, might have changed over time. These, possibly wrong assumptions are sometimes not needed or less prominent is this stage which increases its reliability.

7.5.1 The usage of Tanga

The usage of Tanga can be said as troublesome in a manifold of aspects and the roots of this were in the initiation and adoption of the reservoirs. Silting of the reservoir due to the upstream farmers, weak management due to limited support of the farmers, miss payments, deteriorated channels and even a sort of sabotage by the flooding of the fields on purpose were reported.

7.5.1.1 Unused plots

With the problem of the distribution of the land, the current situation is heavily affected. Upstream farmers, starting farmers or farmers that had plots on the site of the dam that want to farm downstream, find it difficult if not impossible to get a plot. The plots now available for dry season farming are only the plots that were conquered in the run for plots in the adoption phase and are used for rice wet season farming only. These plots are of high value to most farmers as rice needs a valley to be grown and rice needs limited financial input.

These plots can only be used on a sort of borrowing principle. The agreement must be made that the dry season farmer will hand the plot back to the wet season farmer when the season is over. The dry season farmers are not willing to take these plots because the fertility of the ground created by the use of, the expensive, fertilizer in the dry season would be used by the farmers in the wet season. The farming activities would harm the fertility of the ground, so the dry season farmers do avoid these plots. This results in unused plots between the used plots and is an extra barrier to create a common wall.

People that have plots now are unwilling to give up these plots for redistribution. The chance that within the new distribution their share will decrease is present.
Most representatives, apart from the fishers that represent the Tang Dabot site, have plots on the site and any decision for redistribution will have to be led by these representatives. And apart from this, the upstream farmers that would like to come down would have the advantage of still maintaining their wet season farming plot upstream for rice while occupying a plot that is now used for the same purpose. The farmer that holds the rice farming plot downstream does see this as unfair.

7.5.1.2 The contribution

Payments form a problem in the current situation. People are unwilling to pay and have little incentives for a range of reasons. First of all, there is no consequence for not paying. The current setup doesn’t allow to stop water flow to plots without cutting of water supply of others. Strict regime from the WUA is lacking and no social control is in place.

Farmers reported even that as a tactic, they would go to the first meeting of the year to see when the valves were to be opened that year and how many people paid their fee. If there were many people not paying their fee, they felt that they had the right not to pay as well. Meetings that should be partly for addressing other aspects than money were only about money. The inability to gather the money was increased by the fact that the individuals who didn’t pay their fees never showed up in those meetings.

Redundant systems in the form of hand dug wells decreases the dependency of the dam water for irrigation. Farmers who were encountered didn’t get water for more than three days, yet, had little complaints about management. When water was flowing, it took away the hard work of using the calabashes. But if the water flow was lacking, no serious consequences for the crop was there.

Apart from this, the WUA lost a serious amount of potential contribution because the upstream farmers didn’t contribute fees. Some of these farmers joined the WUA in the beginning but most of them, if not all, left the WUA. Different reasons were given. First of all, they didn’t have direct benefit of the water because they mostly used hand dug wells. Secondly, some told that they were willingly to pay in the beginning due to the idea that the dam was a common good. But when individuals took over, the incentive to pay was lost.

As a result of this, the bank account is around 500.000 Cedis, 50 euro’s, which is by far not enough to do proper maintenance. This leads to a decrease in trust in the WUA and payments are postponed.
7.5.1.3 The problem of the upstream farmers

Upstream farmers, that form a serious threat for the silting of the dam according to the agricultural extension officer, cannot be placed downstream. Multiple reasons can be found for this. First of all there is no possibility for placing them downstream because of the unwillingness of the wet season farmers to give up their plots downstream. Secondly the tensions created in the past form a hurdle. And next to this, the upstream farmers are unwilling because the farming ground upstream is reckoned to be more fertile and the plots are close to their houses. And finally, there are no consequences for farming upstream that could be an incentive to move downstream. An unsustainable situation is created in this way.

The upstream farmers reckon they do not do any harm to the reservoir by means of silting the reservoir when the rain time comes and their walls rain away. They say their walls are so strong that they can withstand the rain. Downstream farmers say this is nonsense and that the walls of the upstream farmers crumbled down mostly in the rain season.

The upstream farmers are the main suspects for the intentionally flooding of the plots by opening the valves during the night. Only when the community spread the word that the person doing this was facing a prison sentence when he was caught, it stopped. The situation is still not settled. Farmers downstream said they tried to approach the group of upstream farmers a few times and sort out the problems so they could join the downstream group. This only lead to an even tenser situation according to the downstream farmers so they left the situation as it is.

This exclusion has still also its impact on the information flow. Although two members of the village are in the WUA as the representatives of the fishers, the information of meetings coming up are often not passed through to them which leaves them partly excluded from decisions that have influence on their dam as well. Although the farmers upstream are part of the WUA, some openly admit that they do not pay the fees. They don’t see the benefit in paying.

7.5.1.4 The fishers

The fishers form a big stakeholder group in the reservoir as well. Yet, because they have little to do with the management, maintenance and input use of the farmers they were left out from the sample. Some interviews were held with them instead.

Little to no complaints were made by the fishers; the fish stock is stable over the year and they were mostly independent of the management apart from the fact
that they have to pay 10,000 cedis each month as a fishing fee. Some fishers mistrusted the management when it came to these payments. In the beginning of the reservoir a receipt was given by the people that collected the money when a fisher paid. However, this changed and now it is unclear to them whether the money is used for private use or whether it is handled properly. Apart from this, their worry was that the reservoir became smaller every year.

7.5.1.5 The WUA

The structure of the Tanga WUA is slightly different compared with the standard. Whether this description is 100% accurate is not sure as ideas of the structure changed per person and over time.

The top exists of 9 executives. Three fit in the standard structure: the treasurer, the chairman and the secretary. Apart from them, it consists two executives representing the fishers who use the dam for the fisheries, two are organisers responsible for practical things as getting the people together in case of a meeting, collecting the fees and so on and two valve openers.

Each of the two valve openers is responsible for one of the valves and they share the key to open the valves. Punctuality is not their priority: the agreement is that they open the water between 13.30 and 18.00.

7.5.1.6 The management

Management was not strong in Tanga but this was not solely caused by the individuals in the management. Cooperation of the farming community, which was needed for proper management, lacked. Examples can be found in the collection of the payments. Due to this inability, the management was not able to do proper maintenance, which led to often malfunctioning of the reservoir.

This bad maintenance had direct influence on the water management again. The more one goes to the back of the plots, the more people start to complain about the management that does not open the valves. Especially the plots in the back use a very inefficient irrigation method. It takes a long time before the water reaches the plots and the management is not always willing to open the valves for this. When individuals from the end of the plots complain of water shortage the valve openers make up excuses as that the key to open the valve is lost.

On their part, the farmers close to the dam tell that it is impossible to let the valves open for longer: due to bad maintenance and fallen slabs, the time of opening the valves should be limited otherwise their crops would be spoiled due to the abundance of water.
Next to this, the fact that there were no strict rules set by the management, lead to lawlessness. People were wasting water, didn’t maintain the site properly, and were even making holes in the water channels on their own so they could create a water supply stream to their plots. This lead to malfunctioning of the channels and to worsen the deterioration of the already mal maintained channels. Management left these practices unpunished.

The hypothesis posed by Joshua Faulkner (2005) that possibly water shortage would lead to stronger water management can on multiple points be rejected as unlikely. Management lacked any control over the water usage: individuals are opening the valves, water wastage stays unpunished, and a feeling of common responsibility and common dependency of the water was mostly lacking. Only if individual needs could be fulfilled people were willing to help.

Practices around the reservoir itself lead often to pollution of the water inside the reservoir. These practices were mainly the production of local fibre for weaving mats used for housing. In this process a lot of unusable material is created and this was dumped in the reservoir. These materials in the water lead to congestions in the valves and trenches. Again, management was unable or unwilling to make sure this did not happen again and only due to the ability of individuals these practices stopped.

All the farmers, including the upstream farmers, said that they were happy the dam came. Mostly benefits for the upstream farmers other than farming were named. The main benefit was that the cattle could stay close to the houses which reduced the chance of being stolen.

7.5.2 The usage of Tonde

The impression after interviewing 40 of the Tonde- farmers, lead to a conclusion that the management of Tonde can be described as strong.

First of all, it was brought forward by respondents that the management stated in meetings that people should feel free to put complaints or annoyance forward towards management without any repercussion. The overall impression that was created during the interviews was that hardly anybody felt management lacked control or ability and interviews were very open.

Strong points brought forward were the yearly meeting in the beginning of the year where agreements were made on how to collect the money, when to open the valves and when to start the building of the common wall. Collecting money was not seen as a problem: everybody paid and when some were reluctant to
pay intervention of management made sure that the fees were to get paid. In a meeting of the WUA however it became clear no fees for this years farming activities were collected yet.

For maintenance clear agreements were made. When there is a problem, a whistle is blown and people, as farmers confirmed, rush in to help. Small maintenance that does not need a lot of man power is done by some individuals themselves.

For the building of the wall the management makes clear agreements: every group of farmers is responsible for a part of the wall. If some farmers fail to build the wall, the social cohesion makes sure that these individuals do fulfil their task. If not, then they are that season no longer welcome but whether that ever happened in the past was not clear. With good reasons, such as funerals and so on, a small fee can be paid as compensation of not being part of the common activity. As earlier said, this year the wall was crumbling down already early in the season and the reason given by farmers for this were the many funerals.

Management was actively busy with maintenance: plans were already made to make sure a leak in the dam will be repaired with the coming of raining season. The overall condition of the dam could be seen as good. The structure of the WUA in Tonde can be called classic. One has three people in the top: the treasurer, the chairman and the secretary. The only woman in this structure is the treasurer: she represents the Red Cross Mother group.

One person is responsible for opening both valves and around 15 persons are scattered among the plots responsible for reporting water wastage, damage and so on. No clear was how strict and official the function of the 15 people in the field was. Not every farmer had heard of these functions and the number of people fluctuated per interviewee.

Some farmers that started to farm only this year were encountered on the field. They didn’t encounter any difficulties to get a plot to farm on and it was a straightforward process. Farmers in the field were willing to explain newcomers how to farm. Whether these farmers had contacts in the network before their farming activities was unclear but the impression was that these farmers had friends in the field already.

7.6 Impact of social capital on the usage

Overall speaking one state that the usage phase is where the results of previous phases come together. In Tanga, previous stages created a situation in which only a part of the potential downstream farmers are using the reservoir. The
farming activities are seen as individual actions in every aspect and management is struggling as only limited support is granted. As a result, limited payments are made. Only part of the potential contributions is paid because part of the potential users of the reservoir farm upstream. Maintenance is falling behind and as a result, farmers see the management as weak. As a result of this, incentives to pay for the usage of the reservoir decrease. The multiple networks, limited bonding and bridging capital in the farming community, which found their basis in ethnic differences, are part of the explanation that the framework of social capital gives for the differences between Tonde and Tanga.

The opposite characteristics found in Tonde can partly be explained by the opposite characteristics in a part of the framework of social capital. A strong network with limited pluriformity regarding objectives, ethnics and so on forms a strong basis in which externalities come forward for the farming community as a whole. Bonding capital creates social control with which the management of Tonde can fulfill their task much easier compared with Tanga.
8 Conclusion

8.1 Conclusions social capital

The usage of the framework of social capital gave additional insight and explanation in the networks of Tonde and Tanga. It was concluded that the farming community in Tonde has a significant bigger social capital compared to Tanga. Tonde and Tanga have distinct and significant differences (based on a 10% confidence interval) in at least three of the six aspects of social capital, which came forward in the implementation and usage of the reservoirs. The most significant differences are in the:

- groups and networks
- social cohesion & inclusion
- trust

These differences in perceptions find their roots in the history of the rural dry season farming communities and have its impact in the differences of the lifecycle of the two reservoirs.

*Groups and networks* play an important role in the differences between Tonde and Tanga. The four villages that are using the Tonde reservoir were represented in one cohesive, gender and ethnic homogeneous group. The group created positive externalities for the community as a whole because it provided the bridging (ties between networks) and bonding capital (ties within the network) that was needed for a successful implementation of the reservoir. This fundamental success factor was lacking in Tanga. Multiple loosely connected networks were present in Tanga. The networks had their own objectives and conflicting perspectives.

*Social cohesion and inclusion* possibly created the biggest difference between Tonde and Tanga. Whereas in Tonde, no history of violence or conflict is recorded, the history in Tanga contains several incidents between two groups/networks in the farming community. The partly ethnic based incidents were about farming activities and are therefore significant as these two groups are the current users of the dam.

*The trust* between and in the groups in Tanga is smaller compared to Tonde. Compared to Tonde, more farmers in Tanga have the perception that other farmers in the same reservoir are likely to take advantage of them or each other. The trust of the farmers in the WUA in Tanga is very low compared to Tonde as well.
8.2 Conclusion impact of social capital

These differences in social capital had different impacts in different phases (initiation, adoption, usage) of the reservoirs. These impacts caused some of the differences between the reservoirs described in the report of Faulkner (2005). The limited maintenance, the weak management, the individual walls in Tanga and the differences in water distribution can partially be explained by the differences in social capital. These differences between the reservoirs find a more likely reason in the differences in social capital, rather than the different water availabilities as was suggested by Faulkner (2006).

The initiation

Empowerment, which is a part of social capital, was the trigger that started the start of the construction of the dam at Tonde. An already existing, cohesive group lobbied for the dam which created a sense of common responsibility for the reservoir in this network.

The trigger that initiated the construction of the reservoir in Tanga was mainly the assembly man that lobbied for the dam. No effort or initiative from the networks that would later benefit from the dam was reported. The foundations of mistrust were laid by unevenly distributed assets on the side where the reservoir is located now. Different groups had to give up unevenly distributed assets while these groups that would later on benefit equally by the reservoir. Already existing mistrust due to tensions limited communication between the groups.

The adoption

In Tonde, strong management had the opportunity to establish itself on the foundations of the existing network that initiated the coming of the dam. Central coordination and the common acceptance of strategically decisions were possible due to the existing network and trust within the group. The common wall and the trench method are examples of such decision that need coordination.

The multiple loosely connected networks that were present in Tanga lacked coordination. Each of the networks had their own objectives and conflicting perspectives. Mistrust and exclusion created a situation in which incentives to initiate or even restore communication were lacking. Due to the lack of an overall connecting network, the mutual dependency was limited and individual actions ruled over coordinated actions.

This troubled adoption in Tanga created a window of opportunity in which individual actions ruled over coordinated action. Effects of the decisions taken on
individual objectives still can be seen in the current use of the reservoir such as the individual wall, the upstream farmers and hand dug wells. Individual run for plots created an uncoordinated distribution of land. As a result of the uncoordinated land distribution, land was often claimed on past property rights. Because some farmers use these plots only for wet season farming, this creates a lot of unused plots in the dry season.

_The usage_

Overall, one state that the usage phase is where the results of previous phases come together.

In Tanga, the farming activities are seen as individual actions and management is struggling as only limited support is granted. As a result, limited payments are made. This effect is increased because there is a loss of potential contributions as part of the potential users of the reservoir farm upstream and the inability for farmers to get plots downstream due to uncontrolled land distribution in the adoption phase. Maintenance is falling behind, channels fall in disrepair and as a result, farmers see the management as weak. Due to this, incentives to pay for the usage of the reservoir decrease even further.

In Tonde the opposite characteristics can partly be explained by the opposite characteristics in a part of the framework of social capital. The WUA of Tonde is based on the cohesive network that initiated the coming of the reservoir. The already acknowledged and existing power structure of this network forms a basis for the WUA to function. Unwanted behavior, such as not paying the WUA or wasting water, can be excluded due to this. As the WUA has the support of the farmers, enough money for maintenance comes in and distribution of land can be controlled.

### 8.3 Conclusion differences between reservoirs other than social capital

The differences in output, usage of fertilizer, seeds and pesticide find no explanation in the differences of social capital. Additional explanation for these differences between the reservoirs may be found in various facets.

The differences in the usage of fertilizer, seeds and pesticide find possible explanations in the different soil conditions of the reservoirs, the different location of the valves in the dam and the different shapes of the fields. Next to this, the knowledge baseline on which the farmers base their input decisions, education and experience may be an additional explanation in this process.
The impact of differences in knowledge and experience is bigger due to the 'satisfactory strategy' farmer's use, rather than 'optimisation strategy'. No extra effort could be seen or detected in order to grow more or extra crops once a satisfactory level was reached. Errors or gaps in the initial knowledge therefore have a long term impact because there is no new information gathered. Due to the cohesiveness in Tonde, it can be argued, the knowledge sharing is increased and errors in the initial knowledge have its impact on the whole farming community.

An additional explanation for the differences for the differences in input was provided by the farmers. They stated that wrong information was provided to researchers. The differences in the input and output/profit per hectare find another possible explanation in the fact that Tonde has only one harvest per dry season while Tanga has two. And as Joshua Faulkner (2005, p: 11) stated in his report that 'The farmers were asked the initial cost of seeds, fertilizer, pesticides, and plot 'rental', as well as the amount of onions harvested, recorded in number of standard sacks. If the farmers grew any other crops, they were also asked the amount of profit received from the sale of this additional crop.' This could have lead misinterpretation of the (intended) question which caused the differences.

8.4 Conclusion framework social capital as multi-actor analysis

Social capital refers to the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded. Social capital is the glue that holds societies together’ (Serageldin: foreword of Grootaert, 2001). The framework of social capital finds itself between social network analysis and Configuration analysis. Social cognitive configurations are used to enable quantitative comparison of the actors' perception of the structural characteristics of the network in which they act. Yet, no statements towards policy issues are integrated in the framework. The main focus of the framework is on the perception of network characteristics.

In the case study of Tonde and Tanga, it can be argued that the perception of the networks by the actors has a significant impact on the functioning of the networks in which these actors act. Different perceptions on aspects of networks and relations in these networks have different influences. Examples can be found in:

- The perception of differences within the networks: In the Tanga reservoir, different ethnic groups are using the reservoir. It can be argued that the perception of the difference in ethnic background and not the ethnic difference itself has a big impact on the functioning of the reservoir. In Gunga Kusaasis and Mamprusis live together and perceive the difference in ethnic background not as a significant problem. Kusaasis in Tang Dabot
however, perceive this ethnic difference between Kusaasis and Mamprusis as relevant and it forms a basis on which conflicts and arguments are built on. These conflicts influence the effectiveness of the local network.

- The perception of the importance of trust in the networks: Influential in the functioning of the networks in the farming communities is which organisation is perceived to be important and how much this network is trusted. The WUA has the formal responsibility and ‘power’ over the reservoir. This formal power proved to be not very influential in the functioning of the network for farming activities in both reservoirs. In Tanga, part of this has to do with the fact that half of the farming community perceives the WUA is not to be trusted. Due to this mistrust, the cooperation of the farmers with the WUA is limited. In Tonde, the farmers perceive the Red Cross mothers group as more influential for their farming activities. This network was the basis on which the WUA is founded: the WUA functions well due to an already existing and trusted network.

The empirical research suggests perception towards networks do matter. And so the theoretical framework of social capital can therefore be a useful addition in network analysis.

In this case study of Tonde and Tanga, the framework of social capital gave a platform that functioned as a basis on which the two sites could be compared. The framework showed numerical differences on various aspects and covered a wide range of network characteristic. These differences allowed the qualitative analyses to be more focused.

This broad focus of the framework however creates the need for additional analysis, such as in-depth interviews, if one wants to know the causes of the differences. With the help of the questionnaire, one will only know the numerical differences between the network characteristics but lacks the insight in the causes of these differences.

The framework of social capital lacks the ability of a model in which possible policy implementations can be compared. The social capital measurement as performed can only be seen as a measurement in one point in time and does not allow studying any dynamics. The problem of time constraints comes forward in question 22 (see appendix) where there is asked for actions of empowerment in the past 12 months. In the measurement it didn’t come forward that one of the 2 reservoirs came into place through empowerment while this proved to be very important.
Apart from this, the framework has some overlap in the six different aspects measured. Examples are the distrust that comes with ethnic conflicts, the collective action and the conflicts and so on. For example when high ranked government officials are mistrusted to a great extent, this could increase the feeling of togetherness in a community because of one common ‘enemy’.

Next to this, the measurement of social capital in order to compare two communities may give results that are distorted. Important roles of individuals, such as the assembly man in Gunga, tend to be diluted. One cross cutting tie of such a central individual, for example, may prove vital for the community while the questionnaire this will not show this. This is because the results are concluded on the basis of averages and/or distributions.

As a conclusion, the framework of social capital has some advantages but, as with all studies, there is a tradeoff. It finds its function in comparative studies and can be used to quantify some relevant qualitative aspects of networks. Disadvantages, in some cases, are the broad scope of the framework, the time constraints and the lack of causal relations.
Recommendations
9 Recommendations

It is worth investing time and money in the choice of the community for who the reservoir will be built. It will determine a very essential part of the future sustainability of the dam. Corrections afterwards will be very hard to implement and will mostly lack prosperity of success.

In order to increase the likelihood that a reservoir will live up to its expectations, the following recommendations are made:

- Use existing, strong cohesive groups as a basis for bottom up implementations of new reservoirs.
  - In this way one uses the highly interdependent and difficult organically grown structure of the society. A structure grown as such proved most successful in the society as it was under the rule of evolution. One avoids intervening in a system that is impossible to understand fully. Using a newly defined network in a top down approach will cause a dynamic of which the outcome is yet unknown.
  - A bottom up approach (where farmers state ‘we want/need a reservoir, such as in Tonde) has advantages compared to a top down approach (where there is asked ‘do you want a reservoir?’, such as in Tanga). A common effort from the farmers to get a reservoir increases common responsibility and common acceptance of the reservoir.
  - Newly created networks after the implementation of the dam, such as the WUA, will not function without the support of the farmers. With the usage of existing networks, one allows the WUA to use already acknowledged and existing power structures as a basis to function.
  - With a strong network, exclusion of unwanted behavior (wasting water, not participation in common labor and so on) is possible. A downside of this is that possibly well-willing individuals can be excluded from the group on other reasons, based on for example ethnic reasons.
  - To locate a strong cohesive group, the framework of social capital combined with common sense can be used. Local NGO’s have a lot of local knowledge and may be a tool for locating these groups as well. Important to realize is that individuals in these NGO’s are likely to have personal objectives and will therefore not always be the right information source.
• Use ethnic homogenous groups
  o Parts of the problems in Tanga were created by ethnic tensions. Ethnic homogeneity proved a binding factor that partly can be explained by the common frame of reference: a shared baseline on which decisions are made and that provides a certain kind of predictability on which can be anticipated. Next to this, one can speculate that the interdependency of individuals in homogeneous groups is bigger: with shared characteristics come shared activities, other than farming alone.
  o Emphasized should be the notion that heterogeneity, based on ethnics for example, itself is not a problem. It only becomes a problem if the actors perceive it as a problem. By choosing homogenous groups, one rules out the existence of (some) differences in a group and therefore the possibility for actors to perceive differences as a problem.

• Use female homogenous groups.
  o Involving gender (female) homogeneous groups in the implementation of small reservoirs can be seen as a favourable course of action with the idea to strengthen the position of the women. It makes them less vulnerable and dependent on the man. This creates a possibility to create a type of social security and avoid a drop to poverty when a husband dies.

• Let the reasons for locating proper sites for building a dam, not only be based on technical reasons.
  o The dam in Tanga was built on a site that was said to be technically the most appropriate. Socially, however it was not the most appropriate place and this had clear impacts on the technical efficiency of the reservoir.

• Social capital is a good start to examine social factors that will influence the implementation of a reservoir, yet it is a start only.
  o As mentioned in the conclusion of this report, the aspects of social capital do influence the functioning of reservoirs. The networks, the trust and the social cohesion for example. However, the framework does not give a full overview of all factors in society that might influence the functioning of reservoirs. Local setups and situations are very deterministic for the successful implementation of reservoirs and only part of these situational circumstances come forward in the framework of social capital.

• Additional research on social issues is recommended.
Because social circumstances do influence the functioning of small reservoirs and social capital lacks the ability to locate them all, additional research is required. A range of other fields that need attention. Examples are the influences on the functioning of the reservoirs of education, the knowledge of farmers, land property issues.

- When one wants to implement reservoirs, solve the land (property) issues before constructing the dam.
  - Use existing and formal power structures to solve the land (property) issues. In the case of Tonde the chief who was involved made sure that the farmers, who were farming on the location where the reservoir was built, lost any right to make claims on land afterwards. In Tanga this was not done and created difficulties.
  - Use locations, if possible, that are not on borders of Tindana’s, chiefs, assembly men, ethnic groups and so on. In most cases this will not be a problem but these issues can be reasons to form a conflict. By avoiding these locations, one avoids potential conflict such as in Tanga.

- Involve all stakeholders in solving land issues.
  - For land issues, Tindana’s are an important group to include in the issues as well. Some of the formal powers might not be in their hands but this group forms a very relevant stakeholder as they fulfill central positions in the communities. Include farmers, fishers, tree owners, house owners and all other stakeholders that are affected by the coming of a new dam. By involving these actors early in the process, feelings of mistrust and exclusions that might affect the functioning of the reservoir, can be avoided.

- In order to make the chance of a successful implementation more likely, one will need to supply the group not only with the necessary means in forms of materials but with essential cross cutting and bridging ties as well.
  - These ties, such as contacts with other small reservoirs and the agricultural extension office, should not be a one way tie. Actively participating as an organization or community within improvements and updating other target groups of these improvements can be seen essential. Long lasting errors in the knowledge of the farmers can be avoided in this way. Bridging ties form an important tie as this creates linkages with communities in the same economical, occupational and social situation. Acceptance of information of these groups is more likely.
Let agricultural extension officers actively participate as soon as possible from the start of the conception and the building of the reservoir.

- Although there was an extension officer in the area, the farmers in Tonde reckoned their main source for their initial knowledge for farming were other farmers and not the extension officer. The information of other farmers is often not based on optimization but on ‘ignorance’ (to quote the local agricultural extension officer). By actively involving the extension officer from the beginning on, such as in Tonde, the initial knowledge would be based on scientific knowledge. Attempts to make changes in the habits of farmers that are based on existing rural knowledge are very hard to make.

A lack of social capital or other forms of social inappropriate circumstances in a community is a sensible reason to abandon, or to postpone, the idea to implement a small reservoir.

- A common resource needs common responsibility. Giving common resources, such as a reservoir, to a loosely connected network will probably not live up to its expectations.

- This however does not mean that one should abandon the community as a whole. Changing the focus from community based to individual based aid might improve results. A more individual approach where the resources are not shared with a whole community may be a more effective solution. Concrete examples depend very much on the local context. Shuffles, donkey cars, loans, onion storage facilities, plows and cows are examples that may fit individual needs for farming activities.

Unsuccessful implementations cannot always be avoided. Implementations based on individual objectives do happen. These implementations will have limited support by the farmers. The creation of a toolbox as attempted by the small reservoir project will have limited effect in such cases.
Appendixes
10 Appendixes

10.1 Final questionnaire

- To which tribe do you belong to or do you consider yourself?
- What is your religion?
- Next to this, the gender of the person was written down.

I would like to start by asking you about the groups or organizations, networks, associations to which you or any member of your household belong. These could be formally organized groups or just groups of people who get together regularly to do an activity or talk about things.

1. Of how many such groups are you or any one in your household (wife, kids) a member?

2. Of all these groups to which you or members of your household belong, which one is the most important to your household in the dry season for the farming activities?

3. Thinking about the members of this group, are most of them of the same….  
   A. Religion (1 Yes 2 No):  
   B. Gender (1 Yes 2 No):  
   C. Ethnic or linguistic background/race/tribe (1 Yes 2 No)

4. Do members mostly have the same…  
   A. Occupation (1 Yes 2 No):  
   B. Educational background or level (1 Yes 2 No):

5. Does this group work with or interact with groups outside the village (or reservoir)?  
   1. No  
   2. Yes, occasionally wet and dry!  
   3. Yes, frequently

6. About how many close friends do you have these days? These are people you feel at ease with, can talk to about private matters, or call on for help.

7. If you suddenly needed to borrow a small amount of money [enough to pay for expenses for your household for one week], are there people beyond your immediate household and
close relatives to whom you could turn and who would be willing and able to provide this money?
1. Definitely
2. Probably
3. Unsure
4. Probably not
5. Definitely not

8. Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?
1. People can be trusted
2. You can’t be too careful

9. In general, do you agree or disagree with the following statements?

A. Most people in this village are willing to help if you need it in the dry season?
1. Agree strongly
2. Agree somewhat
3. Neither agree or disagree
4. Disagree somewhat
5. Disagree strongly

B. In this village, one has to be alert or someone is likely to take advantage of you in the dry season. And in the wet season?
1. Agree strongly
2. Agree somewhat
3. Neither agree or disagree
4. Disagree somewhat
5. Disagree strongly

10. How much do you trust….

A. Local district officials
B. Assembly man
C. Water user associations

1. To a very great extent
2. To a great extent
3. Neither great nor small extent
4. To a small extent
5. To a very small extent
11. In the past 12 months did you or any one in your household participate in any communal activities, in which people came together to do some work for the benefit of the community?  
1. Yes  
2. No (skip to question 14)  

Answer = …

12. How many times in the past 12 months? And which was the most important one?  

Answer = …

13. Did you or would you contribute time or money to that project?  

A. Time  
1. Will not contribute time  
2. Will contribute time  

B. Money  
1. Will not contribute money  
2. Will contribute money  

14. If there was a water supply problem, such as in the reservoir, in this community, how likely is it that people will cooperate to try to solve the problem?  
1. Very likely  
2. Somewhat likely  
3. Neither likely or unlikely  
4. Somewhat unlikely  
5. Very unlikely  

15. In the past month, how many times have you made or received a phone call?  

16. What are your three main sources of information about what the government is doing (such as agricultural extension, etc.)?  
Answer 1, 2 and 3!  

17. How many times in the past month have you asked advice to a group or friend regarding farming questions? And were they from the same reservoir?  

18. [If not zero] Were any of these people….  

A. Of different ethnic or linguistic background/ race/caste/tribe? (1 Yes, 2 No)  
B. Of different economic status? (1 Yes 2 No)  
C. Of different social status? (1 Yes 2 No)  
D. Of different religious groups? (1 Yes 2 No)  

19. In general, how safe from crime and violence do you feel when you are alone at home?
1. Very safe
2. Moderately safe
3. Neither safe nor unsafe
4. Moderately unsafe
5. Very unsafe

\[ \text{Answer} = \ldots \]

20. In general, how happy do you consider yourself to be (now)?
1. Very happy
2. Moderately happy
3. Neither happy nor unhappy
4. Moderately unhappy
5. Very unhappy

\[ \text{Answer} = \ldots \]

21. Do you feel that you have the power to make important decisions that change the course of your life? Rate yourself on a 1 to 5 scale, were 1 means being totally unable to change your life, and 5 means having full control over your life.
1. Totally unable to change life
2. Mostly unable to change life
3. Neither able nor unable
4. Mostly able to change life
5. Totally able to change life

\[ \text{Answer} = \ldots \]

22. In the past 12 months, how often have people in this village got together to jointly petition government officials or political leaders for something benefiting the community?
1. Never
2. Once
3. A few times (<5)
4. Many times (>5)

\[ \text{Answer} = \ldots \]

23. Lots of people find it difficult to get out and vote. Did you vote on the last presidential election?
1. Yes
2. No

\[ \text{Answer} = \ldots \]

24: If you could improve something about or in the reservoir, what would it be?
25: And to who would you go to?
26: why did you start dry season farming?
27: What do you see as the biggest difference between Tonde and Tanga?
28: Did your life improve after the coming of the small reservoirs?
Any comments or additives that could help the project?
10.2 Adjustments made in questionnaire

During the first 2 weeks of the stay in Ghana, final adjustments were made to the questionnaire. Many involved cultural differences and definitions that were not clear.

First of all, an addition was made with the questions

- To which tribe do you belong to or do you consider yourself?
- What is your religion?
- Next to this, the sex of the person was written down.

As well as in the end of the questionnaire the following questions were added:

- 24: If you could improve something about or in the reservoir, what would it be?
- 25: And to who would you go to?
- 26: Why did you start dry season farming?
- 27: What do you see as the biggest difference between Tonde and Tanga?
- 28: Did your life improve after the coming of the small reservoirs?
- 29: How do/did you determine your strategy regarding the crops seeds, the amount of fertilizer used and the amount of seeds?
- 30: Do you have any comments or additives that could help the project or that you would like to share with us?

The following clarifications were made:

- Q1: household= direct family such as wife and children. This does not include uncles, nephews and so on, living in the same family compound.
- Q2: was split into dry and wet season and focussed only on the dry season. Due to different farming activities, the importance of networks and associations could change with seasons as well.
- Q7 till Q 9: was split into dry and wet season or focused on dry season only. The reason for this was the likelihood of change of trust during the change of season.
- Q 11-13: in order to make the questions less socially desirable, which could influence the reliability of the questionnaire, these questions were changed in order and the way they were asked. Instead of asking ‘would you contribute time and money?’ these were changed first by asking In the
past 12 months did you or any one in your household participate in any communal activities, in which people came together to do some work for the benefit of the community? How many times in the past 12 months? And which was the most important one? Did you or would you contribute time or money to that project?

- Q14: An addition was made by giving an example of a water supply problem and was related to the reservoirs.
- Q16: Instead of supplying the respondents with a list of possibilities, the questions became an open question.
- Q17: During ‘practice rounds’ with the questionnaire, it appeared that within these region the question ‘17. How many times in the past month have you got together with people to have food or drinks, either in their home or in a public place?’ was answered consequent with the answer ‘countless’. It was very common to do such a thing and so the question was replaced by the questions: ‘17. How many times in the past month have you asked advice to a group or friend regarding farming questions? And were they from the same reservoir?’
- Q20: more than one specialist of the SRP showed her/his concern about the word happy: in practice this appeared not to be a problem.

10.3 Statistical tests

10.3.1 Overview measurement gender/religion/ethnical background

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10.3.1.1 Chi-square test ethnics

Skipping rows and/or columns filled with zeros.

Expected counts are printed below observed counts

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Total | 35 | 38 | 73

Chi-Sq = 3,391 + 3,123 + 0,715 + 0,659 + 1,695 + 1,562 = 11,146
DF = 2, P-Value = 0,004
4 cells with expected counts less than 5,0

10.3.1.2 Chi-square test Religion

Expected counts are printed below observed counts

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Total | 35 | 38 | 73
Chi-Sq = 0,565 + 0,521 +
0,177 + 0,163 +
1,671 + 1,539 +
1,730 + 1,593 = 7,958

DF = 3
* WARNING * 2 cells with expected counts less than 1,0
* Chi-Square approximation probably invalid
4 cells with expected counts less than 5,0

10.3.1.3 Chi-square test number of man and women

Expected counts are printed below observed counts

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<tr>
<td>Total</td>
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Chi-Sq = 0,037 + 0,041 +
0,064 + 0,069 = 0,210

DF = 1, P-Value = 0,646

10.3.1.4 Q1: Student T test number of membership to groups

Two-sample T for C5 vs C6

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<th>StDev</th>
<th>SE Mean</th>
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Difference = mu C5 - mu C6
Estimate for difference: -1,190
95% CI for difference: (-1,543; -0,838)
T-Test of difference = 0 (vs not =): T-Value = -6,74  P-Value = 0,000  DF = 70
Both use Pooled StDev = 0,749
### 10.3.2 Q3-5: Overview homogeneity groups and interaction of groups

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</tr>
<tr>
<td>No</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Same gender?</th>
<th>Same education?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tanga</strong></td>
<td><strong>Tonde</strong></td>
</tr>
<tr>
<td>yes</td>
<td>0</td>
</tr>
<tr>
<td>no</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Same ethnic?</th>
<th>interact outside reservoir?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tanga</strong></td>
<td><strong>Tonde</strong></td>
</tr>
<tr>
<td>yes</td>
<td>35</td>
</tr>
<tr>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>frequently</td>
<td>0</td>
</tr>
</tbody>
</table>

#### 10.3.2.1 Q3B: Chi-square test gender difference in group

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tonde</th>
<th>Tanga</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14,05</td>
<td>12,95</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>23,95</td>
<td>22,05</td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>35</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>35</td>
<td>73</td>
</tr>
</tbody>
</table>

Chi-Sq = 11,923 + 12,945 + 6,998 + 7,598 = 39,465

DF = 1, P-Value = 0,000

#### 10.3.2.2 Q3C: Chi-square test ethnics

**Hypothesis:** there is no relation between being Kosaasi and farming in the 2 reservoirs
Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tanga</th>
<th>Tonde</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>4,32</td>
<td>4,68</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>26</td>
<td>38</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>30,68</td>
<td>33,32</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>38</td>
<td>73</td>
</tr>
</tbody>
</table>

Chi-Sq = 5,086 + 4,685 + 0,715 + 0,659 = 11,146
DF = 1, P-Value = 0,001
1 cells with expected counts less than 5,0

10.3.2.3 Q5: Chi-square test group working outside reservoir

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tonde</th>
<th>Tanga</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>26,03</td>
<td>23,97</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>11,97</td>
<td>11,03</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>35</td>
<td>73</td>
</tr>
</tbody>
</table>

Chi-Sq = 4,672 + 5,073 + 10,157 + 11,027 = 30,929
DF = 1, P-Value = 0,000

10.3.2.4 Q6: Student T-test number of close friends

Two-sample T for C1 vs C2

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>StDev</th>
<th>SE Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>35</td>
<td>3,40</td>
<td>2,33</td>
<td>0,39</td>
</tr>
<tr>
<td>C2</td>
<td>38</td>
<td>4,50</td>
<td>3,15</td>
<td>0,51</td>
</tr>
</tbody>
</table>
Difference = μ C1 - μ C2
Estimate for difference: -1,100
95% CI for difference: (-2,402; -0,202)
T-Test of difference = 0 (vs not =): T-Value = -1,68  P-Value = 0,097  DF = 71
Both use Pooled StDev = 2,79

10.3.3 Q7: Measurement overview willing and able to provide money in close atmosphere

<table>
<thead>
<tr>
<th>Borrow money</th>
<th>tanga</th>
<th></th>
<th></th>
<th>Tonde</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>counts</td>
<td>%</td>
<td></td>
<td>counts</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Defina</td>
<td>32</td>
<td>91,4%</td>
<td></td>
<td>36</td>
<td>94,7%</td>
<td></td>
</tr>
<tr>
<td>proba</td>
<td>1</td>
<td>2,9%</td>
<td></td>
<td>1</td>
<td>2,6%</td>
<td></td>
</tr>
<tr>
<td>unsure</td>
<td>0</td>
<td>0,0%</td>
<td></td>
<td>0</td>
<td>0,0%</td>
<td></td>
</tr>
<tr>
<td>proba not</td>
<td>1</td>
<td>2,9%</td>
<td></td>
<td>1</td>
<td>2,6%</td>
<td></td>
</tr>
<tr>
<td>def.not</td>
<td>1</td>
<td>2,9%</td>
<td></td>
<td>0</td>
<td>0,0%</td>
<td></td>
</tr>
</tbody>
</table>

10.3.4 Q8: Measurement overview Can/cannot be trusted

<table>
<thead>
<tr>
<th>common trust</th>
<th>Tanga</th>
<th></th>
<th></th>
<th>Tonde</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counts</td>
<td>%</td>
<td></td>
<td>Counts</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>can</td>
<td>27</td>
<td>77,1%</td>
<td></td>
<td>35</td>
<td>92,1%</td>
<td></td>
</tr>
<tr>
<td>cannot</td>
<td>8</td>
<td>22,9%</td>
<td></td>
<td>3</td>
<td>7,9%</td>
<td></td>
</tr>
</tbody>
</table>

10.3.4.1 Q8: Chi-square test common trust

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tanga</th>
<th></th>
<th></th>
<th>Tonde</th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27</td>
<td>35</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29,73</td>
<td>32,27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>3</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5,27</td>
<td>5,73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>38</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chi-Sq = 0,250 + 0,230 +
1,409 + 1,298 = 3,187
DF = 1, P-Value = 0,074

10.3.5 Q9a: Measurement overview willing to help: dry

<table>
<thead>
<tr>
<th>willing to help</th>
<th>Tanga</th>
<th>%</th>
<th>Tonde</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>agree strong</td>
<td>30</td>
<td>85,7%</td>
<td>38</td>
<td>100,0%</td>
</tr>
<tr>
<td>agree somewhat</td>
<td>3</td>
<td>8,6%</td>
<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>neither agr/dis</td>
<td>2</td>
<td>5,7%</td>
<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>disagree somewhat</td>
<td>0</td>
<td>0,0%</td>
<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>Disagree strong</td>
<td>0</td>
<td>0,0%</td>
<td>0</td>
<td>0,0%</td>
</tr>
</tbody>
</table>

10.3.5.1 Q9B: Chi-square test willing to help: dry

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tanga_2</th>
<th>Tonde</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>38</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>32,60</td>
<td>35,40</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1,44</td>
<td>1,56</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0,96</td>
<td>1,04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>38</td>
<td>73</td>
</tr>
</tbody>
</table>

Chi-Sq = 0,208 + 0,191 +
1,695 + 1,562 +
1,130 + 1,041 = 5,828

DF = 2
* WARNING * 1 cells with expected counts less than 1,0
* Chi-Square approximation probably invalid
4 cells with expected counts less than 5,0
10.3.6 Q9B: Measurement overview taking advantage: wet and dry

<table>
<thead>
<tr>
<th>people take advantage in dry season</th>
<th>wet tanga</th>
<th>dry tanga</th>
<th>wet Tonde</th>
<th>dry Tonde</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counts</td>
<td>Counts</td>
<td>Counts</td>
<td>Counts</td>
<td>Counts</td>
</tr>
<tr>
<td>agree strong</td>
<td>27</td>
<td>10</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>agree somewhat</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>neither agr/dis</td>
<td>4</td>
<td>12</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>disagree somewhat</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Disagree strong</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>13</td>
</tr>
</tbody>
</table>

10.3.6.1 Q9B: Chi-square test taking advantage: wet

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tanga_2</th>
<th>Tonde</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>23,01</td>
<td>24,99</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3,84</td>
<td>4,16</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2,88</td>
<td>3,12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1,92</td>
<td>2,08</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>3,36</td>
<td>3,64</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>38</td>
<td>73</td>
</tr>
</tbody>
</table>

Chi-Sq = 0,690 + 0,636 +
0,007 + 0,006 +
0,439 + 0,404 +
1,918 + 1,766 +
3,356 + 3,091 = 12,314

DF = 4, P-Value = 0,015
8 cells with expected counts less than 5,0
Due to the expected counts, the division is made between agree and not agree and neither agree or disagree. This led to a statistical situation in which the chi square can be used:

<table>
<thead>
<tr>
<th></th>
<th>Tanga counts</th>
<th>Tonde counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>agree</td>
<td>31</td>
<td>25</td>
</tr>
<tr>
<td>neither</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>disagree</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>25</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>26,13</td>
<td>29,87</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3,73</td>
<td>4,27</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>5,13</td>
<td>5,87</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>40</td>
<td>75</td>
</tr>
</tbody>
</table>

Chi-Sq = 0,906 + 0,793 + 0,019 + 0,017 + 5,133 + 4,492 = 11,360
DF = 2, P-Value = 0,003
2 cells with expected counts less than 5,0

10.3.6.2 Q9B: Chi-square test taking advantage: dry

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tanga_2</th>
<th>Tonde</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>wet counts</td>
<td>dry counts</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>agree</td>
<td>31</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>neither</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>disagree</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Only agree and disagree taken

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>14</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>25,83</td>
<td>19,17</td>
<td></td>
</tr>
</tbody>
</table>
2       0       9       9
5,17    3,83

Total    31       23       54

Chi-Sq = 1,033 + 1,393 +
        5,167 + 6,964 = 14,557

DF = 1, P-Value = 0,000

1 cells with expected counts less than 5,0

**cumulative Tonde**

<table>
<thead>
<tr>
<th>Tonde</th>
<th>wet counts</th>
<th>dry counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>agree</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>neither</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>disagree</td>
<td>11</td>
<td>26</td>
</tr>
</tbody>
</table>

Only agree and disagree taken
Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th>Cl</th>
<th>C2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>16,70</td>
<td>15,30</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>19,30</td>
<td>17,70</td>
</tr>
</tbody>
</table>

Total    36       33       69

Chi-Sq = 4,131 + 4,506 +
        3,572 + 3,897 = 16,106

DF = 1, P-Value = 0,000

**10.3.7 Q10a: measurement overview trust in DC**

<table>
<thead>
<tr>
<th>Trust in local district officials (DC)</th>
<th>Tanga</th>
<th>Tonde</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counts</td>
<td>%</td>
</tr>
<tr>
<td>very great extent</td>
<td>12</td>
<td>34,3%</td>
</tr>
<tr>
<td>great extent</td>
<td>1</td>
<td>2,9%</td>
</tr>
</tbody>
</table>
10.3.7.1 Q10a: chi-square test trust in DC

Values cumulatives of great and very great; small and very small

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>14.38</td>
<td>15.62</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>6.71</td>
<td>7.29</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>13.90</td>
<td>15.10</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>38</td>
<td>73</td>
</tr>
</tbody>
</table>

\[
\text{Chi-Sq} = 0.133 + 0.123 + 0.780 + 0.718 + 0.059 + 0.054 = 1.866
\]

\[
\text{DF} = 2, \ P-Value = 0.393
\]

10.3.8 Q10b: measurement overview trust in assembly man

<table>
<thead>
<tr>
<th>Trust in Assembly man</th>
<th>Tanga</th>
<th></th>
<th>Tonde</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counts</td>
<td>%</td>
<td>Counts</td>
<td>%</td>
</tr>
<tr>
<td>very great extent</td>
<td>29</td>
<td>82.9%</td>
<td>35</td>
<td>92.1%</td>
</tr>
<tr>
<td>great extent</td>
<td>6</td>
<td>17.1%</td>
<td>1</td>
<td>2.6%</td>
</tr>
<tr>
<td>neither small nor great</td>
<td>0</td>
<td>0.0%</td>
<td>1</td>
<td>2.6%</td>
</tr>
<tr>
<td>small extent</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>very small extent</td>
<td>0</td>
<td>0.0%</td>
<td>1</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

10.3.9 Q10c: measurement overview trust in WUA
<table>
<thead>
<tr>
<th>Trust in top of WUA</th>
<th>Tanga</th>
<th></th>
<th>Tonde</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Counts</td>
<td>%</td>
<td>Counts</td>
<td>%</td>
</tr>
<tr>
<td>very great extent</td>
<td>14</td>
<td>40,0%</td>
<td>36</td>
<td>94,7%</td>
</tr>
<tr>
<td>great extent</td>
<td>2</td>
<td>5,7%</td>
<td>1</td>
<td>2,6%</td>
</tr>
<tr>
<td>neither small nor great</td>
<td>1</td>
<td>2,9%</td>
<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>small extent</td>
<td>3</td>
<td>8,6%</td>
<td>1</td>
<td>2,6%</td>
</tr>
<tr>
<td>very small extent</td>
<td>15</td>
<td>42,9%</td>
<td>0</td>
<td>0,0%</td>
</tr>
</tbody>
</table>

Counts cumulative of great and very great; small and very small; neither condition left out, with small error as result

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>37</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>25,03</td>
<td>27,97</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>8,97</td>
<td>10,03</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>38</td>
<td>72</td>
</tr>
</tbody>
</table>

\[ \text{Chi-Sq} = 3,256 + 2,914 + 9,084 + 8,128 = 23,381 \]
\[ \text{DF} = 1, \ P-Value = 0,000 \]

10.3.10 Q15: number of telephone calls past month

<table>
<thead>
<tr>
<th>telephone used past month</th>
<th>Tanga</th>
<th></th>
<th>Tonde</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Times named</td>
<td>%</td>
<td>Times named</td>
<td>%</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>60,0%</td>
<td>25</td>
<td>65,8%</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>17,1%</td>
<td>1</td>
<td>2,6%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>5,7%</td>
<td>4</td>
<td>10,5%</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0,0%</td>
<td>2</td>
<td>5,3%</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0,0%</td>
<td>1</td>
<td>2,6%</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0,0%</td>
<td>0</td>
<td>0,0%</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0,0%</td>
<td>1</td>
<td>2,6%</td>
</tr>
<tr>
<td>countless</td>
<td>6</td>
<td>17,1%</td>
<td>4</td>
<td>10,5%</td>
</tr>
</tbody>
</table>
Hypothesis: there is no relation between being a farmer on Tanga or in Weega and the chance that one has never used a telephone.

Expected counts are printed below observed counts

<table>
<thead>
<tr>
<th></th>
<th>Tanga</th>
<th>Tonde</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>25</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>22,05</td>
<td>23,95</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>13</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>12,95</td>
<td>14,05</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>38</td>
<td>73</td>
</tr>
</tbody>
</table>

Chi-Sq = 0,050 + 0,046 + 0,086 + 0,079 = 0,262
DF = 1, P-Value = 0,609

Hypothesis cannot be rejected.

10.3.11 Q16: Measurement overview main information source

<table>
<thead>
<tr>
<th>main source:</th>
<th>tanga</th>
<th>Tonde</th>
</tr>
</thead>
<tbody>
<tr>
<td>times named</td>
<td>%</td>
<td>times named</td>
</tr>
<tr>
<td>relatives</td>
<td>10 0,212766</td>
<td>15 0,263158</td>
</tr>
<tr>
<td>radio</td>
<td>16 0,340426</td>
<td>29 0,508772</td>
</tr>
<tr>
<td>market</td>
<td>16 0,340426</td>
<td>9 0,157895</td>
</tr>
<tr>
<td>phone</td>
<td>0 0</td>
<td>1 0,017544</td>
</tr>
<tr>
<td>chief</td>
<td>0 0</td>
<td>1 0,017544</td>
</tr>
<tr>
<td>assembly man</td>
<td>2 0,042553</td>
<td>2 0,035088</td>
</tr>
<tr>
<td>car</td>
<td>1 0,021277</td>
<td>0 0</td>
</tr>
<tr>
<td>wua</td>
<td>1 0,021277</td>
<td>0 0</td>
</tr>
<tr>
<td>agricol</td>
<td>1 0,021277</td>
<td>0 0</td>
</tr>
</tbody>
</table>

10.3.11.1 Q16: chi-square test main source information

question main source info market/friend/radio

Expected counts are printed below observed counts
<table>
<thead>
<tr>
<th>Tanga_2</th>
<th>Tonde</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>11,05</td>
<td>13,95</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>19,89</td>
<td>25,11</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>11,05</td>
<td>13,95</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>53</td>
</tr>
</tbody>
</table>

Chi-Sq = 0,100 + 0,079 + 0,762 + 0,604 + 2,215 + 1,755 = 5,516
DF = 2, P-Value = 0,063
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