

Analysis of institutional arrangements and variables that affect sustainable small water infrastructure operations, management and maintenance in Lambani, Limpopo Province (South Africa)

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Abstract

Rural communities from the former homelands (independent states) of South Africa are faced with massive challenges of water shortages. Former homelands states were mainly used accessing water from boreholes or hand pumps, which are now not functioning. It is therefore very important to analyses factors that affect the sustainability of these boreholes and or hand pumps known as small water infrastructures (SWIs). Problems were identified after a serious of discussions with the village including data collect through the use of a questionnaire. A total of 60 households were randomly sampled. The main purpose was to get primary information of the villagers in regard to the poor conditions of the SWIs within the village. Data was collected through the assistance of five youth members from the village who are Tshivenda speaking people. Some of the problems that were identified was that not even a single SWI in Lambani is in a working condition and that has led to shortage of water. Villagers stand in long queues for days to collect water for domestic use. Taps run dry for weeks and that forces villagers to collect from the Levuvhu River that is passing next to the village. There were no institutional arrangements put in place as to how the boreholes will be managed. Contradicting statements from the villagers and or small scale farmers, tribal leaders and municipality makes it difficult for the researchers to get to the bottom of the real problem. More than three different contractors were employed to do the same job over a number of years. The last contractor completed the work mid-March 2014, but the job is not done because they are still unable to pump the water from the dam. Poorly defined water rights, ignorance from the side of both community and government officials, an increased number of people who rely on one water infrastructure, lack of public investment and spending on water infrastructures, poor maintenance of the infrastructure, etc., are some of the major issues that contribute to the lack of water in Lambani. The paper argues that there is a need for authorities to be in contact with the villagers regarding each and every aspects that will impact on their lives. There should be proper institutional arrangements that are put in place with regard to the utilisation of water, maintenance, operation and management of the SWIs.

Keywords: homelands, sustainability, boreholes, small water infrastructures, households, villagers, Levuvhu, institutional arrangements, maintenance.

INTRODUCTION

Water is fundamental to life, the environment, food production, hygiene, etc. On the other hand South Africa, is facing a number of significant challenges in relation to water, both at the level of the resource as well as in the actual provision of water services by municipalities. According to Council for Scientific and Industrial Research (CSIR) (2010) one of the challenges for South Africa lies in the efficient and balanced use of water, together with other natural resources, to create an environment conducive to social and economic well-being.

Recent studies have estimated that the demand for water in South Africa will exceed supply by 2025 if nothing is done to supplement current water resources. The sustainability of the sector as a whole is also at risk due to the poorly maintained and often ill-equipped infrastructure, general under-pricing of water across the value chain and the deteriorating quality of water services in a number of municipalities.

Above that today's water infrastructure networks have aged, because many pipes were laid many years back. Utilities face huge requirements for replacement and maintenance, stressing their resources and affecting sustainability. As controlling and managing the water distribution infrastructure becomes more challenging it is important that more research is conducted on the water infrastructures, especially in rural areas where the infrastructure are neither properly used nor maintained. Infrastructure is back on the priority development agenda of developing countries, especially in Sub-Saharan Africa; more broadly, infrastructure affects human welfare directly and indirectly *via* access to and quality of basic services such as water and sanitation, though the impact can differ widely across regions, communities or income groups (Bogetić & Fedderke, 2005).

Research has been conducted on the issues, but not all did adequately address issues relating to the high failures of the small water infrastructures (SWIs) especially in rural communities and/or areas. It is therefore the main reason of this article to attempt to address some of these issues. According to Merrey and Cook (2012) institutions provide the rules and norms that people use to form organizations, enabling them to cooperate with one another, coordinate their activities, and mobilise resources to do things that individuals alone could never accomplish. Keeping this in mind, the type of infrastructure that is discussed or talked about in this article may include dams, reservoirs, wells and rainwater harvesting systems. Dams have been essential in establishing and supporting towns and farms as well as providing food through the irrigation of croplands.

Today, dams and reservoirs also help control flood waters to protect people and property, keep rivers navigable, provide electricity from renewable energy for towns and factories, and provide recreational opportunities such as fishing, camping and water sports. The aim of this paper is to present the situation analysis in the area. The purpose of the situation analysis was to provide baseline information in terms of institutional arrangements and variables, including the constraining factors, which affect the optimum performance, operations, management and rehabilitation requirements of the SWIs in Lambani.

LITERATURE REVIEW

Defining Small Water Infrastructure

According to Rinaldi, Peerenboom and Kelly (2001) “infrastructure” is a network of independent, mostly private owned, man-made systems and processes that function collaboratively and synergistically to produce and distribute a continuous flow of essential goods and services’. According to United Nations’ Economic and Social Commission for Asia and the Pacific (UNESCAP) (2006) water infrastructure can be defined as a stock of facilities and installations needed to develop and manage water resources, including delivery, treatment, supply, and distribution of water to its users as well as for the collection, removal, treatment and disposal of sewage and wastewater.

Bolger, Monsma and Nelson (2009) define water infrastructure as one that integrates built infrastructure components with the protection and restoration of its supporting natural watershed infrastructure and the use of emerging small-scale water technologies and water

management solutions. According to Taylor and Goldstein (2010) water infrastructure refers to the basic physical and organizational water-related structures needed for the functional operation of society; these include both built (e.g. reservoirs and retention systems, piped collection and distribution systems, treatment systems) and natural infrastructure (e.g. forested land, stream buffers, flood plains and hydrologic networks, wetlands).

Senzanje, Simalenga and Jiyane (2011) concludes the discussion by defining the SWIs as any technical hardware that is used by farmers in the Limpopo basin (Lambani falls within the basin) in managing water resources for both domestic and agricultural use, and is operated on a small-scale as well as by smallholder farmers. They further state that typical examples of SWIs found in the basin include small reservoirs, small weirs, sand dams, boreholes, shallow wells, small scale irrigation schemes, family drip kits, treadle pumps and rainwater harvesting practices.

Defining Institutions and Institutional Arrangements

Defining institutions has become one of the marathons that have taken place in the agricultural and other sectors. Many researchers and authors took efforts to define it. According to Ostrom (1999) as cited by Araral (2010) there are several challenges to scholars undertaking institutional analysis. He further state that these challenges are evident in different degrees. First the term institution refers to many different types of entities, including both organizations and rules used to structure patterns of interaction within and across organizations. Second, institutions are visible to the extent that they are formal or informal shared patterns of understanding, Third, to develop a coherent approach to studying diverse types of institutional arrangements, such as markets, hierarchies, firms, families, voluntary associations, national governments and international regimes, one needs multiple inputs from diverse disciplines. Fourth, given the multiple languages used across disciplines, a coherent institutional framework is needed to allow for expression and comparison of diverse theories, and models of theories, applied to particular puzzles and problem settings. Fifth, at any one level of analysis, combinations of rules, attributes of the physical world and the characteristic communities of individuals involved are combined in a configurable rather than an additive manner.

In the broadest sense, an institution is a set of rules, conventions and norms that sets a standard of behaviour for the members of the society. As a necessary condition for setting a standard of behaviour, these rules, conventions and norms must be shared by the members of the relevant community and must remain anchored in their minds. The rules provide expectation about agents' behaviour in particular situations and structure the strategic space of actors so as to produce equilibrium outcome. Each of these forms of institutions is supported by an enforcement mechanism, in case they are not self-enforceable, namely by the law, which itself is a set of formalized norms and conventions (Haita, 2006). According to Feder and Feeny (1993), institutions can be classified into three basic categories: (i) constitutional order specifies the basic rules about the societal organization; (ii) institutional arrangements are created to within these institutional rules, and include laws, regulations, associations, contracts and property rights, and (iii) normative behavioural codes embody the cultural values that coerce behaviour and authenticate the institutional arrangements. North (1990) asserts that men live in a world of apparent rapidity institutional change, with all levels of institutional organizations continually evolving and altering the choices available to individuals.

According to Gleeson and Piper (2002) institutions are based on social and traditional aspects. The International Institute for Environment and Development (IIED, 2002) refers to them as rules and regulations for resource management as well as the organizational structure required for the enforcement. Gleeson and Piper (2002) define institutional arrangements as a complex of laws, customs and norms that channel our energy toward social goals and the way we relate to others. The definition is based on the assumption that it is practised within a culture regulated by its institutional arrangements, and by the mind-sets of the players. The former are taken to be gazetted laws and regulations, commonly accepted but not legally binding rules and guidelines, and organizations established by the culture. North (2005) defines institutional arrangements as the combination of formal constraints, in-formal rules, and their enforcement characteristics. According to Knight, Lyne and Roth (2003) institutional arrangements are influenced by the quality of management. Baer and Marando (2003) define institutional arrangements as rules and public policies. According to North (2005) institutional arrangements are the combination of formal constraints, in-formal rules, and their enforcement characteristics. Formal institutions are defined as political constraints on government behaviour enforced by legal institutions. Formal rules encompass constitutional constraints, statutory rules, and other political constraints. In contrast, in-formal institutions are private constraints stemming from norms, culture, and customs that emerge spontaneously. The key difference between formal and in-formal is that in-formal institutions remain in the private realm, whereas formal constraints are centrally designed and enforced.

MATERIALS AND METHODS

Description of the study area

Lambani is situated about 60 kilometers in the eastern side of Thohoyandou and approximately 15 km west of the Punda Maria Gate (Kruger National Park) in the Limpopo Province, South Africa. Its geographical coordinates are 22° 43' 0" South, 30° 50' 0" East and its original name (with diacritics) is Ha-Lambani. It forms part of both the Thulamela Local Municipality and Vhembe District Municipality. Lambani is divided into 19 sub-villages (Figure 1). Its traditional leader is Chief Lambani who is assisted by headmen (one headman for three villages). The majority of the villagers in Lambani are Tshivenda speaking people.

Lambani is a part of the former homeland state of the Republic of Venda. The Republic of Venda was declared a self-governing state on 01 February 1973. On 13 September 1979, it was declared independent by the South African government and its residents lost their South African citizenship. In common with other Bantustans, its independence was not recognized by the international community. It was formed after the segregation of people under the Natives Land Act (No. 27 of 1913) and the Native Trust and Land Act of 1936. The Natives Land Act (No. 27 of 1913), also known as the Black Land Act, made provision for the allocation of land to Africans and was passed due to constant pressure from white people to prevent the encroachment of black people on white areas. This law incorporated territorial segregation into legislation for the first time since Union forming in 1910. Venda was re-absorbed into South Africa on 27 April 1994 and now forms part of the Limpopo province.

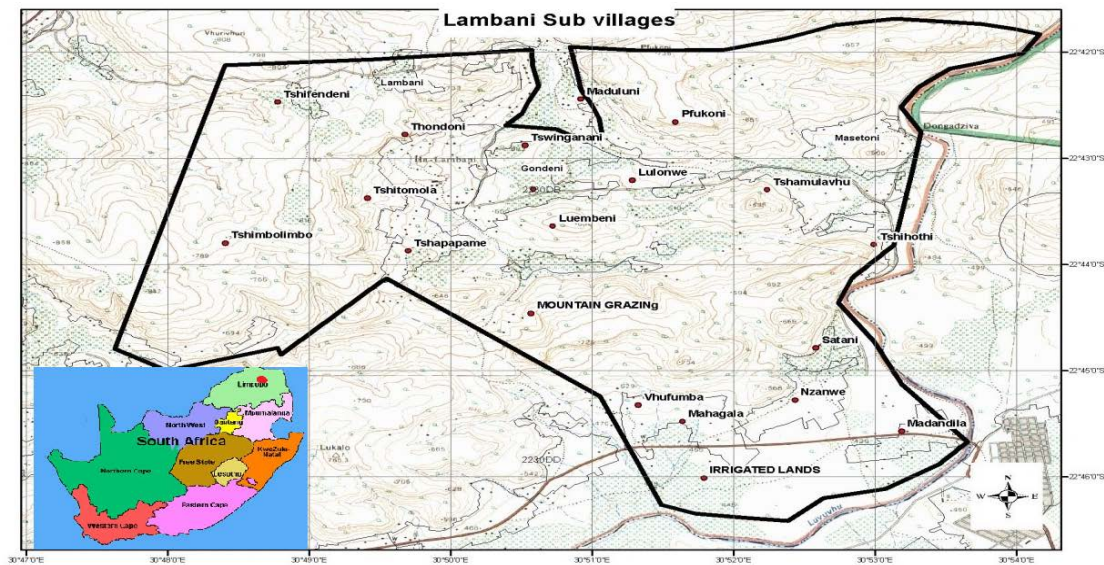


Figure 1: Map of Lambani.

The agricultural sector in the Lambani is made up of small-scale farmers. The small-scale farmers are engaged in various irrigation schemes including organic agriculture that belong to various associations. The main problem with these irrigation schemes is that they do not function optimally and efficiently due to problems ranging from lack of markets for their products and capital requirement. Hence these irrigation schemes require the support of the local government in the running of their business. More of their constraints include lack of access to water (even though there is a river passing nearby), water supplies insecure and fragmented land rights, non-viable and small farm units, deterioration of natural resources, lack of infra-structures, transport network, financial support, research and extension services. What is the main concern is that small-scale farmers cannot afford to pay for water as they are unable to sell their produce to lack of markets and other related constraints.

Methods

A survey was conducted in Lambani and more than 400 households were randomly selected to be included in the survey. Interviews were conducted with the head of the households using both one-on-one discussions and a structured questionnaire to gather data and information with the aim of assessing the real reasons behind the poor maintenance and sustainability of the SWIs, poor agricultural production, development and its collapse especially institutional arrangements which are most of the times used as guidelines. These interviews were semi-structured in a form of guided interview in which some of the questions were predetermined, new questions were also generated during the interview. As a result, the interviews took the form of discussions, during which both interviewer and interviewee learnt from each other.

RESULTS

Factors that affect SWIs

A meeting was held on 18 October 2011 in Nzanwe whereby the discussions were about the SWIs, shortage of water, institutions and institutional arrangements (Figure 2) and other matters that are related to the SWIs.



Figure 2: Attendants of the village meeting under the big tree in Nzanwe (Lambani).

It was found that there are no institutional arrangement that were formally communicated with the villagers as to how the reservoirs and dams will be managed within their village by the relevant authorities. Villagers believe that the poor state of affairs is because of poor of consultation with them. They believe that whatever guidelines or institutional arrangements that are put in place should be communicated with them first before implementation. Based on that it will be very difficult for the villagers to secure and take care of the SWIs.

Variables that affect sustainable utilization of SWIs

In all 19 sub-villages of Lambani all the SWIs are not in good working conditions (were last used prior to 1994). After the reintegration of the homeland to South Africa, people stopped utilising the boreholes and hand pumps since they were promised taps by the new democratic government. Other problems were identified such as poor implementation of both institutions (INST) and institutional arrangements (INSTAR), lack of consultation and communication (COM) from relevant authorities including the traditional leaders, maintenance (MAIN), finance (FIN) and infrastructure (INFRA) which forms part of the variables that were found to impacting negatively on the SWIs. Much of the IFRA is not well maintained and that results in the dilapidation of the SWIs. Most of the SWIs will need to be replaced and there is a need to install news pipes in response to demographic shifts and population growth. These variables or problems will require both local municipality and provincial government, through the assistance of the tribal leaders, to act swiftly before the area is declared a disaster area due to serious shortage of water and drought. Even though the area is a semi-arid, community can still collect water from the Levuvhu river that is passing through the village (which they are even using it to irrigate their croplands, wash their laundry and even let their livestock drink water from it).

Their taps run dry for a very long times, and once there is a water available on the taps, long queues of villagers can be seen all over village (Figure 3). Taps run dry for more than a week and that makes life difficult for the villagers because they end up not being able to meet their basic needs (drinking, cooking, doing laundry, etc.). According to Bostoan (2005), UNICEF and WHO (2012) drinking water supply service, which is one of the human needs, accomplishes its main purpose of maintaining and or improving public health when the drinking water is of a certain quality and quantity. Based on the statement it clearly show that villagers of Lambani are deprived their basic human right.



Figure 3: Long queues for water in Lambani.

In most cases villagers are forced to drink or share the same water with livestock that is roaming the streets. Due to this shortage of water and long queues, villagers are forced to complement their water needs (such as irrigation, drinking and laundry) with the unsafe and or contaminated water from the Levuvhu river (Figure 4).



Figure 4: Villagers making use of the water for irrigation (top left), laundry (top right), school for drinking (bottom let) and recreational (bottom right) purposes.

To make matters worse the hand-pumps and or boreholes not working conditions due to poor management, maintenance and lack of consultation with the villagers (Figure 5). All these hand pipes have been in this poor state for years despite the desperate plea by the villagers to them get fixed. Villagers still believe that if these hand pipes are fixed; they will ease the shortage of water in their village and their health status will improve and agricultural production in area will improve because they will be able to effectively make use of both of their backyard gardens and croplands.



Figure 5: Non-functional hand-pumps or boreholes in Lambani.

There is a new reservoir that was built in Lambani for the supply of water, but villagers were neither informed nor involved in the construction (Figure 6). The construction of the reservoir was concluded mid-2011, but it is still empty. They were just informed about it at the later when they posed questions to their traditional leaders during a meeting. Decisions to build this type of reservoirs and not communicating or informing villagers and their traditional leadership, leads into the failure of essential services that are supposed to be rendered to the people by government. That clearly shows that if nothing is communicated to the end users, neither institutions nor institutional arrangements put in place will work. Furthermore this newly build reservoir lies empty because there are no pipes that are connected to the reservoir from the pipeline to supply water.

There has been problems with contractors that were hired to construct a pipeline. A new contractor was hired to build a pipeline of more than 50 km from the Nandoni dam to Lambani. The Nandoni Dam is situated along the Luvuvhu River and located near ha-Mutoti and ha-Budeli villages that are just a few kilometres from Thohoyandou town in the Vhembe District in the Limpopo province. The river follows a course along the southern edge of the Zoutpansberg and eventually joins the Limpopo River in the far northern corner of the Kruger National Park on the border between South Africa, Zimbabwe and Mozambique.



Figure 6: Newly build reservoir (red circled) in Nzanwe (Lambani).

As mentioned, a number of problems have been found to be crippling or affecting the sustainable use of the SWIs. These included those already mentioned and the inefficient and lack of reliable and comprehensive data from both the villagers (including Chief, headmen and members of the community), stakeholders and officials (such as engineers, government officials, etc.). Again lack of communication also leads to poor performance, which will also contribute to poor maintenance, management and operations of the SWIs in Lambani. Some of the points that contribute or affect the performance, maintenance and sustainability of the SWIs is:

- Poorly defined water rights and water markets which were introduced within Lambani. Not even a single villager have a clear knowledge about the functionality of these water rights. But at the end of the month those who are having croplands next to the river are compelled or forced to pay a certain fee. According to Harrera *et al.* (2006) as cited by Ward (2010) without well-defined rights to water, infrastructure repairs suffers with little incentive for everyone to contribute their share of financing. That has led to few villagers, especially the small-scale farmers, having less access to the water and that affected their agricultural and brick making productions. Those who continue to irrigate their lands pay ridiculous amounts based on what is claimed that they have used by the authorities. According to Ward (2010) this is because local, regional and national governments are unable to quickly respond to rapidly changing water shortages.
- Lack of institutional arrangements put in place with regard to the usage of the infrastructures. Unclear laws, formal and or in-formal rules that define the allocation of water to irrigation affect the performance of the system and in some cultures define the performance.
- Ignorance from the side of the villagers. Utilising resources without taking care of them is the constraining factor of success in most, if not all, sub-villages. Villagers used as much as water as they can use without looking at the capacity and the state of the water infrastructures including dams, reservoirs, etc.
- An increased number of people who rely on one water infrastructure for their daily usage and needs.
- Lack of public investment and spending on water infrastructures. The blame has been shifted to the government by the villagers as they believe that government is solely responsible for the entire infrastructure within their villages. Meaning that villagers believe that government including the municipality should be fully responsible for maintaining all water infrastructures. For villagers to invest in these types of infrastructures is none to impossible.
- Poor maintenance of the infrastructure. Most of the dams and reservoirs are very old since they were built or constructed some years back. Based on that the existing infrastructure is aging and deteriorating. It is a technological and financial challenge to maintain and upgrade it in such a way that quality water can continue to be delivered to all sectors.
- Lack of patience from the side of the governmental officials who are involved with rural communities or villagers. It is hard for the governmental officials to understand that they have to repeat the same thing to the villagers over and over before it can be understood by them and put into practise.

Finally, there is no consistent set of institutional arrangements across Sub-Saharan Africa; however, any existing arrangement might be effective if it conforms to the appropriate policy, legal, and regulatory framework (Banerjee *et al.*, 2008). According to Ruiters (2011) water is a key natural resource and a reliable and affordable water supply underpins all

economic and social development and much of South Africa's water infrastructure is at a crossroads following decades of underinvestment, and vital elements of the nations' infrastructure are in serious disrepair, if not in a crisis. In conclusion, according to Manuel (2005) the aging stock of infrastructure against rapidly growing needs has led to renewed emphasis by the government on scaling up infrastructure investments as part of broader policy efforts to lay the foundation for accelerated and pro-poor economic growth and more rapid economic and social integration of the society. Even though the Minister emphasise this during his term and very few rural areas' infrastructures were developed and over 85% of them are far worse than it was before. That clearly indicates how poorly government is doing in rural areas despite the call to develop rural areas. Based on the current state of corruption in government it will be very difficult to reach such villages and reach government goals. Corruption, even though it does not form part of this study, needs to be mentioned because it is serious and is hampering service delivery in South Africa, more especially in rural areas that were part of the former homelands (or self-governing states).

SUMMARY AND CONCLUSION

A clean and dependable source of water is a fundamental necessity for all and one which is taken for granted. This is justified by the increasing rates of water shortages in Lambani and scores of people can be queuing with containers once water is available. That has led to villagers not been intensively involved in agricultural activities, especially crop production, even though they are facing hunger. If these SWIs are properly managed and looked after, they can play a crucial role in terms of socio-economic development and poverty alleviation, overcome water shortages, and ensure the sustainability of water through proper institutions and institutional arrangements.

Unfortunately there is no effective communication and collaboration within the Lambani villagers and or communities, including the government and municipality. Government and municipalities do not consult with the villagers beforehand, meaning that some of the infrastructures within the village were requested by villagers, and it took both government and municipality time before they respond to their needs. Once their needs are accepted and budgeted by government and municipality, they are no more going back to the villagers to inform them about the approval and budget allocations on what they have requested, they just come into the village and implement. That causes havoc because most of villagers have forgotten about that. Those mismatch cause a lot of stumbling blocks for the development of the village.

Currently the implications of institutional arrangements on SWI rehabilitation requirements are that there was never any communications with regard to the SWI. The communication channel with the villagers was dead from the beginning and it has further led to this current disaster in the area. Therefore lack of discussing both institutions and institutional arrangements between the relevant authorities and the villagers from the beginning is a serious problem. All the relevant authorities, including provincial government, municipality, tribal leaders and the relevant stakeholders' poor communication with the villagers, had led to the misappropriation and poor management of the water infrastructures. Due to that mistake many water infrastructures are not well looked after by the villagers as they believe it is not within their jurisdiction and that they have to look after them. Based on that lack of all relevant stakeholders to take responsibility about these failures, does not make things easier, but makes it more difficult on daily basis. Many of the problems and other collectively managed water resources can be ascribed largely to the failure of institutions to

enable problems beyond the individual to be managed collectively. That means the nature of these demands, and the institutional responses to them, vary widely and are not amenable to simple definitions and prescriptions.

In conclusion, there are indications that infrastructure and infrastructure assets are deteriorating faster than planned, and that many infrastructure facilities that should be in good working order are overloaded, are no longer operational or are in need of complete renewal. Whereas service delivery protests traditionally centered on the lack of access to services, recent protests now include failing service delivery as well. The lack of maintenance of existing infrastructure has been highlighted as perhaps the key contributor to the current state of municipal infrastructure. Literature that exists on the state of affairs points to a number of causes, most notably the lack of sufficient and competent technical staff, and insufficient funding.

It is therefore very important that water resources must be managed in an integrated way to ensure that water is protected and used to its full potential. Above that is it very critical that education and training with regards to the protection of water infrastructures is disseminated to the citizens, especially those who are in the rural areas such as Lambani. In conclusion, it is very important if government can play a constructive role in water allocations by establishing regulations, standards or requirements for the upkeep of the infrastructures based on the needs of the users, especially small-scale and or smallholder farmers in rural areas, in consultation with them.

RECOMMENDATIONS

During this study it was realised that there are more things that needs to be done in Lambani for the development of the community, and few issues were identified and recommended as follows:

- **Good leadership from the traditional leaders:** Whatever it is discussed by the traditional leaders and the outside sources, such as municipality, government, etc., should not be finalised without consultation with the villagers. Meaning that everything should be discussed with the villagers before final decisions are taken. That will also improve the standard of leadership and community will build stronger bond with their leaders.
- **Introduction of new institutions and institutional arrangements:** Precepts of good leaders and proper institutional arrangements are keys to sustainable water usage and management. Without proper guiding policies and institutional arrangements nobody will take care or ownership of the infrastructures and that will lead in its degradation. It is therefore very important that whoever is involved in the usage of the water should adhere, adopt and implement institutional arrangements for the benefit of everyone.
- **Improved communication between the policy makers, traditional leaders and the villagers (community).** In particular, in this case, the local councillor together with the Chief of the village should engage with their subordinates in each and every development in their village. By doing that it will improve the sustainability of the infrastructures in the village, and villagers will take ownership of it. Improved communication could clarify the extent of the Council's responsibilities versus the responsibilities of the State and national governments. As a result, local council - supported by its residents – could potentially have greater influence in lobbying the State and national governments for improved funding and other actions that would

benefit them and also increase funding for further development and future maintenance of the infrastructures.

- **Public scrutiny:** Involving the community in the process from the beginning should increase public trust. Plans to build anything within the village should be communicated to all relevant stakeholders including the community. There is a need to develop monitoring schemes and access-to-information guarantees that ensure accountability by all parties involved.
- **Patience is very crucial for providing basic services.** Therefore there is a need that governmental officials and all other related official from all sectors, especially those involved in projects, to be patient and put themselves in the shoes of the rural villagers (especially the elderly whom are the ones that are mainly involved in agriculture the youth are not interested) to feel as to how hard it is.
- **Job opportunities:** The area has over 70% of unemployment. It's therefore important that job opportunities are created. By doing so, it will contribute positively towards the livelihood and socio-economics statuses of the villagers, stop malnourishment and assists villagers in achieving food secured village. It will also contribute in reducing both the high rate of crime and substance (especially alcohol and drug abuse) in the village.
- **Training on the usage of water:** Majority of the villagers are illiterate, it's therefore very important that when government is providing services or any other assistance to the villagers, they need to take their level of education into consideration.

In conclusion, the existing institutional linkages need to be reviewed as to conform to the needs of small water infrastructure management, sustainably, maintenance and improve eco-efficiency.

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