MASTER THESIS

FINAL DRAFT

Governing the irrigation water in Ethiopia:

Case study of Shelle village, Arbaminch Zuria Woreda

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Abstract

This case study is about irrigation water management practices in Shelle village, Arbaminch Zuria Woreda, Southern Nations Nationalities and People Region (SNNPR) of Ethiopia. The study focuses on the actual situation in the water governance system of the village. The reason to assess this situation is that within the allocation of water in this area rivalries are detected, people that operate farms for crop production experience problems with allocation of irrigation water (irrigation water schedule), this resulted in conflict among water users. These issues are predominantly caused by the system of water governance that is in use in this area, and thus that shortages are not inherent to the water system.

In order to investigate the issues and the governance system, the deductive approach in Contextual Interaction Theory (CIT) (Bressers, 2009) is applied by which the wider context of water governance problems in the village is described and analyzed. The theory also discusses in detail the structural context of the governance system which helps to assess the influence of the institutional context on the policy and decision-making in the area. The structural context includes five dimensions of governance, also referred to as elements. Next to the CIT also the governance assessment tool (GAT) (Bressers et al, 2013) was used. The tool has five governance dimensions (levels and scales, actors and networks, perspectives and goal ambitions, strategies and instruments, responsibilities and resources) and four governance quality criteria (extent, coherence, flexibility and intensity). Applying this tool enabled to assess the quality of water governance system in the village. There are a set of both descriptive and evaluative questions which were answered in this tool that in turn contributed to answer the research questions.

The study identified water sources available to the village, the water resources that have been used for irrigation purposes in crop production. In the same line, strategies and instruments used to solve problems (challenges) were analyzed. In addition, the identification of actors and their roles, the way they were practicing their power and resources were studied. Finally the resource allocation by the management body to take action in the management system and serving crop production was covered. All in all, after revealing problems of water governance system of the village, recommendation was given to the administration of the village so that they can improve their water governance system.

Key-words: Irrigation management, Water resources management, Water governance assessment tool, Crop production, Best Management Practices (BMP)

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CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Effective water resource management is characterized by a balanced set of water policies and institutional reforms that influences the efficiency of market forces and strengthen the government capacity to carry out their essential roles in responsible and transparent manner (The World Bank, 1993). Ethiopia has integrated water resources management policies in use that include different aspects of water resources management system. To illustrate some issues dealt with: Water for agriculture, water supply for households and sanitation, water for aquatic lives, water for energy, water for navigation and water for mining industry. These aspects of water resources management are interrelated and need substantive policy efforts. Most of world water resources (about 70%) are used for agricultural activities. These activities, however, contributes to pollution of water bodies because of excess nutrients, pesticides and pollutants released from farm land (The Organization for Economic Co-operation and Development(OECD)).

According to the United Nation Water Report (2012), these 70% of global water withdrawals goes to food production which is impacting water security. This is because of rapid growth of world population that result in increasing food demand especially in developing nations, at the same time more water for more households is needed. Although food and beverage processing companies take into account using minimum amount of water in food and beverage production, this has not be adequate to preserve water resources.

About 80% of Ethiopian population rely on agriculture to earn a living and almost 50% of the country's Gross Domestic Product (GDP) has been generated from agricultural activities (World Bank, 2006). There are many small farmers who have less than 1 hectare land to plough. However, they contribute to around 95% of agricultural output. Fluctuations in hydrological conditions result in severe drought and floods in some regions of the country. According to Kassa and Onochie (2017), only in the year 2016, about 10 million people were starved because of the drought and from these:2 million in Oromia region, 1.6million in Somali region, 0.4 million in Afar region and 0.4 million in Southern Nations Nationalities and People region.

After rice, wheat and maize respectively, banana and plantain (Musa species) are the fourth staple food crops in the world. In global trade, banana dessert is the most known commercial fruit leading by high volume and price(Woldu *et al.*, no date). Similarly, there are areas where banana has been produced in south and south western parts of Ethiopia and thus serves as the major source of income generation for farmers. Production of banana is mostly conducted by using irrigation from surface water to maintain maximum yield.

Therefore, this irrigation water (which is part of other water resources) needs to be well managed in order to be effective in banana production.

In Arbaminch Zuria Woreda (where Shelle village is located), Southern Nations Nationalities and People of Ethiopia, there is large percentage of crop production by irrigation system (e.g 65% of total banana production in the country) (Woldu et al., no date). Hence, this case study assessed the present governance system for irrigation water of the village by using governance assessment tool in the context of a broader assessment of the water governance system for water resources and water use. It also tried to identify areas of challenges (problems) and strategies and instruments used to solve those problems in irrigation water governance in crop production. Finally, the thesis gave recommendations to local administration of the village to take appropriate action.

1.2 Problem statement

Arbaminch Zuria Woreda is one of potential sources of fruits and cereal crops in Southern Nations Nationalities and People Region (SNNPR) of Ethiopia. Especially banana is the most common agricultural product of the Woreda which has been used as commercial crop so that it serves as peoples' income generation. Shelle, Elgo, and Sile villages are included under Arbaminch Zuria Woreda where significant amount of banana has been produced. In order to get this commercial crop, people use irrigation (from surface water) in addition to rain to ensure the continuity of production. During rainy seasons, an irrigation activity stops since farmers then use rain water to maintain soil moisture. In Shelle village, there is less collaboration among stakeholders that lower crop production capacity which is almost the same to other surrounding villages. In these villages, there is less-organized irrigation water management, this lowers crop production capacity.

As an illustration, less organized irrigation water application schedule, low level of public participation in decision making, lack of transparency and accountability are some areas where less-organized irrigation water management system exists. For these reasons, assessing the extent in which governance of irrigation water is properly organized in Shelle village in comparison to other villages in order to find options for improvement is mandatory to increase crop production, particularly banana, in this area.

1.3 Research Objective

The aim of this research is to give recommendations to local administration of Shelle village how they can improve their irrigation water management system by assessing the present irrigation water governance system for crop production in the village.

1.4 Limitations of the Research

Since Ethiopia is under state of emergency from October to March, 2016/17, with more 4 months extension. During data collection phase of the research by interviews, respondents hesitate to provide detail information, because they were afraid that they may be victim of some political problems although they were aware about the confidentiality of collected data for the purpose of this thesis. In addition, they were afraid of exposing irrigation management problems since they believe that the consequence may affect them in future. Therefore, most of irrigation management problems are identified by observations and document analysis in addition to limited information from interviews. Moreover, there are very limited secondary data at local level but some existing unpublished documents which cannot provide adequate information.

CHAPTER 2 LITERATURE REVIEW

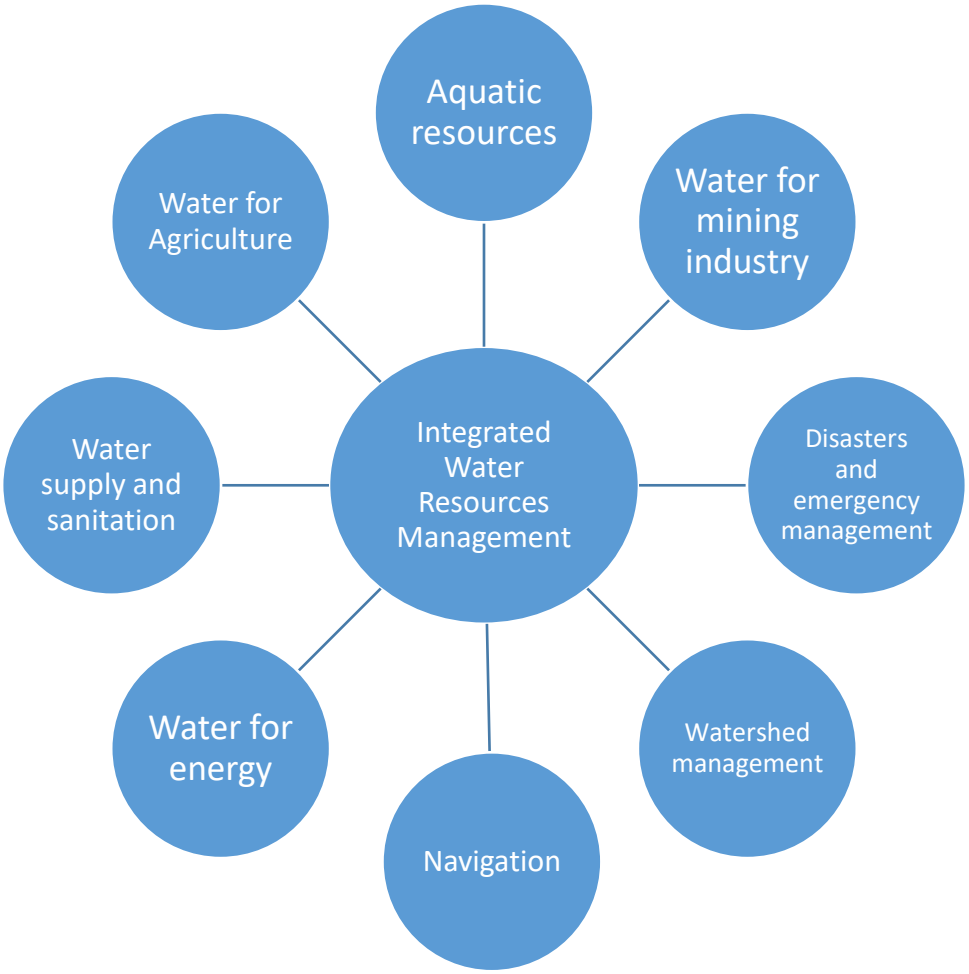
2.1 Water resources management system

Water resources management comprises different sectors of water management such as irrigated agriculture, municipal water supply, flood management, hydro-electric power, tourism and so on by which each of them have their own operation system, legislation and policies. Having their own objectives, these sectors deal with complex and interconnected activities under different water governance levels that could be ambiguous to be implemented individually by each sector (Bhaduri *et al.*, 2014). The activity in one water management sector has an effect on the other either positively or negatively. To illustrate, the policy developed for flood management in a particular flood prone region should be a sub-set of the overall natural resource management policy and agricultural policy of the region. In that case, all natural resources management and agricultural practices that can be an input for flood management such as farming style, reforestation, afforestation, and other related topics come together and reinforce flood management policy.

Another inextricable agenda with water resources management is green economy which is the foundation for socio-cultural, economic, and political welfare of a given society. In the same way, green economy and water resources management are pillars for environmental protection, food and energy nexus (United Nations Environment Program, 2012). The report further explains the preservation of water, especially fresh water ecosystem as a fundamental principle of sustainability which provides continuous and healthy life environment to humankind. Domestic water uses, water supply for irrigation purposes, poultry, and livestock productions are all interconnected with the concept of water resources management. Furthermore, waste recycling, groundwater replenishment, preventing soil erosion, and protecting environment from flood are crucial water resources management agendas that are integrated to the concept of green economy.

In addition, energy and water are interconnected life leading pillars on this planet. Management of water resources can support and then ensures the energy balance. To list some; hydropower, blue energy, water cooling in thermal and nuclear energy plants are areas where water and energy are interconnected. In the following figure 1, the way how different aspects of water resources are integrated in Ethiopian water resources policy is illustrated.

Figure 1 Integration of different aspects of water resources management ("FDRE, Ethiopian Water Resources Management Policy.pdf," no date)



2.2 Water resources and Irrigation management

The timing and application of irrigation water to the farmland including the upstream and downstream water requirements of crops is called irrigation water management (USDA, 1997). Controlling excess water, soil condition, fertilizers, and other resources are also part of this management system. In addition, both theoretical and practical knowledge of management aspect is important to make appropriate decisions in irrigation water management. Lack of knowledge in decision making in this respect sometimes results in conflict among other water users and upstream and downstream water users, among which farmers. Proper water allocation, identification of stakeholders in management and public participation in particular helps to minimize the occurrence of complexities in sharing water resources among each other.

Best Management Practice (BMP) for irrigation purposes focuses on nutrient management and fertilizers rates in addition to the frequency and volume of water applied to farm area. The effect of heavy rainfall on soil, because it washes away important compounds such as nitrate from soil, is incorporated in BMP for irrigation purposes. Water quality, quantity, application rate (amount of water applied per hour) and speed of water flowing through farm area and other factors related to irrigation activities are included in BMP for irrigation. ((Dukes *et al.*, 2015)

Dukes et al (2015) additionally described factors that affect yield in irrigation activities. For example: salinity, alkalinity, soil PH (acidity and basicity), oil pollutants and heavy metals. From these all factors, salinity is the most dangerous and common agricultural problem in the world especially those areas who are close to coast. In BMP for irrigation water, the management starts from preseason water application test where all above mentioned factors can be checked to take appropriate measures. In these preseason tests, the quality of soil, water, leakage, field preparation (farm area), delivery of chemicals, and other factors should be checked. Therefore, BMP in irrigation water use increases efficiency and uniformity, and reduces contamination of both soil and water.

2.2.1 Irrigation management in Ethiopia

In Ethiopia, from the total land area of the country which is about 112 million hectare, about 30 -70 million hectare is cultivable (Awulachew et al, 2010). However, currently only 15 million hectare is being cultivated from which irrigation covers only (4 - 5) % of cultivated land. That means a very small portion of land has been cultivated by irrigation water. The reason behind this small scale irrigation practice in the country is that the challenge starts from planning, design, delivery and maintenance of the irrigation management system including variations in availability of water resources. According to FAO (2015) report on irrigation market brief in Ethiopia, however, the current actions toward the challenge is promising, which focuses on community participation from medium to large scale in conjunction with small scale intervention at farmer's level. As an example, the report mentions irrigation activities in sugarcane productionin Mathahara and Wonji Shoa irrigation Schemes, which covers 8960 hectares and 10150 hectares respectively, are publically managed irrigation schemes which could be an indicator of present ongoing improvement of the irrigation activities in the country.

As District et al (2011) discussed, there are three advantages of community based irrigation water management practices.

a. Local people are close to the issue (they live closer to irrigation system) and they work together with local government rather than regional and national government who react at a distant. Local community's those daily life is based on irrigation activity should

get well managed and organized water resources management because they are vulnerable to the consequence of either good or bad management. If they encounter challenges, they can solve by discussion among themselves including defining rules and regulations concerning irrigation water management and related issues.

b. Local people have comprehensive knowledge and understanding concerning soil and water condition of their farm area. By cooperating with local agricultural experts for some technical support, more and more yield can be attained.
c. In addition, community based irrigation water management lowers the cost of collective action (working with people of different areas and culture) since people in the same area are homogeneous, they interact daily; share the same culture, language, and other socio-economic background.

2.3 Rain-fed agricultural practices in Ethiopia

In Ethiopia, water by rainfall is available in rainy seasons which are used for agricultural activities though there are fluctuations in frequency and amount. These rainfalls contribute to perennial and seasonal rivers, ground water, wetlands, and soil moisture content. (Awulachew et al, 2010)stated that there are 12river basins in Ethiopia which contribute about 125 billion m^3per year of runoff to the basins. The largest basin, Abbay basin covers about 45% of the total runoff contribution in northern and northwestern part of the country whereas most parts of Southern Nations Nationalities and People Region, is covered by the Rift Valley basin. According to Schütt and Thiemann (2006), Arbaminch Zuria Woreda exists in Abaya-Chamo Basin (sub-basin in Rift Valley basin) andwhich covers about an area of 18,100Km^2 and located in the East African Rift Valley. Shelle village is also in this basin at a distance of about 30km from Arbaminch (the capital city of the Woreda) to the south direction. The following figure 2 shows river basins of Ethiopia and table 1 shows the irrigation potential in these basins.

Figure 2 The River Basins of Ethiopia (Awulachew*et al.*, no date)

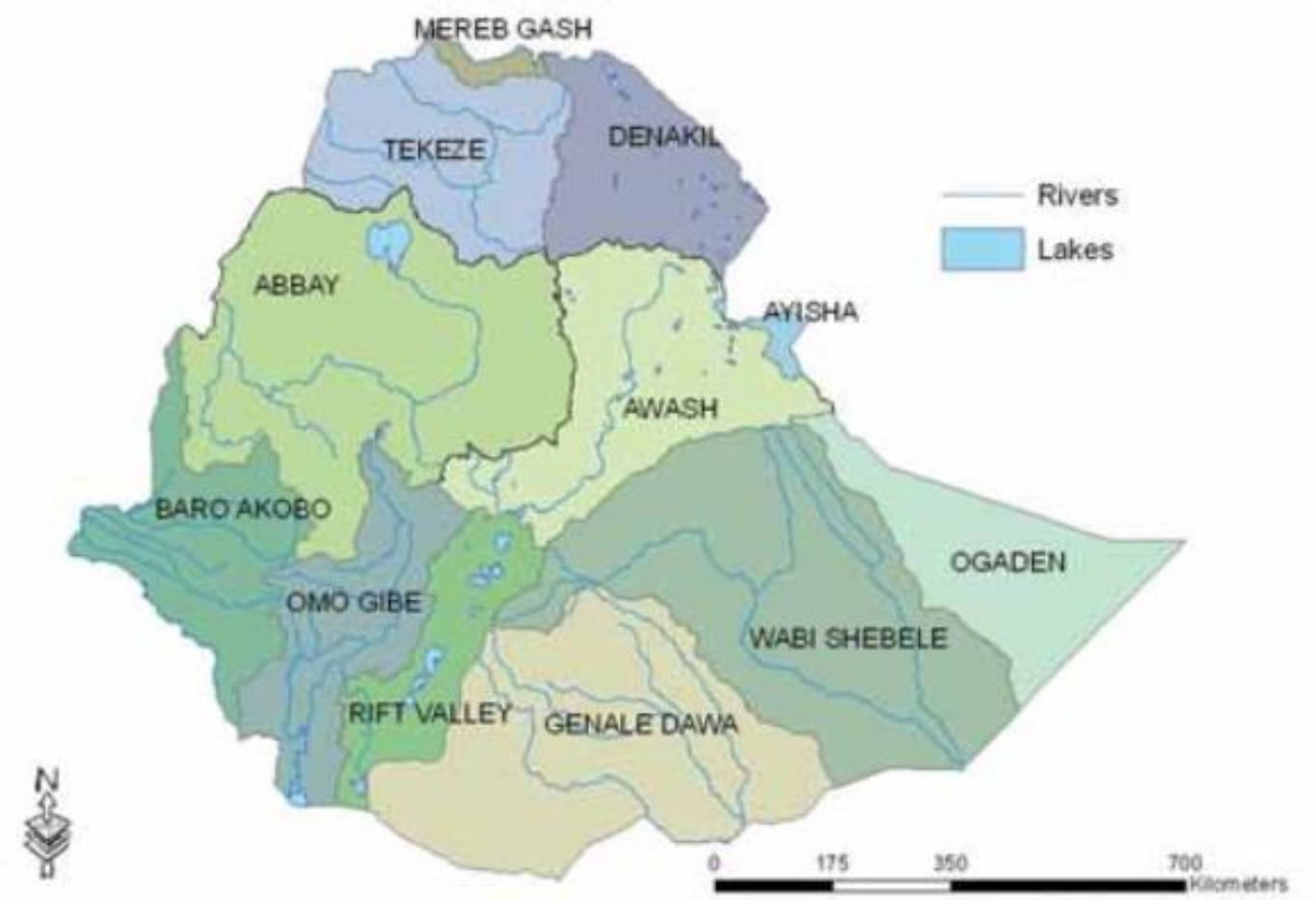


Table 1 Irrigation Potential in the River Basins of Ethiopia (Awulachew*et al.*, no date)

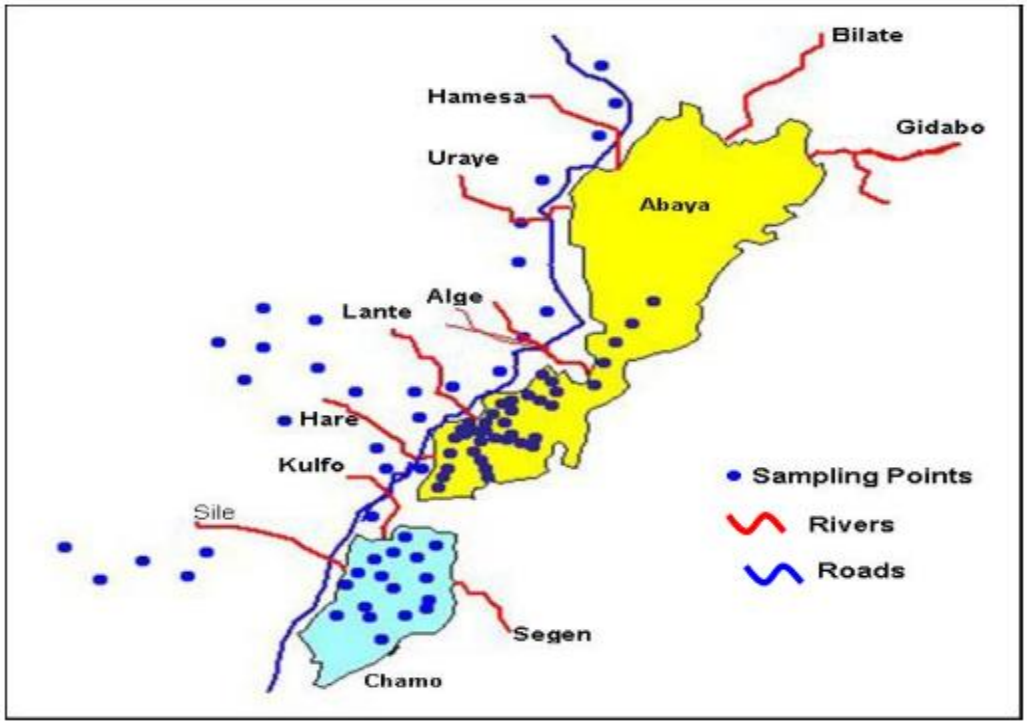
S.No	River Basin	Catchment Area (Km^2)	Irrigation Potential (Ha)			
			Small Scale	Medium Scale	Large Scale	Total
1	Abbay	198,890.7	45,856	130,395	639,330	815,581
2	Tekeze	83,475.94	N/A	N/A	83,368	83,368
3	Baro Akobo	76,203.12	N/A	N/A	1,019,523	1,019,523
4	Omo-Ghibe	79,000	N/A	10,028	57,900	67,928
5	Rift Valley	52,739	N/A	4000	45,700	139,300
6	Awash	110,439.3	30,556	24,500	79,065	134,121
7	Genale Dawa	172,133	1,805	28,415	1,044,500	1,074,720
8	Wabi Shebele	202,219.5	10,755	55,950	171,200	237,905
9	Denakil	63,852.97	2,309	45,656	110,811	158,776
10	Ogaden	77,121	N/A	N/A	N/A	
11	Ayisha (Gulf of Eden)	2000	N/A	N/A	N/A	
12	Mereb	5900	N/A	N/A	N/A	
	Total	1,123,974.53				

N/A: indicates No Available data

The classification of irrigation potential as small scale, medium scale and large scale in the above table is based on the area covered by irrigation farm land (ha), the amount of budget that is invested on the farm, the number of agricultural experts including other stakeholders in the activity etcetera.

There are irrigation activities from tributary rivers to Lake Chamo and Lake Abaya in the woreda. Tiruneh (2005) described that there are crops such as tobacco (Northern part of Lake Abaya), cereals (Irba Lola, Bilatte), Banana (Arbaminch, Sile), and cotton (Arbaminch, Sile). The following figure 3 shows these tributary rivers and the two lakes which exist in the rift valley river basin of Ethiopia as stated above in figure 2. Moreover, table 2 shows major tributary rivers to these lakes with associated irrigation activities and areas irrigated.

Figure 3 Major tributary rivers to Lake Abaya and Lake Chamo **(Tiruneh, 2005)**



NB: The figure is taken from the research conducted on water quality analysis of the area. The sampling points on the figure indicates the pointswhere water quality tests were conducted, which is not the interest of this study.

Table 2 Major tributary rivers to Lake Abaya and Lake Chamo and their associated irrigation schemes(Tiruneh, 2005)

S.No	River	Irrigation Scheme	Irrigated Area (Ha)
1	Bilate	Tobacco Farm	1000
2	Gidabo	Gidabo Diversion Wamole	1300 50
3	Hare	Hare Farmers irrigation	1200
4	Baso	Baso Project	N/A
5	Wajifo	Wajifo Project Shafe Project	400 N/A
6	Amesa	Humbo-Amesa Irrigation	N/A
7	Alluvial fans of Abaya	Abaya state farm	700
8	Kulfo	Arbaminch state farm	1200
9	Sile	Sile state farm	1300
10	Argoba (Wezeka)	Argoba Irrigation	80
Total	Total		7,630 + unaccounted

Average annual precipitation and Temperature in Regional towns of Ethiopia

Ethiopia (Federal Democratic Republic of Ethiopia) is composed of nine regional states (appendix 3) namely: Tigray, Afar, Amhara, Oromia, Somali, Benishangul Gumuz, Southern Nations Nationalities and People Region, Gambella, and Harari and two city administrative states (Addis Ababa city administration and Dire Dawa city administration council). As the following table 3 shows, the average annual precipitation vary from the lowest 203mm in Afar region to the highest 1222mm in Benishangul Gumuz region. In addition, 15.2^{o}C is the lowest average annual temperature condition in Amhara region whereas 28^{o}C is the highest average annual temperature record in Afar region. (Source: Climate-data.org)

Climate-data.org uses two different data sources: the first is Climate Model by climate-data.org which gets data from more than 220 million data points from all over the world at a resolution of 30 arc seconds. The weather data was collected between 1982 and 2012 which is refreshed from time to time. The second data source is from location data by openstreetmap.org which is open data licensed under open data commons Open Database License (ODBL).

Table 3 Average Annual precipitation and temperature of capital cities of regions in Ethiopia (Climate-data.org)

S.No	Region	Average annual precipitation (mm)	Average annual Temperature (^{o}C)
1	Oromia (Adama)	20.5	808
2	Afar (Semara)	28	203
3	Amhara (Bahir Dar)	15.2	1145
4	Somali (Jigjiga)	19.4	712
5	Benishangul Gumuz (Asossa)	21.9	1222
6	Southern Nations Nationalities and People Region (Hawassa)	19.2	1007
7	Gambella (Gambella)	27.6	1148
8	Harari (Harar)	19.4	723
9	Tigray (Mekelle)	19.1	581
10	Addis Ababa	16.3	1143
11	Dire Dawa	24.6	637

According to the source, the average annual precipitation and temperature of the Arbaminch Zuria Woredais 21.8^{o} C and 818mm respectively whereas in Shelle village average annual precipitation and temperature is 16.9^{o}C and 1452mm respectively.

2.4 Governance Assessment

The definition of governance and government has been the discussion agenda among many scholars over a long period of time. There was the traditional definition of governance and government which uses them synonymously as "the formal and institutional processes that functions at the state level to maintain public order and facilitate collective action"(Stoker, 1998, p. 1). The author explains that the growing study concerning this concept redirect the use and definition of governance to a new process of governing, or a changed condition of ordered rule, or the new method to govern society. Another argument is that the outputs from governance and government are almost the same; it is the matter of processes they follow to achieve the objective.

However, the baseline agreement concerning this concept is that governance is about the governing style, but still the boundary between and within public and private sectors have been blurred (Kooiman and Vliet, 1993, pp. 64; as stated in Stoker, 1998). As explained by Stoker (1998), the following five propositions clearly state the governance characteristics and use:

1. Governance is about a set of actors and institutions that are drawn from government, but beyond it by operation.
2. Governance recognizes blurred boundaries in responsibilities of actors to deal with economic and social issues of the citizens.
3. Governance identifies power dependence among different institutions in taking collective action. One institution may depend on the other and exchange resources in cooperation.
4. Governance is about autonomous self-governing of actors in the network. Having their own policy, actors and institutions use their resources to deal with their own issues.
5. Governance recognizes itself to get things done without resting on the power of the Government, which is an authorized state to steer and guide the society.

Moreover, the concept of governance from the perspective of public administration, as Peters and Pierre (1998) discussed, is the process which maintains public services, market conditions, the networks and partnerships between the public and the government. Furthermore, governance is about maintaining the public-sector resources under some degree of political control and developing the way to use resources properly for the benefit of the society. The authors also described that government is however, the hierarchy, the regulation, and the way state is organized (judiciary, legislative and executive system).

In the water governance system of Shelle village, the network between farmers and the local government, their cooperation to improve the yield from crop production is the governance system therein. This governance system facilitates the market condition for the farmers so that

they can sell their crop products in a controlled (legal) way. That means, the governance system encourages the formal market system therefore farmers should pay taxes for the local government. In addition, the agricultural experts in the village provide trainings for the farmers concerning the way they should control weed, irrigation water schedule, and fertilizer application etcetera.

Management, however, is the day-to-day activities in the organization including strategies, policies, work processes and daily progresses which is established by governing body. In most cases, governance is 'what to do', whereas management is 'how to do' activities. ("Corporate governance," no date).

According to Bressers et al (2013), the term "Governance" by its definition has various meanings in practice and in policy science literature. The concept of governance used in this case study is from public administration perspective which defines water governance as: the way of organizing and guiding water resources management to attain specific objective. It is a combination of legal, political, financial aspects, and resource distribution and use; encouraging technical applications of appropriate solutions toward goal attainment. Moreover, collective activities performed among different actors in water resources management is organized and guided by water governance. The authors further elaborated water governance as protecting and modifying water systems and sanitation chains to support the needs of ecological and human kind. Therefore, for this case study, this is relevant concept and definition of governance in water resources management that is used throughout the case study. Managing available water and human resources (farmers and agricultural experts) in the village in organized and planned manner can lead to attain the goal of increasing crop production. This requires water governance system of the village to facilitate proper allocation of the resources, to control the legal and political situation in the village, as well as to keep the societies welfare.

From Contextual Interaction Theory (CIT) (Bressers and Boer, 2013), the deductive approach of the theory discusses the understanding of wider context of existing problems, cultural, economic and technological context in the governance system. The theory also discusses in detail the structural context of the governance system which helps to assess the influence of the institutional context on the policy and decision-making in the irrigation water management system for banana production in the village. The structural context includes five dimensions of governance and four governance quality assessment criteria. Next to the CIT, the governance assessment tool (GAT) (Bressers et al, 2013) enables to assess in details how the structural water governance system of the village is organized. The five governance dimensions are: levels and scales, actors and networks, perspectives and goal ambitions, strategies and instruments, responsibilities and resources. In addition, the four governance quality criteria are: extent, coherence, flexibility and intensity. Applying this tool enables to assess the quality of water governance system in the village. There are a set of both descriptive and evaluative questions

to be answered in this tool that in turn contribute to answer the research questions. The tool also provides the analytical framework which helps to assess if the governance is supporting or restricting the potential to supply irrigation water to the production locations of crops. CIT uses actors' involved in the management of the water resources as a center of analysis and it depicts actor characteristics and contexts that influence the system. As Bressers (2009) indicated, motivation, cognition and resources are the core characteristics of actors that participate in relevant processes. The model deals with interaction of actors in relevant processes in the governance system and the influence of factors and conditions upon them. Each of the actors will have some idea about the goal to be attained (motivation); the information and knowledge needed, and has some interpretation of the situation, the 'what and how' (cognition) and available resource and power to execute activities.

As elaborated by Bressers et al (2013), Water governance Assessment Tool (GAT), as indicated above, consists of five governance dimensions and four quality assessment criteria. The discussion for this tool and the way it will be applied in this case study is described under research design, section 3.1. However, the following explanation is given according to (Kuks, 2000)on the five governance elements (dimensions).

a. Levels of governance: The multi-level governance system and relation with various administration levels. Which level of governance dominates the policy and in what relations they work?
b. Actors in the policy network: The actual involvement of multi-actors system in the policy arena and inclination of each actor to work together.
c. Problem perception and objectives: The multi-faceted problem area and to what extent the problem is serious to deal with it. The identification of the problem if it is individual problem or public problem.
d. Strategy and instruments: The multi-instrumental behavior of policy strategy and characteristics of these instruments; the target group of the policy and the timing of policy application.
e. Responsibilities and resources for implementation: The multi-resource-based approach that focuses on which organization is responsible to implement the policy and available resources and power in policy implementation.

2.5 Use of irrigation water in production of banana

About 20 million tons of banana have been produced annually from eastern and southern Africa region which accounts about 25.5% of world's banana production(Karamura *et al.*, 1998). Although the production is at small scale farming level, it is the main source of food for consumers of about 30 million people.

The authors further elaborated that in addition to banana, plantain is the most common agricultural product which is nowadays part and parcel of socio-economic activity of people. Furthermore, both green cooking and table bananas are common marketed for food. However, in some parts of the region such as Rwanda and Burundi, banana is used as the main constituent of beer production so that it is the most common commercial crop in these countries. Annually, about 64% of beer production is from banana in these countries that encourages the farming activity of small scale farmers so that they can generate income for their economic development.

In addition, banana production encourages mixed farming system in the limited size farm land. It serves as fodder to feed animals which in turn provide manure for the farm. Apart from mixed farming, intercropping is possible by planting legumes together with banana to use the farm area for multiple purposes at the same time and thus producers get balanced diet.

Production of banana needs regular application of water throughout the year either from rainfall or surface water so that the plant's health and high yield can be maintained. In banana production process, the most important and expensive work is managing irrigation water that suits water requirement of the plant. These management process includes: The amount of water to be applied (Liters/ha/day), the source of water (ground water or surface water), water application method (irrigation method including sprinkler irrigation and drip irrigation), water quality, flow of water either by gravity or pumping method etc. In order to distribute irrigation water evenly over the farm area to reach each root of the plant, the designer have to have an information about crop water requirement of the plant, irrigation schedule (timing and discharge), evaporation and transpiration, crop factor and other related factors which can affect the plant by competing for irrigation water.

Crop factor $= \frac{crop\ water\ use(\frac{mm}{day})}{evaporation\ (\frac{mm}{day})}$, (Diczbalis and Toohill, 1993).

Therefore, to replace water lost by evaporation, irrigation is required to maintain the yield from the plant.

The authors further elaborate how less organized irrigation water management in banana production results in small bunches, less weight, and weak plant vigor. Since bananas are

shallow rooted plant (30cm-40cm), it is difficult to suck water from soil moisture. To maintain continuous yield of fruit, irrigation water must be applied regularly. When the soil water content is at field capacity (all excess water is drained from soil and soil is saturated safely), and the soil is sandy loam, that is favorable soil environment for maximum yield. Sandy soil is not appropriate for banana plantation even though it is saturated. Because shallow roots of the plant cannot support it. Clay soil is also not favorable for banana production since the rate of water infiltration is low and it holds more water and creates inundation. Medium soil type (sandy loam) is good in holding water for the safety of banana plant.

2.5.1 Production of banana in Ethiopia

As Woldu *et al.* (*no date)*described, in Ethiopia, there are about 59.64% (53,956.16ha) of total fruit area. Annually about 68% (478,251.04 tons) of the total fruit produced, and about 38.3% (2574035) farmers involved in fruit production activities. Moreover, in south nation nationalities and people of Ethiopia (SNNP), about 68.72% (37,076.85ha) of land is covered by banana. About 77.53% (370784.17 tons) of banana has been produced annually in average and 22.38% (1,504,207) of farmers are engaged in banana production activities. From SNNP of Ethiopia, Gamo Gofa zone, Benchi-Maji zone and Sheka zone are the most common banana production centers in the country. Especially, in Gamo Gofa zone, where Arbaminch is the capital city and Shelle village is also located (the focus of this case study), about 70% of total banana in the country is gained from this zone. As stated in section 1.2, there are variations in the amount of banana produced from one village to another by irrigation because of different reasons such as problems in irrigation management, lack of availability of water, lack of fertilizers etcetera. One good thing is that people of these zones use chopped banana leaves and sliced weeds to help fertility of the soil when it decomposes.

However, there are some problems in banana production in Ethiopian context. As Woldu et al (no date) stated, less variety of bananas exists in the country which affects the productivity and production of the fruit in the country. About 5 - 8.95 tons/ha of banana produced in the country which is very less than average world's banana production of 15.8 tons/ha. Although the variety and scale of production is far less than world's production level, Ethiopia is exporting this fruit and generating income from it.

CHAPTER 3 RESEARCH DESIGN

Research design is a set of sequential procedures based on choices that should be followed to answer research questions (Creswell, 2003). The strategic ways used to answer research questions are discussed in this chapter.

3.1 Research Framework

As Verschuren and Doorewaard (2010) explained, research framework is a schematic presentation of the research objectives and appropriate steps followed to attain the objective. The following seven steps show the framework of the research.

Step 1: Characterizing briefly the objective of the research project

The aim of this research is to give recommendations to local administration of Shelle village how they can improve their irrigation water management system by assessing the present irrigation water governance system for crop production in the village.

Step 2: Determining the research object

The research object of this research is irrigation water governance system of Shelle village. Taking this research object as the central discussion point, assessment and analysis of the governance system is conducted.

Step 3: Establishing the nature of research perspective

This research is problem assessment research by nature in order then to give recommendations to local administration. By using the CIT and the Governance Assessment Tool, the case study assessed the current irrigation water governance system of Shelle village to identify problems. It also tried to identify the areas of challenges (problems) perceptions by actors in irrigation water management. Strategies and instruments used to tackle those problems is also analyzed. Therefore, there are two perspectives combined in this research. The first is identifying available water resources and the irrigation water management challenges (problems) related to those resources. The second is assessing the impact of the water governance system on the irrigation water management challenges of the village. This was done by assessing the actors' roles and their relationships with the local people at large, by using CIT and GAT. Limited comparison of water governance system in the other villages is conducted so that best management practices can be recommended to Shelle village.

Step 4: Determining the sources of research perspective

The research depends on scientific literature that hands frameworks to assess the relevant process within the village in its relevant context. The key concepts in the research and theoretical information therein are derived from literature. The research also depends on the data and information collected to analyze the result. Table 4 below shows key concepts and theoretical information included in the research perspective.

Table 4 Concepts and theoretical information

Key concepts	*Frameworks and documents*
- Water resources management - Challenges in irrigation water management - Water governance assessment tool	- Frameworks on water resources management - Frameworks on water governance assessment tool - Preliminary research

Governance Assessment Tool (GAT)

Governance assessment tool is used in this case study to assess the quality of the water governance system in the village. The tool is relevant to this study to clearly assess the management of irrigation water allocation system, resource distribution, actors and their relationships, strategies and instruments used in the village to solve problems and also in the improvement of future plans to increase production of crops. Therefore, after assessing water governance system of the village, based on literature and data and information collected, the study gave recommendations for improvement.

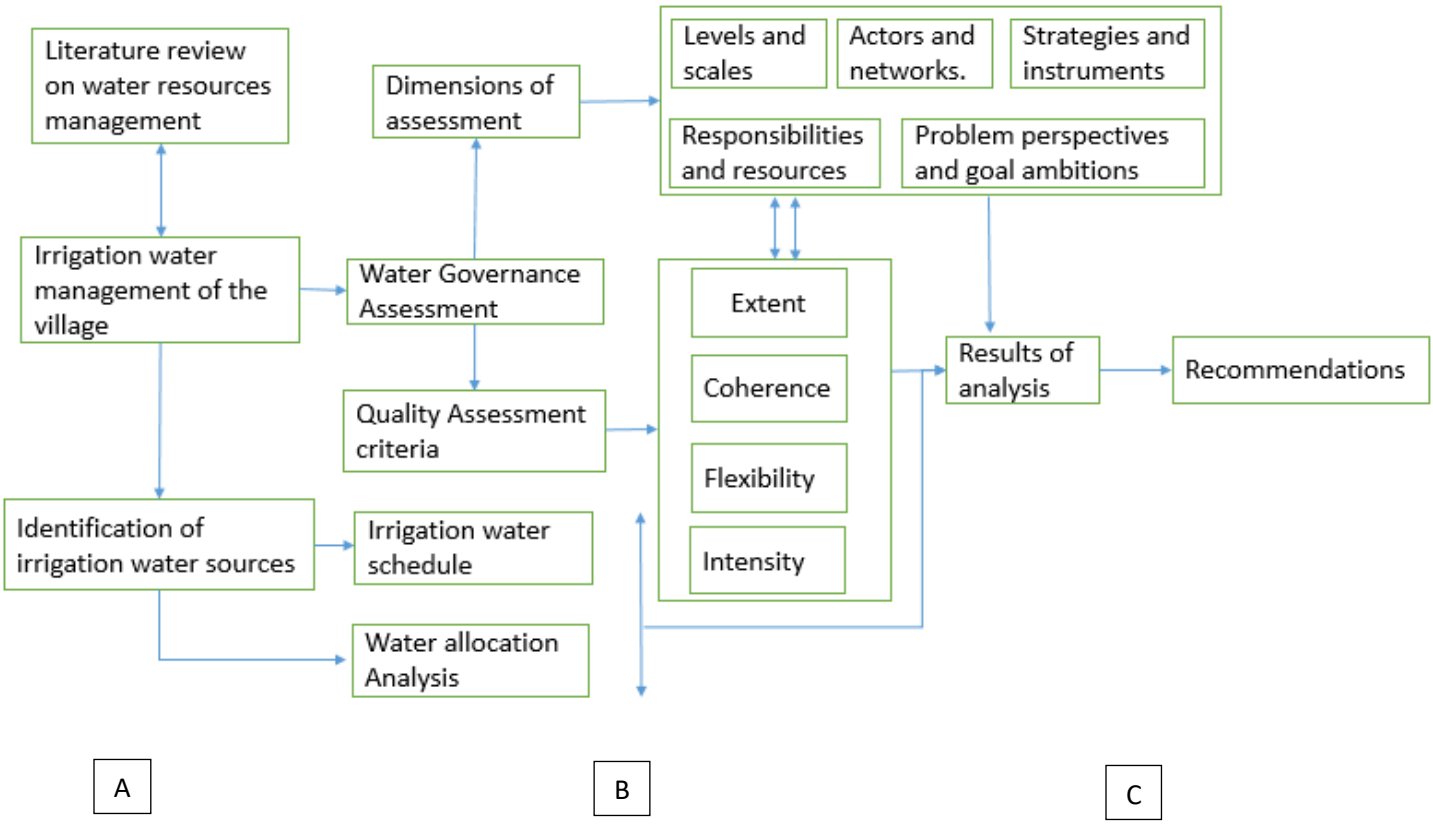
Table 5 Evaluative questions for water governance assessment tool (Extracted from: Bressers et al., 2013)

Governance dimension	Quality of the governance context			
	Extent	**Coherence**	**Flexibility**	**Intensity**
Level and scale	How many levels are involved in managing irrigation water?	Do these levels work together?	Is it possible to move up and down levels (up scaling and downscaling)	Is there a strong impact from a certain level towards behavioural change or management reform?
Actors and networks	Are all relevant stakeholders involved? Who are excluded?	What is the strength of interactions between stakeholders?	Is it possible that new actors are included or even that the lead shifts from one actor to another when there are pragmatic reasons for this?	Is there a strong pressure from an actor or actor coalition towards behavioural change or management reform?
Problem perspectives and goal ambitions	To what extent are the various problem perspectives taken into account?	To what extent do the various perspectives and goals support each other, or are they in competition or conflict?	Are there opportunities to re-assess goals?	How different are the goal ambitions from the status quo or business as usual?
Strategies and instruments	What types of instruments are included in the irrigation management strategy?	To what extent is the incentive system based on synergy?	Are there opportunities to combine or make use of different types of instruments? Is there a choice?1	What is the implied behavioural deviation from current practice and how strongly do the instruments require and enforce this?
Responsibilities and resources	Are all responsibilities clearly assigned and facilitated with resources?	To what extent do the assigned responsibilities create competence struggles or cooperation within or across the management staffs?	To what extent is it possible to pool the assigned responsibilities and resources as long as accountability and transparency are not compromised?	Is the amount of allocated resources sufficient to implement the measures needed for the intended change?

Step 5: Making the schematic presentation of research framework

The following figure 4 shows the research framework of this case study.

Figure 4 Schematic Representation of Research Framework



(A) Description of current irrigation water management situation in the village based on literature, data and information collected

(B) Identification of irrigation water sources and assessment of water governance system of the village

(C) Based on results of analysis, giving recommendations to the administration of the village

Step 6: Formulating research framework in the form of an elaborate argument

(A) And (B) The study of literature review on core concepts and preliminary research that can help to apply water governance assessment tool to assess the water governance system of the village. Identification of water sources, water allocation, commercial benefits people have been gaining from banana production, and the water ownership arrangement analysis fall under this category.

(C) After analysis of collected data and information, in conjunction with results from assessment of water governance system of the village, and also limited comparison with experiences of other villages in irrigation water management, recommendations were given to the local administration.

Step 7: Checking if the research framework leads to attain the research objective

Developed framework is good so that it can lead to attain the research objective.

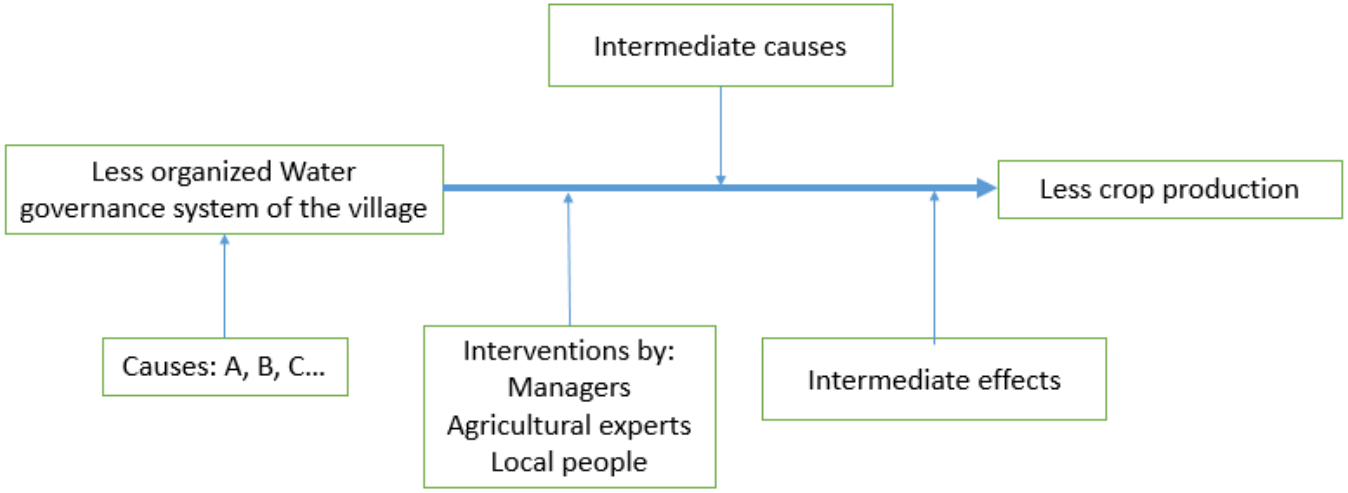
3.2 Conceptual Model

The conceptual model is the outline of the research which decides what exactly have to be included in the research and what is not (Verschuren and Doorewaard, 2010, 2nd edition, p. 268). It is the systemized and simplified picture of the field of study and relationships (causal) therein.

Consequently, in this case study the relationship between causes and effects of the situation in water governance system of the village is included. As stated under section 1.2, less organized water governance system of the village resulted in less crop production and other related consequences.

As indicated under figure 5below, there were causes that lead the water governance system of the village to be ineffective. These causes are identified in the research. Then, this ineffective water governance system weakens the crop production capacity. The causal relationship is described in the following figure 5.

Figure 5 Schematic representation of Conceptual Model



NB: Causes: A, B, C… indicates identification of different causes (reasons) that weakens the water governance system in the village.

3.3 Research Questions

The Main research questions

1. What are present water governance challenges (problems) in irrigation water management system during crop production activities in Shelle village, Arbaminch Zuria Woreda?
2. How to improve the irrigation water management system?

Sub questions

1. What types of water sources are there in Shelle village and where do they exist?
2. How existing irrigation management is organized in the village?
3. What are levels and scales of the water governance system in the village?
4. Who are major actors? And to what extent they work together?
5. What are challenges (problems) perceptions among different actors in irrigation management of the village? And what strategies and instruments are used?
6. What is the quality of the water governance system?
7. How responsibility and resources allocation practice looks like in Irrigation Water Management system of the village?

3.4 Defining Concepts

For the purpose of this research the following key concepts are defined:

Water resources management: The process of planning, organizing, and distribution of water for farmers so that they can use either for agricultural or domestic purposes.

Rain-fed agriculture: Agricultural practices based on water from rain-fall to maintain soil moisture.

Irrigation agriculture: Agricultural practices based on water from diverting rivers (water flows by the force of gravity) or pumping water to farm area (water flows by applying external pressure) to maintain soil moisture.

Water governance assessment tool: A set of questions in the form of matrix consisting of both descriptive and evaluative questions to assess the quality of water governance system.

Water allocation: Allocating water for different purposes such as irrigation scheduling, drinking water for animals, domestic water use etc.

Crop production: Production of crop from farm area either by rain water or by irrigation from surface water such as rivers or ground water.

3.5 Research Strategy

The approach of this research is in-depth study approach on single case (the case of Shelle Village). However, limited comparison with other villages with best irrigation water management practices is conducted so that to make recommendations for improvement.

3.5.1 Research Unit

The research unit for this case study is irrigation water management system of Shelle village in crop production.

3.5.2 Selection of research units

As Verschuren and Doorewaard (2010) explained, the selection of informants and respondents for data and information collection is arranged in the following ways:

Informant: Someone who provides data about other people, situations, objects or processes

Respondent: A person who supplies information about himself or herself

Local water resources manager: He or she serves as both informant and respondent. He/she explains challenges related to irrigation water management practices and the general situation of water governance system in the village. The interview includes other members of irrigation

water management of the village based on how strong data and information they provide to this case study.

Local agricultural experts (development agents): They serve as both respondents and informants. They explain both technical and management details of the problems based on the questions (interviews) they are asked.

Local community (water users or farmers): They also serve as both informants and respondents. They are assumed to give the real (practical) image of water governance system on the ground and can explain complaints they have on the irrigation water management system that serve as an input data for this case study.

3.5.3 Research Boundary

The research boundary is used to demarcate the research so as to conduct in a given time frame and also meet the objective by answering research questions. There might be complaints from local people especially such as availability of irrigation equipment, technologies sand resources allocation problem sand further inquiries from management bodies that may fall beyond the scope of this research. So, issues which need advanced research are not be included in this study. Only issues concerning present water governance system specifically based on the set of questions from water governance assessment tool are targeted in this research

3.6 Research Materials and Accessing Method

Research material and accessing method is the way of organizing and defining where are data and information that a researcher needs to answer research questions. Which source should be analyzed, and how to get them are all planning and designing of the way to attain the research objective (Verschuren and Doorewaard, 2010)

In this research, data sources are people, documents, media and reality (from observation). The strategic way applied to use these sources are by interview (individual face to face), analyzing documents and observing the reality on the ground. Analysis of document includes the current water management system in the village, and achievements they made so far including future perspective of crop production. The following table 6 shows data sources, types of information needed, accessing method and to which research questions they contribute.

3.6.1 Data Collection Method

Table 6 Types of data or/and information needed, Data sources, and Accessing method

Research questions	Types of information needed	Data sources	Accessing method
1. What types of water sources are there in Shelle village and where do they exists?	Type of water source: - Availability - Quantity - Quality	Primary data - Local community - Local Agriculture Experts	- Individual interview (face-face) - Observation
		Secondary data - Documents	Content analysis
2. How existing irrigation management is organized in the village?	- Organizational culture - Resource allocation and ownership	Primary data - Local Water manager - Agriculture experts - Local community	- Direct individual interview (face-face) - Observation
3. What are levels and scales of the water governance system in the village?	- Levels and scales of management - Top-down or - Participatory	Primary data - Local water manager - Agriculture Experts - Reality	- Direct individual interview (face-face) - Observation
		Secondary data - Document	Content analysis
4. Who are major actors? And to what extent they work together?	Actors involved - Roles, networks - Level of public involvement	Primary data - Local water manager - Agriculture Experts - Reality	- Direct individual interview (face-face) - Observation

		Secondary data - Document - Media	Content analysis
5. What are challenges (problems) perceptions among different actors in irrigation management of the village? And what strategies and instruments are used?	- Challenges (problems) perceptions in irrigation management - Strategies and policy instruments used	Primary data - Local community - Agriculture Experts - Reality	- Direct individual interview (face-face) - Observation
		Secondary data - Documents - Media	Content analysis
6. What is the quality of the water governance system?	Extent, Coherence, Flexibility and Intensity of the governance system	Primary data - Local community - Agriculture Experts - Reality	- Direct individual interview (face-face) - Observation
		Secondary data - Documents - Media	Content analysis
7. How responsibility and resources allocation practice looks like in Irrigation Water Management system of the village?	- Transparency and accountability of management - Resource allocation	Primary data - Local community - Agriculture Experts - Reality	- Direct individual interview (face-face) Observation
		Secondary data - Documents - Media	Content analysis

3.6.2 Data analysis method

After collecting data and information, the methods of analyzing them to get certain result is described in the following table 7.

Table 7 Data and information collected and respective method of analysis

Data and information collected	Method of analysis
Type of water source: - Availability - Quantity - Quality - water allocation	Qualitative method: Analysis of water supply and demand including irrigation and domestic water use in the village. Historical background of their irrigation water management practices.
Organizational culture - Levels and scales of management - Top-down or Participatory	Qualitative method: Analysis of irrigation water management structure in the village, the way it organized, vertical or horizontal. Levels and scales of the management system.
Actors involved - Roles and networks - Level of public involvement	Qualitative method: Analysis of who is in charge of management, what is his/her or their role, how do they cooperate, and involve people
Challenges (problems) perceptions in irrigation management - Strategies and instruments used to solve problems	Qualitative method: Analysis of what, where and why the exact challenge (problem) is and how each actors perceive those problems. Analysis of which strategies are used to solve those problems and which type of instrument (s) is (are) applied.
Extent, Coherence, Flexibility and Intensity of the governance system - Strengths - Weaknesses	Qualitative method: Analysis of quality of water governance by using GAT. Table 5 above is used in this analysis.
Responsibility and resource allocation practices	Qualitative method: Analysis of how the management body is responsible and transparent in allocating resources on time and without bias.

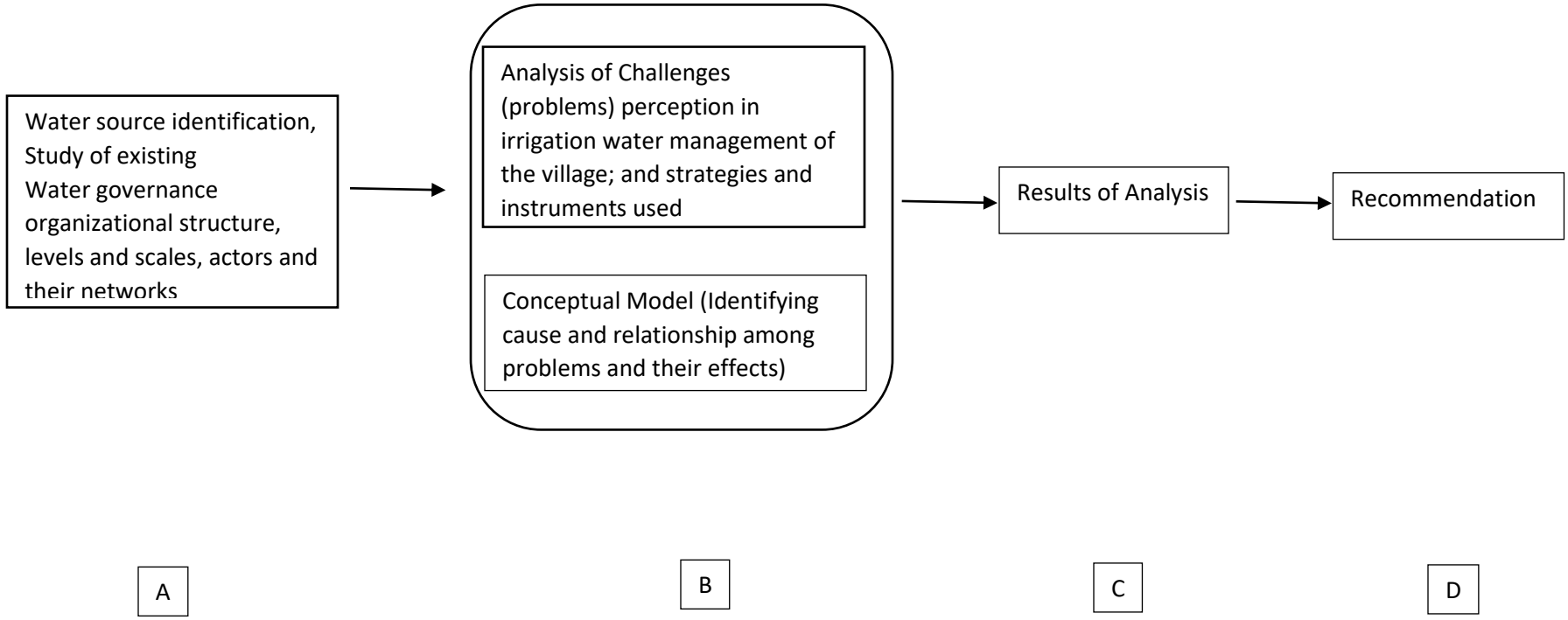
3.6.3 Validation of Data Analysis

Triangulation is used to validate collected data and information in this thesis. That is by comparing (cross checking) data/information collected by interview and document analysis together with observation. Comparison of the reality on the ground which is obtained from observation with the perspective of the research framework helps to validate data/information. Therefore, this is to avoid bias in data analysis and then the result of triangulation is used to analyze data in this thesis.

3.6.4 Analytical Framework

The analytical framework of the case study is shown schematically in the following figure6.

Figure 6 Schematic representation of Analytical Framework



Data analysis was conducted by the following procedure:

a. Firstly, the study identified water sources that the village has been using for irrigation purposes in production of crops. Moreover, the organizational structure of water governance system in the village, levels and scales of management system were analyzed. This is done from data collected by interviews, documents, and reality based on observation. The analysis was by applying GAT. At the same time, the role of actors in the management processes was analyzed. In this analysis step, research sub-questions number 1, 2 and 3 are answered including some descriptions as a steppingstone to the rest of the questions that lead to answers in the consecutive analysis.
b. Secondly, the present challenges (problems) in irrigation water management in the village and to what extent it is serious from the perception of actors, was identified. The strategies used and instruments applied to solve those problems were analyzed based on data and information collected together with other related literature on the water governance topic. This was also done by applying GAT. From this analysis step, research sub-questions number 4, 5, 6 and 7 are answered.
c. Thirdly, by combining results of analysis from first and second step, summary of results (answers) concerning all research sub-questions are organized and presented. This step helps to answer the main research question by ensuring that all research sub-questions are answered.
d. Finally, based on the answers of research sub-questions in previous steps and the summary of result of analysis in the third step, recommendation is given to implied bodies in the village that are responsible to deal with the issues.

3.7 Research Planning

3.7.1 Planning of Activities and Time Schedule

Verschuren and Doorewaard (2010) viewed research planning as of activities in a study that helps to check if the research activities are going well toward achieving intermediate goals effectively so that the final target of the research can be gained. This research was conducted from the beginning of the month of March to the end of month August 2017.

CHAPTER 4 IRRIGATION WATER MANAGEMENT SYSTEM IN SHELLE VILLAGE

Introduction

In this chapter, the management of irrigation system in Shelle village is described. There are two rivers, namely: Sile and Sego rivers. Which are the main rivers used for irrigation and other domestic purposes. In addition, there are different crops cultivated by these rivers other than banana such as sugar cane, onions, cotton, mango, maize and pepper. Moreover, In order to manage these rivers in collaboration with other stakeholders, there are two water committee in the village who are responsible for managing water allocation and distribution system to each farmland according to the area in hectare to be irrigated. The more the area in hectare of the farm land, the more water amount and duration of irrigation water application as well. The details of these water sources, irrigation water schedule and management practices therein, is discussed in this chapter to answer research sub-questions 1 and 2 that are listed above in section 3.3.

4.1 Irrigation water sources and crop production in Shelle Village

Sile and Sego rivers are the two rivers used for irrigation activities in the Shelle village. Sile River enters the village flowing from South West to the North East direction crossing the village. Whereas, Sego river flows from the other side of the village from South East to North East direction. The following figure 7 shows Sile and Sego Rivers respectively.

Figure 7 The two rivers used for irrigation in Shelle village

a) Sile River b) Sego River

The two rivers were used in the past to serve as drinking water and also for other domestic uses. As indicated on figure above, people still use Sego River to wash clothes, and their bodies. However, currently ground water is used for drinking purposes which is enough in amount for drinking water demand of the village. This change emerged in the past decade. The quality of

ground water is controlled by people from the villages' health center who regularly add chlorine and also examine the quality of the water from time to time. The following figure 8 describes one of ground water commonly used in the village for drinking purpose.

Figure 8 Ground water for drinking purpose

The two rivers (Sile and Sego) are mainly used for irrigation purpose and to some extent; they serve as drinking water for animals. These rivers irrigate about 1088 ha of land in the village. Almost all agricultural activities in the village are based on irrigation and very limited portion of the village uses rain fed agriculture. This is because of the limited amount of rain in the area and variation in the rain season throughout the year. The amount of water from these rivers is sufficient for irrigating the farmland in the village. However, the volume of these rivers varies based on the amount of rainfall.

4.1.1 Irrigation water allocation and use in Shelle Village

Each farmer has an average of 2.5 hectare of farm area that they use for agricultural activity. From the minimum of 0.25 ha to the maximum of 5 ha, these farm areas are owned by local farmers. In order to irrigate their farmland, the West part of the village uses Sile River while the East part uses Sego River. There is a water committee in the village that controls the water ownership and allocation for irrigation. The committees exist of local farmers who are selected by the local administration and the society in the village. They decide the duration of irrigation water application to each farmland (irrigation schedule), resolve conflicts, operation and maintenance of irrigation canals, and also control regulations and rules therein.

There are some gaps in implementation of regulations and rules in which the control over water diversion from one farmland to another is not clearly stated for the day and night time separately. Some complains from farmer's shows that water theft is common during night time by which some farmers cheat irrigation water and divert it to their own land and adjust to its original flow direction after some hours. In addition to that, 6 hours of water application to farm land is allowed per hectare, and 3 hours for a half hectare plot of land. However, some farmers get water for more hours while others get less. Although there are binding rules and penalties (fines) for inappropriate activities in irrigation water allocation and use in the village, the prevalence of these rules is not seen in practice. As a result, in the current situation, there is an expansion of illegal irrigation water users in the village. Moreover, sometimes there is conflict among upstream and downstream water users since more water is used by upstream part of the village and that results in less water at the downstream part. Elgo village is the downstream village for Sego River and Sile village is the downstream village for Sile River just after Shelle village which is the upstream part of the villages in both cases so that it uses more irrigation water from both rivers. Therefore there is variation in water use even within Shelle village in which the upstream part of the village use more water while the downstream part uses less water in comparison.

The two rivers have their own water committee and they cooperate in decision making activities while sharing experience. There is another committee at the Woreda level (higher level) who controls the activities of these two committees (Sile and Sego water committee). If there are issues that are beyond the capacity of Sile and Sego water committees, water committee at the Woreda level would see the issue and address it in collaboration with the local administration and farmers as well. There are various kinds of crops in Shelle village such as onion, garlic, mango, maize, pepper, banana, and sugarcane. These crops are cultivated either separately on different fields or as an intercropping farming system (growing different kinds of crops together on the same field). This intercropping is used to use soil fertility by optimization since different crops use different minerals in the soil. In addition, since evapotranspiration of different crops is different, intercropping is used to save irrigation water as well. The following figure 9 shows different types of crops in Shelle village.

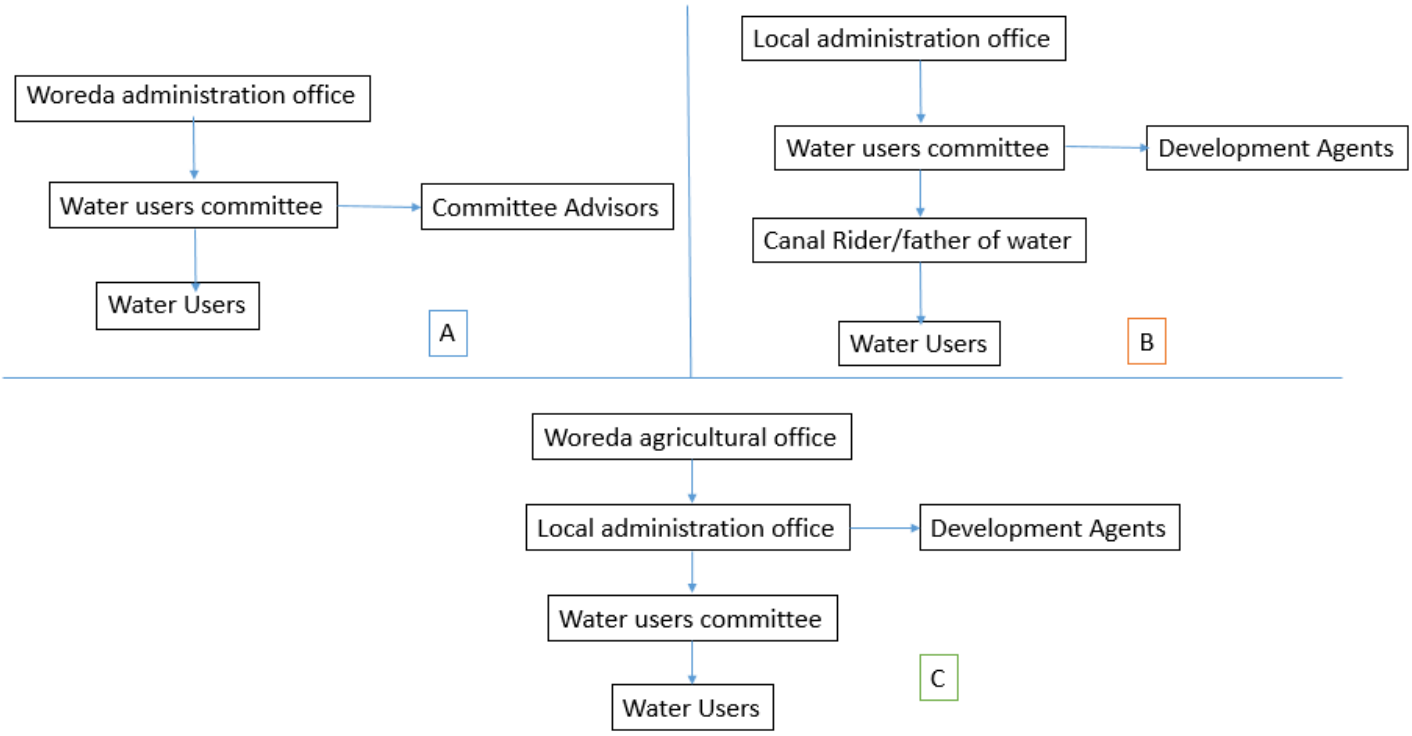
Figure 9 Intercropping farming system

a) Onion, maize and banana b) Pepper, maize and banana

4.1.2 Organizational structure of irrigation management

In different parts of the country, there are different types of structures of irrigation institutions (organization of the management system). The following figure 10 describes the three categories of the organizational structure of irrigation institutions in different villages of the country according to Hailesillassie et al, (2016).

Figure 10 Types organizational structure of irrigation institutions (Hailesillassie et al, 2016).



At Woreda and below levels, these agricultural institutions vary in organizational setup. There is no predefined organizational structure that should exist in all villages. These institutions consists of agricultural development agents which are in some villages also called as agricultural experts, water users (farmers), advisors, local administration and water committee. Performance of advisors are seen as providing ideas to support the operationalization of each activities such as prioritization of each farmlands in water allocation, solving disputes among water users and providing capacity building programs for local farmers.

From above mentioned organizational structure of irrigation management, type C is recognized in Shelle village where Woreda agricultural office mostly lead the activities and water users (farmers) are at the end of the arrangement in the hierarchy. Moreover, Water committees are the very active actors in the hierarchy because they are next to farmers and every issue related with irrigation practices should be dealt with this committee. However, if the issues need further investigation or if it is beyond the scope of this level, it goes to local and Woreda

administration offices. In most of technical works, both development agents and water committee cooperate to solve problems and also to smoothly conduct their activities.

In addition, as mentioned earlier, in different villages, different forms of organizational structures are common. For example, from figure above in type A, there is direct relationship between water committee and Woreda administration without interference of local administration. This type of arrangement can help to shorten the distance that water committee and water users need to go to present their issues such as financial support to higher levels. In contrast, Woreda administration would be busy with bulk of issues which directly flow from farmers; as a result it is difficult to give feedback for each issue immediately. In order to solve problems at lower levels before taking them to Woreda levels, advisory committee plays significant role. This committee serves as an intermediate between Woreda administration and water committee so that issues can be handled at lower levels. Moreover, in type B on figure above, the organizational structure starts from local administration and includes canal rider or father of water next to water committee. This type of organization is the best from the other two because of the existence of these canal riders. They are not appointed individuals from government side, but selected from farmers' themselves and they prefer to settle issues at lower levels instead of calling higher levels down for discussion. Therefore, this level is very crucial because they are part of the farmers that immediately react to conflicts and other issues. As a result, immediate response can be given to farmers by which they can continue in their crop production activities.

CHAPTER 5 GOVERNANCE OF IRRIGATION WATER IN SHELLE VILLAGE

Introduction

In this chapter, the governance of the irrigation system in Shelle village is described and analyzed by applying the Governance Assessment Tool (GAT). As stated in section 3.1 above, the five GAT elements (levels and scales, actors and their networks, problem perception and goal ambitions, strategies and instruments, responsibilities and resources) are discussed. Moreover, the four Governance Quality Assessment criteria (Extent, Coherence, Flexibility and Intensity) are also included in the discussions. The network among local farmers and local administration, water committee at Woreda administration and at the local level are analyzed. Challenges (problems) during and after construction of irrigation canals, starting from diversion point to the farm land, the management of flood control during peak flow in the canal and sedimentation control is discussed. This answers research sub question 3 to 7 which are listed in section 3.3 above.

5.1 Levels and scales

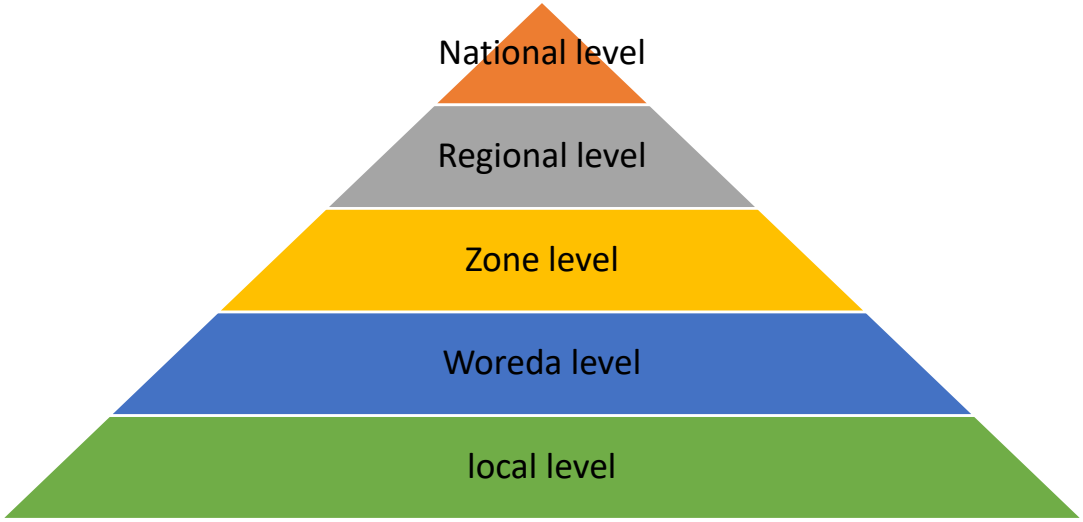
The agricultural activities in Ethiopia as mentioned before are based on rain-fed and artificial irrigation practices, the regional climate condition, topography of the area and soil condition. In some regions of the country, there is regular rain during rainy season which enable farmers to conduct rain-fed agriculture. This includes most parts of Oromia and Amhara regions where large scale of agricultural activities are covered by rain water in addition to irrigation. In South Nations Nationalities and People Region (SNNPR), however, irrigation is mostly common in some zones, especially Gamo Gofa Zone, Benchi-Maji zone and Sheka zone. Arbaminch Zuria Woreda is located in Gamo Gofa Zone that includes Shelle Village where this case study is conducted. Therefore, farming system by irrigation are common for crop production activities in this village.(Unpublished document).In the following discussions, the four governance assessment qualities in the village are analyzed.

Extent was assessed as supportive

There is a complete inclusiveness of important aspects in irrigation water management of Ethiopia. These includes several levels of (irrigation) management: national level (ministry of water, irrigation and electricity), regional level (that is responsible for irrigation activities in several Zones included in the region, e.g. for this case study, South Nation Nationalities and People Region), Zone level (responsible for several Woreda included in the zone, e.g. Gamo Gofa Zone) and Woreda level (that is responsible for irrigation activities in several villages included in the Woreda, e.g. Arbaminch Zuria Woreda); and the local level (Shelle village administration). These are the hierarchical arrangement of irrigation management system in Ethiopia from top to down. As this hierarchy goes down from national to local government, the responsibility of managing irrigation activities rests on the shoulders of the local administration and the local water committees. Higher administration (national and regional) participate by training local agricultural experts, providing fertilizers, pesticides and expansion of the

agricultural and other related sectors in the country by coordinating both foreign and domestic educational institutions. The following figure 10 shows the hierarchical arrangement of irrigation management system in Ethiopia.

Figure 11 The hierarchical arrangement of different levels in irrigation management



Coherence was assessed as neutral

The governance element levels and scales as it is practiced in the village, brought a mildly neutral effect on the improvement of irrigation practices in terms of introducing new technology, capacity building programs for agricultural experts, and awareness creation for farmers. The coherence across different irrigation management levels and scales has neutral impact on changes that has to be made to improve the cooperation among stakeholders that is especially at the local government. Activities of different levels are to some extent recognized as mutual dependent on one another. However, in order to make decisions concerning water allocation to each farmland, sometimes the rules and regulations are left aside while negotiations prevails. There is reliance on the general agreement that the more the area in hectare of farmland, the more irrigation water to be allocated. Regardless of crop water requirement, crop type, soil type, and other factors that need to be used as criteria in water allocation, negotiated agreement is used in general terms which results in discrimination (bias). This results in unfair irrigation water allocation to farmlands.

Flexibility was assessed as neutral

The irrigation management was partly flexible at the higher level (National and Regional government) while it is highly flexible at and below Zone level, especially at local levels. The relation between levels and scales is based on decentralization of power with upper levels limited (financial) support. The less flexible management system at higher levels is because of that responsible individuals at these levels are assigned by prime minister of the country and regional higher administration bodies respectively. Because of this, there are several steps and procedures to be followed to change policies made, and strategic plans at national and regional levels which made the system less flexible. At the levels below zone including Woreda and local

administration, it is easy to change plans, and actions to deal with certain issues in a short period of time. Most of the time, complains from farmers concerning water allocation for irrigation is the reason to change plans made by water committee at the local level and therefore this made the system neutral in flexibility. This assisted the empowering rather than controlling of stakeholders at different levels and scales in their activities.

Intensity was assessed as supportive

Currently, there is a strong positive impact from national and regional government on local levels that they should incorporate animal breeding in addition to crop cultivation. There are selected species of sheep, cows, hens and goats that are provided to farmers from higher management levels (National and Regional government). These species can give more number of offspring in comparison to the usual (ordinary) animals so that farmers can be benefited easily. This positive impact from higher management levels drives the only irrigation based lifestyle of the village to mixed farming (a farming style which involves both crop cultivation and rising of livestock) and intercropping which enable the local farmers to prosper. These show that upper levels are deeply involved in the irrigation policy or projects operationalization.

Summary of levels and scales

According to Bekabil (2014), there are two types of agricultural production systems in Ethiopia. These are: the pastoral nomadic system and the mixed cropping system. The pastoral livestock production system dominates the semiarid and arid lowlands (usually 1500m below mean sea level). A vast area of land is dominated by small livestock production system. In a similar manner, in Shelle village, mixed cropping/farming type of agricultural production system is commonly used. The process of crop production and livestock production goes hand in hand. This crop production system is mostly used to secure food for households (home consumption). Furthermore, it is used to generate cash for schooling, taxes, farm inputs (fertilizers and pesticides), clothing and others. Furthermore, the wide geographical inclusiveness (scales) of stakeholders in the irrigation water management system of the village is arranged from top to bottom. The involvement of various levels (multi-level character) creates wide scope of the scales by which various ideas and improvement concepts can be generated. There is a national regulations and rules to administer farm land ownership and properties therein. However, farmers and local administrative bodies have their own say, having their own local regulations and rules, as a sub-set of irrigation water management system of the area. This administrative system (at local level) dominates the present activities of crop production system in the village. There is a slightly self-regulation approach by which local administration in conjunction with farmers decide and drive the system.

The biggest hindrance to improvement and utilization of water resources in the village is not the lack of water availability and involvement of different stakeholders at various levels. However, it is the confined management system which is unclear, but being implemented or practiced by water committee. This hurdle impedes the growth and development plan of the village by crop yield. There is a prevalence of lethargy in continuous discussion to deal with issues, resolving conflicts and to fill the information gap between farmers at upstream and downstream irrigation water users. There need to be planning processes by which farmers can

strategically involve in the actions of water committee, which dominates the enforcement of regulations and rules at this level, to make the operationalization of the management system clear, viable and transparent. The alluring top down arrangement of the management system is the most important organizational setup to properly communicate and facilitate the operations at local level. This can be more strengthened by forming cooperation with development agents by the side of local administration. In this manner, the involvement of different levels and scales prevails which in turn assists to fill the information gap between water committee and the farmers.

The following table 8 summarizes the analysis of a dimension of GAT, levels and scales, with respect to the governance quality assessment criteria.

Table 8 Analytical discussion of the irrigation water governance (levels and scales) in Shelle village in terms of the governance quality assessment criteria

Quality of the governance context levels and scales			
Extent	**Coherence**	**Flexibility**	**Intensity**
The extent on levels and scales was assessed as complete. Which is as follows: National level, Regional level, Zone level, Woreda level, and local level (local administration and water committee) - responsibilities and activities involved in each levels. Geographically, the inclusiveness of stakeholders is satisfactory. However, there are drawbacks from administrative aspect.	There is less interdependence among different levels, from national government to local government. Sometimes, decisions are given by water committee negotiating with farmers regardless of regulations and rules. Domination of action arena is by water committee that reassessing sometimes conducted if farmers complain on decisions made or actions taken.	There is decentralized irrigation water management, which enhanced flexibility. However, this is not fully visible at higher levels. Farmers and local administration take the lead either to appoint or fire members of water committee. This makes the management system flexible. Development agents serve as technical supporters from the side of local administration.	The irrigation management levels currently involved at all levels want to bring change to the status quo. Agricultural experts are slightly positive in responding to complaints from farmers to deal with issues between farmers and water committee. This enabled the management system to be sustainable with its limited positive effects on crop production system in the village.

5.2 Actors and their networks

Extent was assessed as supportive

Almost all important actors are included in the irrigation water management starting from national government to the local government. The interaction of ministry of water, irrigation and electricity with other ministries such as ministry of agriculture and ministry of livestock and fisheries in the country is one of significant networks among stakeholders that work together. In order to provide fertilizers and pesticides, ministry of agriculture supports ministry of water, irrigation and electricity both financially and supplying professionals who can share experience so that capacity building in this sector would be expanded. The network between ministry of livestock and fisheries and ministry of water, irrigation and electricity is that they work together on animal breeding such as sheep, goat, cows and hens so that farmers would practice mixed farming style instead of relying on crop cultivation only. This completeness and networking, therefore, reflects the existence of what is important for irrigation policy or projects.

Coherence was assessed as restrictive

There is limited degree of interaction in the policy network and less productive, substantial coordination among actors. There are some weaknesses because of communication gaps between local agricultural experts and farmers. As Ethiopian Ministry of Agriculture (2011) stated, improper crop and varietal selection, irregular crop rotation cycle, improper cropping pattern and intensity of crops are some of the consequences of weak interaction between these actors. These problems are also common in Shelle village where there is slightly weak interaction among different stakeholders. These include: local administration, development agents (DA) or sometimes called agriculture experts in different villages, water committee, and farmers. These restrictive coherence among different actors therefore impeded the future improvement of the irrigation water management of the village.

Flexibility was assessed as supportive

There is a flexible system of governance to optimize the contribution of different actors in achieving the future development of irrigation program. For instance, the flexibility of the actor's in the network at local level enables them to fire and replace local water committee every time they want to do so. This is because of the fate of water committee to stay on the power is determined by the local farmers and local administration. If they (water committee) perform their activities in a clear and fairways, they have the opportunity to serve (stay on the power) for a long period of time. Otherwise, the farmers fire them and replace by another individuals. Therefore, if new agendas appear, the context reflects that it is possible to include new actors in the irrigation management system of the village.

Intensity was assessed as neutral

There is actor's coalition toward improvement of crop yield from time to time. Besides, there is a push from upper levels to introduce mixed farming and intercropping system in the agricultural activities of the village to help them to change the previous traditional farming style

to modern farming system. The multi-actor character of the management system is open to the policy arena in theory although it lacks practical implementation. This character is partially visible at local level since water committee dominates the activities to be conducted therein. The position of farmers is to explain complains (if they have) after the irrigation water is allocated and to discuss with development agents to solve problems. In addition, the urgency of reassessing the reason of weak network among actors at local level is not taken as serious because there is no third party (for example from higher management levels) that conduct regular evaluation on the performance of water committee, development agents, complains from farmers and the action taken by local administration to keep regulations and rules in place. As illustrated earlier, there is no problem in policy formulation, but putting these policies in action by collaborating with one another is the biggest problem. Thus, it needs to recheck the cooperation among these stakeholders to form the new, tightly strengthened collaboration among actors.

Moreover, in order to deal with future improvements and to positively impact the crop production system in the village, the present coalition among stakeholders is not satisfactory that it could result in total reduction of crop yield especially banana, which is the commercial crop in the area. If there is no improvements in the interaction among stakeholders, the future prospects of the irrigation water allocation becomes badly unfair and farmers lack confidence on activities of water committee. There is a good opportunity of amending/assessing regulations and rules at this level although the positive effect is not significantly seen yet. The process of capacity building (in terms of skilled man power) and knowledge transfer from development agents (DA) or agricultural experts to farmers would be better improved by closely cooperating and sharing experiences. As a result, both economic and social welfare of the community can be ensured.

The following table 9 discusses the analytical summary of the actors and their networks in the irrigation water management of Shelle village.

Table 9 Analytical discussion of the irrigation water governance (actors and their networks) in Shelle village in terms of the governance quality assessment criteria

Quality of the governance context actors and their networks			
Extent	**Coherence**	**Flexibility**	**Intensity**
Complete because it includes most stakeholders, from national to local government, important stakeholders are included. Multi-actor characteristics of participation are recognizable. From the policy arena of the management system, theoretically, it is open to the public although there are some confined activities by water committee which hinders the maximization of crop yield.	Less frequent discussions among actors and networks, but coherence is lacking in core issues such as agreement on irrigation water schedule. Regular complaints from farmers make agricultural experts to intervene and deal with issues to solve problems. There is a strong reaction from farmers to improve or recheck decisions made by water committee.	Very flexible at local level because farmers can fire and reelect another water committee, farmers with more interest in an issue can gather themselves with local administration and take decisions. Local administration leads the amendments or re assessments of regulations and rules of irrigation water allocations if needed. This enhanced the prevalence of negotiations and agreements rather than regulations and rules.	There is evidence of an actor coalition as transition towards modern irrigation system such as construction of lined canals and also protection works from flood. Contentment by few works of water committee do not be hurdle for the farmers to keep silent if faults are encountered. Local administration deal with other implied higher officials for serious issues which require changes in policy of water management for both irrigation and domestic uses.

5.3 Challenges (Problem) perceptions and goal ambitions

Extent was assessed as neutral

The irrigation management in the village has similar goals of attaining high crop yield. The inclusiveness of local farmers in decision making is not common practice, instead, most of the decisions concerning irrigation activities in the village are solely made by water committee. There is an opportunity to reassess goals, to fire and replace water committee. Sometimes agricultural experts intervene in the activities of water committee to help in decision making and settle issues concerning water allocation system. The irrigation water governance in the village is said to be horizontal (participatory) but in practice, that is not visible. As discussed earlier, it is water committee who controls irrigation water issues and then makes decisions by limited participation of farmers. However, this does not prevent farmers from having ambitions

which are different from status quo, to have transparent, participatory and responsible water committee.

Actors from higher levels such as regional and national government perceive problems as they can be managed (solved) at lower levels easily. That means most of these problems such as water allocation problems, construction of protection works, and new technology implementation, are not as serious as they are assumed to be by local levels. However, in reality, there are some cases in which large scale financial support and skilled human power are needed. To illustrate some, construction of canals through upstream water users is the problem which needs attention since sedimentation and erosion is common around this area. Waterways need to be repaired, managed and controlled in an organized manner so as to prove its sustainability. The reaction from higher levels is only if serious problems are encountered such as plant disease that covers huge amount of hectares at the same time in different villages. For example, lack of fertilizer and pesticide supplies are areas where national and regional actors assume them to be serious and react quickly. In other ways, local actors perceive these problems that they can try to manage them whatever the problem would be although they should report to higher levels if serious cases encountered. These different views among actors together with continuous discussions and observations from distance, instead of taking immediate measures, resulted in delay of finding solutions which favors the seriousness of the problems that in turn hindered the maximization of crop production system in the village.

Coherence was assessed as restrictive

The multifaceted irrigation management problems in the village are partly taken at stake to be dealt with as different values, which are significantly observed as instantly affecting the welfare of the community. Management at local level including water committee, and farmers are mostly the processors in solving these challenges (problems) with limited participation of national and regional level. This include response to farmers if complains arises in irrigation water schedule to give solutions so that farm areas that lack water can get it. Furthermore, conflict resolving activities are in place by negotiated agreements both within the village and among different villages that are at downstream parts. The values given to other problems such as sedimentation and erosion of river side banks are not given attention by each actor though farmers are victims of the result in the period of high flood from the rainfall and river flow. This is because, local administration and other actors at higher levels give different values to different problems by categorizing them as short, medium and long term solutions accordingly. However, this method of categorization did not bring immediate solution to respective challenges. Besides, there are some gaps in the prioritization of problems between water committee and local administration that they assume each problem from different perspectives and values. Therefore, this led to complicated irrigation water management system in the village by which each actor perceive problems differently in fragmented dimensions that in turn affects crop yield.

Flexibility was assessed as supportive

In principle, there are opportunities to re assess irrigation policy or project goals that would make the system more flexible. Activities such as construction of flood protection works and water allocation for irrigation are acknowledged by Arbaminch Zuria woreda and local administration. Flexibility is there to change plans, to propose either short term or long term joint schemes together with water committee, national and regional government each having different set of goals. In addition, there are many goals that are realized in the village to ensure fair irrigation water allocation among farmers. However, there are financial limitations from both national and regional government to implement these goals. This is because of mixed farming system by which funds are calculated together for both animal breeding and plant production. As a result there is no clearly separated funding system in the village that can be for animal breeding and plant production.

Intensitywas assessed as neutral

In addition to business as usual track, there are works done to push forward the development of irrigation water management in the village in the last decade. There are some initiatives organized by Arbaminch Zuria Woreda in order to facilitate capacity building programs for agricultural experts and farmers. This is to create awareness among farmers so that they would not be strange to the new technology for agricultural activities. These include the way to use fertilizers, selected seeds, and agricultural machines which are used for plough, weed removal and harvest. However, these programs lack continuity which creates blurred understanding among farmers. But, previously established sense of ownership in the farmers made them to adhere to their traditional way of irrigation management (practices). Consequently, there are some changes from the status quo that enabled them to improve their agricultural yield. The following are among various challenges (problems) in the village in which different perceptions are identified during the study.

5.3.1 Construction of waterways

The construction of waterways for both Sile and Sego rivers are the major challenges encountered in the village. During heavy rain, the strong turbulent flow from each rivers removes protection works from sides of the rivers so that water flows out of canals to the village. In addition to high discharge of flows to the village, there is accumulation of sediments in the farmland which affects the crop yield.

Figure 12 Washed side banks of Sile and Sego Rivers

High flood level of the rivers during rainy season washes fertile soil from upstream part of Shelle village and accumulates in Chamo Lake (where the two rivers join the lake). The downstream villages, Elgo and Sile villages also lose their fertile soil in the same manner.

Currently, local administration coordinates local farmers to construct river side protection works at the sides of each river. Each farmer contributes his/her effort to keep the rivers in their route in order to prevent soil erosion and sedimentation. They contribute both financial support and also by serving as a daily laborers. However, these constructions did not resist the strong turbulent force from the rivers so that the soil is eroded most of the time. These high floods that flows from the rivers are expanding the river ways and this in turn reduces the areas of farmlands which are close to the river bank. Moreover, there is a small scale project that is owned by Catholic Church to construct lined canals at the upstream part of the village which covers only small distances (short canal length). Apart from financial support from Catholic Church, the involvement of non-governmental organization to deal with these issues is not significant. That is because of the lack of promotional activities that are in place to reveal the significant benefits that the village can get from crop production especially banana, as a commercial crop. If there is focus on promoting high crop yield in the area, there could be high level of involvement of investors and other NGO's to participate in activities therein. The perception from local administration and water committee from another perspective is that they are proud of having such available water for irrigation throughout the year which enables them to be satisfied by the little product they make from the farm area. However, they are not eagerly (there is lack of motivation for improvement) looking for better production systems such as farming style by applying new technology. It is either from regional or national level that facilitates such activities by which farmers can be motivated and boost their crop yield. These diversified ideas made the operationalization difficult on the implementation of various objectives concerning improvement and preservation of current benefits from crop production.

5.3.2 Irrigation water schedule

As explained earlier, local farmers are not fully satisfied by activities of water committee in irrigation water schedule. These shows prevalence of unclear water allocation system which

indicates the weaknesses of water committee in the village in preparing schedule for irrigation water application. Most of the time, there is conflict between upstream and downstream water users in the case of both rivers because of unfair allocation of water for irrigation.

Problem perception with this regard emanates from the unclear operationalization of activities in the irrigation water allocation of the village which is driven by water committee. This committee assumes that irrigation water can be reached to each farmland and also it would be enough for the requirement, whatever the discharge, timing and crop water requirement would be. This is mostly effected because of limited participation of agricultural experts in the committee. Some technical works that have to be considered were left aside in water allocation only focusing on diverting some amounts of water to the farmland by schedule. Farmers, on the other hand, perceive the problem as lack of responsibility and transparency of the committee. The prevalence of bias and unfair activities were sometimes observed as revealed secrets to the public. Therefore, it resulted in firing these committee members who are responsible for the action and replacing by other individuals. These different views on the problem paved the way for the issue to take a long time to be solved and prevent the farmers from boosting their crop products.

5.3.3 Poor Collaboration and Networking among stakeholders

Among different agricultural and irrigation departments in the country as a whole and in regional institutions, there is poor collaboration and networking among stakeholders. Apart from providing short term trainings for development agents (DA'S), fertilizers and pesticides supply, agricultural and irrigation departments at national and regional levels are not regularly going down to local level to visit the activities in practice. This gap resulted in delay of completion of irrigation projects which are under construction such as sugar factories and water supply projects. These poor collaboration among stakeholders resulted in loose control over operation and maintenance of irrigation structures such as irrigation canals and drinking water supply pipes. This effected because of the perception that local actors can independently handle their issues without the interference of actors at higher levels. However, this gap resulted in negative impacts on ongoing projects that they face lack of financial supports in addition to some technical and management shortcomings.

In the similar manner, in Shelle village, these varied problem perception among different actors resulted in information gap between local water committee and local farmers on irrigation water schedule. Lack of collaboration among local agricultural experts, local water committee and local farmers resulted in unequal irrigation water distribution. Downstream water users get less irrigation water application hours when compared to the upstream water users. Moreover, the amount of water (discharge) decreases as water flows from the upstream to the downstream part of the village. In the upstream part of Shelle village, the construction of canal is by concrete (lined canals) since the flood pressure in that area is high. This was to protect the canal from erosion. However, canals in the downstream part of the village are not constructed by concrete (unlined canals) which is mostly exposed to sedimentation. These idea fragmentations (varied perception of issues) among actors leads to varied interpretation to

problems to find appropriate solutions and also resulted in different goal ambitions or objectives.

Therefore, there are varied objectives (goal ambitions) that actors at different levels targeted to achieve in their future improvement in the village. Farmers and administration at local levels are partly satisfied by what they have at hand (less motivation for improvement and trying to sustain the status quo). Whereas, other actors at higher levels need more and rapid change in crop yield by applying new technology. This implies that there is a gap even in formulating and operationalization of common objectives that include ideas of both local and higher level actors. It is required to maintain present benefits that farmers are earning from their farmland; however, they should be aware that they can earn more if they apply new technology farming style that can maximize their crop production capacity. This is not because of lack of awareness creation in the village to motivate them for betterment, but because it takes a long time to bring behavioral change in the mindset of the people. The summary of problem perception and goal ambitions with respect of the four governance quality assessment criteria is presented in the following table 10.

Table 10 Analytical discussion of the irrigation water governance (problem perceptions and goal ambitions) in Shelle village in terms of the governance quality assessment criteria

Quality of the governance context Problem perceptions and Goal ambitions			
Extent	**Coherence**	**Flexibility**	**Intensity**
The water committee lacks prioritization of problems and taking immediate measures. E.g. construction of river banks. Varied problem perceptions among local and other higher levels actors impede the improvement. Satisfaction by little product is experienced among local farmers that hinders them to have candid discussion with other actors.	There is a gap among different management levels to deal with certain issues. E.g. to reallocate irrigation water, penalties on water cheaters. Varied problem perception resulted in delay to give solution to issues. Sometimes, things should start from the scratch such as awareness creation, instead of agreeing on common objectives	Yes, there are opportunities to re-asses goals; based on their performances, water committee reviews achievements and loses in order to reorganize themselves. Achievements so far are as a result of high flexibility. If certain issues are recognized as a point of discussion among actors at any levels, the stage is open to discuss and deal with the issue although it sometimes end by agreement (not practically observable)	The ambitions are different from the status quo; to have a more organized and interconnected system of governance. Little reluctance recognized from farmers that they want to adhere to the current farming style ignoring new technologies, and farming system. However, this is being improved by continuous discussions and practically observable products which are owned by experts at this level

5.4 Strategies and instruments

Extent was assessed as neutral

There are various instruments that are applied to solve problems. These include: Regulations, negotiated agreements, social instruments and physical measures. The following are some of these instruments that are commonly used.

i. Regulation

There are binding regulations and rules which governs irrigation water system of Shelle village. Both written and unwritten rules exists that clearly states the norms, procedures, and regulations by which activities should be implemented. For example, in order to control irrigation water theft, there is a rule which states the fine that night irrigation water cheaters must pay 500 ETB and day time irrigation water cheaters must pay 300 ETB. Therefore, this rule prevents farmers not to divert water to their farmland without appropriate irrigation schedule provided to them.

ii. Negotiated agreements

Due to regular complains from farmers on irrigation water schedule which is done by water committee, there are a number of meetings conducted to discuss and solve problems by agreements. The measures taken by fining irrigation water cheaters did not solve the problem over a long period of time. Therefore, currently, local farmers and agricultural experts are focusing on regular discussions to bring change in mind set of cheaters in order to bring behavioral change among the people in the village as a whole. There are formal meetings and trainings which are coordinated by Gamo Gofa Zone and Arbaminch Zuria Woreda in collaboration with Arbaminch College of Agricultural Science as a capacity building strategy to help local agricultural experts and water committee to improve their management skills.

In addition, physical measures are taken as a punishment by which irrigation water cheaters are taken to prison to learn from their mistakes. This measure is applied if the cheater repeats the action and did not show behavioral change. Because of this, physical measure is not common in this village as an instrument to solve problems.

Coherence was assessed as neutral

There is some overlap in the implementation of regulations and rules and dealing with issues by agreement. Only serious issues are assumed to be dealt with bylaws, unless all other issues are mostly seen by negotiated agreements. In addition, there are non-financial incentives from national and regional government to other lower management bodies at zone and Woreda levels in order to benefit them by providing knowledge and skills to train other stakeholders at local level how they can manage irrigation water.

Flexibility was assessed as supportive

There are opportunities to combine different instruments from different fields. For example: since agriculture is the backbone for the economic growth of Ethiopia, they can be linked together. Agriculture and economic growth, or innovations, work hand in hand to the betterment of the future prosperity of the country. Linking them together helps as a mechanism to reduce both financial burden and lack of skilled man power in agricultural fields. Moreover, these mechanism of following multiple and sometimes indirect routes to deal with issues by multi-instrumental process enabled the system to be flexible. This is because, mostly, the approach does not need to adhere to certain predefined rules and regulations such as constitution and other legal documents to deal with issues. Priorities are mostly given for negotiated agreements and discussions unless serious issues encountered which requires legal procedures. This enhanced setting objectives for future improvements and to generate sense of ownership and use rights among different stakeholders.

Intensity was assessed as neutral

Available instruments invite new management policy or new instruments if needed; and formulated by each actor in the system. Moreover, the existing water governance system is open to change, or to deviate to any appropriate direction which can bring positive impact on the utilization of irrigation water in the village. These situations mildly support behavioral change of actors at local government since it takes long time and also needs long term projects to bring practically visible changes. However, there is no intervention currently to amend or change the common practices in place used to conduct the usual track of managing irrigation water. Therefore the openness to change has no meaning if not put in practice; but the current situation is promising that if certain shift is encountered, the result can be positive toward improvement. With regard to governance quality assessment criteria, the strategies and instruments used to deal with issues are presented in the following table 11.

Table 11 Analytical discussion of the irrigation water governance (strategies and instruments) in Shelle village in terms of the governance quality assessment criteria

Quality of the governance context Strategies and Instruments			
Extent	**Coherence**	**Flexibility**	**Intensity**
There are two common instruments used that are considered to be relevant in the area. Negotiated agreements and regulation; partly use physical and social instruments which make the strategies multi-instrumental. The scope of issues taken into account to be dealt with by these strategies is remarkably significant therefore their effect is visible to the public.	There are non-financial incentives which are not fully utilized. Financial incentives are offered to some farmers. E.g. to encourage animal breeding. The different instruments used are supporting each other so that starting by agreements and negotiations, then legal procedures follows the steps if required. However, if multiple issues are encountered simultaneously, this sometimes brings complexity	The water committee uses combining different instruments; negotiated agreements and regulations. In order to reach to their different goals (objectives), there are multiple roads whatever the possibility of attaining the goal would be. The threats, are never supported by farmers that they like to implement plans and strategies although sometimes awareness creation would be compulsory	There is behavioral deviation from current management system toward improvement. Instruments yet in place to enforce the procedures. The management system support changes whatever strategies that are to be followed. The current development in crop production and market control from economic perspective of the management system urges to bring visible changes in reality so that farmers can enjoy their benefits from crop yield

5.5 Responsibilities and Resources

Extent was assessed as restrictive

In the irrigation management of Shelle village, responsibilities and resources for irrigation water management are not clearly assigned. More encumbrances are on the shoulder of local administration and water committee in order to facilitate and use resources in a sustainable manner. Other actors at higher administration levels however, react to issues being at distant that they provide required financial, technical and other logistic supports if needed. Human resources is enough at local government to deal with the management of irrigation water in the village to allocate, design, use and distribute water to each farmland. There are a group of agricultural experts organized together with development agents to handle irrigation and other agriculture related issues. These experts are mostly responsible for controlling pesticides, fertilizer application, and also to serve as a mediator in case if there is disputes between

farmers and water committee. Under relevant irrigation water allocation procedures, agricultural experts deal with conflict resolution that brings farmers and water committee to have common understanding of problems and then to find solutions together. This is not fully visible practically in the village unless some special cases occur such as serious conflicts that may result in court cases. Therefore, there are enough human power though some of them are not fully skilled professionals in this particular work. In addition, if there is actors' network and interdependency in operationalization of regulations and rules of the irrigation water management system of the village, the human power is enough to support the accomplishment of strategic plans that can help them to maximize their crop production system.

Coherence was assessed as restrictive

Although there are some fragmentation in separation of power between local water committee and local government, there are legal authorities (power) given to local administration to protect and control water resources in the village. The cases of illegal water users (irrigation water theft) is to be seen initially at this level (local administration), and then followed by appropriate legal procedures. At this local level, water use rights (irrigation water allocation) is determined (conducted) by water committee and it is at the final stage that if farmers have complains on the activities, they can discuss and fix them together with agricultural experts and development agents. In these cases, transparencies are demanded from water committee to ensure that water allocation is conducted fairly by considering key factors such as crop type and soil type. From national government point of view, there is clear resource distribution including funds. Some government funded projects that are used to construct side banks of rivers are monitored by Arbaminch Zuria Woreda and Gamo Gofa zone. The monitoring of these activities after construction regarding their use/service period is conducted by local administration. From the foreseeable future of the water management system of the village, it can be concluded that there would be changes over time that responsibilities and resources will be to some extent, clearly assigned and utilized accordingly.

Flexibility was assessed as supportive

There is strong discretion to pool resources and people to ensure the implementation of plans for irrigation projects. There are also resources combinations systems by which farmers perform some activities by their work force (as daily laborers) that allows them to be self-dependent. Financial resources are mostly limited to local supports from farmers and local administration. However, actors at national and regional government provide some raw materials (not necessarily money in cash) such as crop seed, pesticides and fertilizers to farmers so that they can use in crop production. The main concern is that if these irrigation water resources in the village are utilized properly, it can be economically viable. If local farmers in collaboration with local administration prepare feasible business plan, as a common objective, and implement it as a trial for the short period of time, the result will be promising because available water resources will be fully utilized and controlled which can result in high crop yield in the village.

Intensity was assessed as restrictive

Currently, the financial capacity of local administration is not enough to drive the water management system by hiring more skilled manpower and providing required financial need of local farmers so that additional funds are needed. These lacks of skilled manpower in the village impede the future development of the crop production in the village. This is observed from the prevalence of disputes and continuous conflicts among water users. Practically visible works that are based on knowledge and experiences in this aspect are rare in the village that led the local administration to economic loss. Synchronizing marketing and maximization of crop production capacity of the village lacks proper organization and arrangement of activities therein. All in all, lack of collaboration and networking in sharing responsibilities and resources among different stakeholders made the irrigation management of Shelle village weak, which resulted in decline in crop yield. Resources other than irrigation water, such as livestock, are given attention at national and regional government than the attention they get at local government. The following table 12 gives the analytical discussion of the irrigation water governance in Shelle village in terms of the responsibility and resources with regard to the four governance quality assessment criteria (extent, coherence, flexibility and intensity).

Quality of the governance context Responsibilities and Resources			
Extent	**Coherence**	**Flexibility**	**Intensity**
Responsibilities are not clearly outlined; resources are not clearly specified for implementation of strategic plans. Therefore, the management system is not multi-resource-based. There are reactions (irregular support) from upper government (either regional or national) to enhance the future crop production improvement although it lacks continuity.	There is still limited collaboration among actors concerning responsibilities and resources. These resulted in the condition that the resources management system at different levels are neither fully supporting nor contradicting each other. There is neutral coherence among actors to share responsibilities.	It is possible (there is an opportunity) to combine responsibilities and resources with adequate support. However, the management system is still flexible that if new strategic plan is prepared that can maximize their crop production; all actors at this level are ready to positively react and accept it.	There is a lack of continual resources; lack of budget (limitation in financing) is common problem. Consequently this resulted in less interest of agricultural experts to work in the village.

Table 12 Analytical discussion of the irrigation water governance (responsibilities and resources) in Shelle village in terms of the governance quality assessment criteria

5.6 Discussion

After applying the five governance dimensions/elements and the four governance assessment qualities of Governance Assessment Tool (GAT) in the irrigation water management of Shelle village, the following summary discussion is made.

The governance circumstances of irrigation system of Shelle village are mixed. From the summary table 13 below, the main supportive governance element is levels and scales while the main supportive governance quality is flexibility. The analysis showed that there is complete involvement of administrative levels that need changes from the current conditions of irrigation management system. Moreover, decentralization of power in the system enhanced flexibility. This is because the system offers farmers to discuss with other actors and take appropriate decision if they have complained on the operationalization of strategic plans. However, as the management level goes to the higher levels such as zones, regional and national level the system becomes less in flexibility. This is because it takes a long time, procedures and steps to change plans, policies and positions at these levels which is rather simple at local level. Moreover, the coherence among stakeholders is better at the higher management levels while it is poor (negative) at lower (local) levels. The reason is that some activities of water committee lack openness to the public. For example, the criteria they used to allocate irrigation water to each farmland is mostly the reason for disputes among farmers, local administration and water committee. These confined activities are not only limited to water committee but also practically observable in other actors such as local administration. They lack providing immediate responses to some issues that need immediate solutions. In addition, in some cases, agricultural experts abstain themselves from fully involving in conflict resolution if they are not called up on by the other actor. Apart from conducting discussions and meetings, practically visible activities are rare. The inclusiveness of different stakeholders (multi-level governance) as smith (1997), described and stated in Kuks (2000), refers to the mutual interdependence between different levels. In the irrigation management system of this village, there are different levels starting from national level to local level. Therefore, it is multi-actor involvement which made the inclusiveness (extent) of the system green (positive). However, lack of collaboration and interdependency in implementation of regulations and rules, especially by water committee resulted in poor network and cooperation among these actors. Moreover, various problem perceptions and goal ambitions are seen mostly because of bias in irrigation water schedule. The corrupt work of water committee that allocates water to each farmland is the cause of problems, as one can understand from complains of local farmers. Most common problem is irrigation water schedule in the village because of unfair water allocation across villages (upstream and downstream) and for plot of land as well. Therefore, these complications reduced the motivation for work in some individuals that are among agricultural experts.

The following summary describes the irrigation water governance system in Shelle village based on the summary of discussions above.

Table 13 Summary of the results by applying Governance Assessment Tool

Governance Dimension	Quality of the governance context			
	Extent	Coherence	Flexibility	Intensity
Level and scale		⇩	⇧	⇩
Actors and networks				⇧
Problem perspectives and goal ambitions	⇧		⇩	⇩
Strategies and instruments		⇩		
Responsibilities and resources			⇩	

NB: green = supportive, yellow = neutral, red = restrictive

⇧ = improving trend, ⇩ = declining trend. The arrows indicate future prospects of the irrigation management in the village if the status quo remains unchanged.

5.7 What can be learned from irrigation management practices in other villages?

In this section, the comparative discussion about irrigation water management in different villages is presented. Firstly, the two nearby villages to Shelle village, Elgo and Sile villages' experiences in irrigation water management are observed and found similar. Secondly, based on Literature, the management of water for irrigation purpose in two areas namely: Gibe Limu Small Scale Irrigation System and Gembela Terre Small Scale Irrigation System are taken as the reference so that Shelle village can get important experience from them. This is to give recommendation to Shelle village so that they can deal with serious problems revealed from GAT analysis above. There are two serious problems distinguished from GAT analysis in above sections. These are: from GAT elements/dimensions, 'Responsibilities and Resources' and from core qualities of governance, 'Coherence' are the two focus areas that need serious attention and need to be improved. Therefore, to bring improvement sharing experience is vital among different villages.

For the first comparison: From observation, Elgo and Sile villages are the nearest villages next to Shelle village which share rivers. The three villages share both Sego and Sile rivers. As described earlier, the two rivers initially join Shelle village (Upstream) and then the Sego River goes to Elgo village while the Sile River goes to Sile village (Downstream). The lack of interaction among stakeholders of these villages impedes water allocation system to both upstream and downstream villages. Shelle village gets more irrigation water from both rivers since it is at the upstream part and Elgo and Sile villages get less irrigation water in comparison.

Therefore, there are similar challenges (problems) in these villages in water allocation and irrigation water schedule. The structural organization of irrigation water management is the same (there are water committees elected by the local farmers, agricultural experts, and other

management levels as explained in Chapter 4). Local farmers are not sharing experience from one another (across these villages) which hinders them from improving their management system by learning from one another. However, sometimes, water committees and agricultural experts of each village conduct meetings and discussions to deal with issues related to some common problems. Furthermore, irrigation water theft, during day and night time is common in these villages and the measures taken on illegal water use is also similar across these villages.

For the second comparison: The irrigation management in two areas (Oromia Region, East Wollega Zone) is selected. These are small scale irrigation system (SSIS) which are used to produce different crops such as sorghum, maize, potatoes, tomatoes, and coffee. The irrigation systems in these areas are also by diverting rivers (Gibe and Lagaya Rivers for Gibe Limu SSIS, and Dokonu River for Gambella Terre SSIS). Irrigation management systems of both areas have their own organizational arrangements and operations therein. There are water committees who are responsible in water allocation, distribution, irrigation schedule, and conflict management (Dejene, 2006). The following table 14 summarizes the best management systems that are in place in these two areas according to Dejene (2006). Therefore, to some extent, Shelle village can learn from these practices as well.

Table 14 Irrigation management in Gibe Limu and Gambela Terre SSIS (Dejene, 2006)

Gibe Limu SSIS	**Gambela Terre SSIS**	**Both SSIS**
Less number of farmers in a given water units (10-20) members	There is night storage of 8400m^3 constructed for the period if water scarcity encountered	Different crop types are given priority to irrigate according to their evapotranspiration (water consumption)
Water committee changes irrigation schedule seasonally based on crop type on the plot of land (however, the allocation is by guess, no measurement). Agricultural experts are included in preparing irrigation schedule	There is a guard to control direction, duration of water flows, water theft, and canal breaching	Water committee conduct meetings fortnightly to deal with issues
Have better written bylaws concerning irrigation management which defines water rights of plot holders and non-plot		

holders, membership requirements, abuses and sanctions, and penalties. (However, these regulations and rules are hardly in practice)		

From the discussions in previous sections of GAT analysis, in Shelle village, the summary under table 13 shows that Responsibilities and Resources (from GAT elements/dimensions) and Coherence (from governance core qualities) are major (serious) problems identified. Therefore, these are areas that need all stakeholders to contribute their efforts in order to improve the current condition of the irrigation water management system. The following sections are describing the way by which improvements can be attained and gaps can be narrowed so that Shelle village can learn and then put in practice the 'best management' practices that are in place in other areas.

5.7.1 Responsibilities and Resources

This element of governance, among others is not practiced accordingly as it can be seen from above GAT analysis. In order to fully practice this GAT dimension in Shelle village, the following discussion is presented after comparing to irrigation management practices in other villages.

From Gibe Limu SSIS and Gambela Terre SSIS, sharing responsibility and resources is visible among local irrigation management staffs. Since there is small number of water users (members from 10 to 20) in a given water units, it is easy to control who gets enough irrigation water, for how long time the water is applied to the farm area, how much is the farm area in hectare that should be irrigated and the crop types on the field can be identified and controlled easily. Proper use of power to attain the goal of high crop yield can be achieved if responsibilities are clearly assigned. In this way, resource can be managed and utilized wisely. In Shelle village however, there are more than 20 members in one water unit which is large number when compared to Gibe Limu SSIS and Gambela Terre SSIS. This large number of water users in a given water unit made the irrigation water control difficult and instead favors water theft. Therefore water resources cannot be utilized wisely. In addition, small number of water users in a given water unit enhances best human resources management. That is because, each and every individual in the unit can be responsible for certain action, and either water allocation or distribution, scheduling every activity can be easily accomplished. Moreover, in order to train farmers together with other agricultural experts, small number of farmers can get proper knowledge and skills than large number of farmers. Hence, in Shelle village, the number of farmers in a given water unit should be reduced to small number so that the irrigation management can be easy.

5.7.2 Coherence

As discussed in previous sections, this core quality of governance, among others is not fully operationalized in the irrigation management of Shelle village. The following discussion is made after comparing the stakeholders' situation in Shelle village with abovementioned Small Scale Irrigation Systems so that Shelle village can get experience and then narrow the gaps that threatened the interaction among stakeholders.

The strength of interaction between each stakeholder is not structurally institutionalized in the irrigation management of Shelle village. This resulted in fragmented and unstable management structure which changes as new issues encountered that need to be dealt with either as a short term or long term project. The stakeholders get no experience of working together since they cooperate for a short period of time because of regular change in structural arrangement. Therefore this can be taken as the drawbacks of 'extreme flexibility' of the irrigation management system in the village. As explained in previous sections, farmers have full rights to replace every management staffs from water committee if they want to do so. So, it takes time for the newly replaced individual to adopt the behavior of existing staffs and share experience together. The repeated replacement activity in turn resulted in lack of trust and respect for one another among stakeholders. Thus, although farmers can fully practice their rights by changing the management staff regularly, this should be supported by regulations and rules that state the rights and responsibilities of both farmers and other workers as well.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Development of irrigated agriculture in Shelle village, as elsewhere in Ethiopia is hindered by problems related to water management. As a result, unfair irrigation water distribution (irrigation schedule) between upstream and downstream users, within and across villages are common in this area and neighboring villages (Elgo and Sile), and as the country at large. These are regardless of the management system which is inclusive such that important stakeholders are included starting from national to local levels. In addition, the management system is more flexible in operation at higher levels than lower levels. It is easy to take immediate measures on certain issues such as amending irrigation policy and punishment concerning irrigation water theft at local level than at higher levels.

Moreover, due to lack of resources (financial and skilled manpower) and poor collaboration among stakeholders (actors and their networks), there are some problems related to technical works such as poor construction of canals and protection works at riversides which resulted in erosion and sedimentation. The peak water flow from both Sile and Sego rivers resulted in erosion and therefore it damages the waterways by washing fertile soil from the riverside farm areas. Even though there were attempts from both higher and local levels of irrigation management to solve this problem, it did not bring long term solution. Furthermore, most of the responsibilities are on the shoulders of local water committee that they control the irrigated agriculture in the village and also deal with managing conflict on irrigation water schedule. In this line, there are complaints from farmers that there is bias in irrigation water schedule. There is no technically predefined water application time (hr.) and the volume or discharge (L) of water to be applied based on soil type, crop type, and other crop water requirement per hectare. However, this is conducted by guess which resulted in conflict among the farmers of both within the village and also across the villages at the downstream of the rivers.

Since regulations and rules are not fully implemented practically in the irrigation water management of Shelle village, negotiated agreements is used instead to solve problems concerning irrigation schedule within and across the villages.

The irrigation water management system in the village is tending towards stability rather than bringing rapid change in a short period of time. This is because actors at local level are satisfied by little improvements and want to sustain the status quo. In addition, some gentle forms of adjustments are enough to deal with some issues. Ambitions for improvements are mostly directed from either regional or national actors to participate other actors at lower levels. As a consequence the tendency toward maximization of crop yield in the village is based on encouragement from actors of these levels by providing pesticides and fertilizers to farmers and training programs to agricultural experts and other local administration staffs.

6.2 RECOMMENDATIONS

Based on the identifications of gaps in the irrigation water management of Shelle village, the following recommendations are made:

The irrigation water management system in Ethiopia is characterized by its inclusiveness of different stakeholders at different management levels from local to national level. Starting from ministry of water, irrigation and electricity at national level, significant number of concerned bodies are involved in the system. However, this has no value if there is no collaboration among stakeholders at each levels of management. Therefore, cooperation and networking among these stakeholders should be practiced by all concerned irrigation management staffs so that they can deal with challenges and issues (problems) in time.

Durability should be given consideration in the constructions of canals conducted to protect soil and riversides. Both lined and unlined canals and side banks of each river need strong and durable construction materials in addition to appropriate design. In that way, the strong water effluent and pressure from river flow can be controlled. There were canals and side banks already constructed but which were damaged by these strong flow pressure from both Sile and Sego rivers.

Although there are agreements locally to solve conflict in irrigation water schedule, both written and unwritten regulations and rules should be given consideration from the government side. This will define the consequences of water theft that results in fines or punishments.

In allocating irrigation water (irrigation water schedule), technical consideration should be given account such as crop water requirement (evaporation and transpiration), soil type and crop type. To do this, agricultural experts should work in close collaboration with water committee of the village.

Public participation in decision making is crucial in allocating water for irrigation. Because, farmers are very close to the issues and also they can suggest supportive and constructive ideas that can help experts and water committee in their activities.

The number of farmers in a given water unit that are governed under water committee should be reduced to small number so that the irrigation management can be easily conducted. Sharing responsibility and resources in an appropriate way can be achieved if there is mutual understanding among stakeholders that in turn encourages stable institutional arrangement that do not change regularly if new issues are encountered. The interrelation between different villages is crucial to share experiences. That is to enable the best irrigation water management system in one village to be adopted in other villages.

REFERENCES

Awulachew, S. B., Erkossa, T. and Namara, R. E. (2010) “Irrigation potential in Ethiopia,” (July).

Awulachew, S. B., Yilma, A. D., Loulseged, M., Loiskandl, W., Ayana, M. and Alamirew, T. (no date) *No Title*.

Bekele S. (2011). Community-based irrigation water management system, Dire Dawa, Ethiopia.

Bhaduri, A., Bogardi, J., Leentvaar, J. and Marx, S. (2014) “The Global Water System in the Anthropocene,” *The Global Water System in the Anthropocene: Challenges for Science and Governance*, pp. 173–182. doi: 10.1007/978-3-319-07548-8.

Bressers, H. (2009). From public administration to policy networks: Contextual interaction analyses.

Bressers, H. and Boer, C. de (2013) “Contextual interaction theory for assessing water governance, policy and knowledge transfer,” *Water Governance, Policy and Knowledge Transfer*, pp. 36–54.

Bressers H., *De Boer C.,* Özerol G. and Vinke-De K. J., (2013). Collaborative water resources management: What makes up a supportive governance context?

“Corporate governance” (no date).

Creswell, J. W. (2003) “Research design Qualitative quantitative and mixed methods approaches,” *Research design Qualitative quantitative and mixed methods approaches*, pp. 3–26. doi: 10.3109/08941939.2012.723954.

Der Beken C. (2007). Ethiopia: Constitutional Protection of Ethnic Minorities at the Regional Level, Ghent University, Faculty of Law, Department of Public Law, Belgium.

Diczbalis, Y. and Toohill, B. (1993) “Agnote Irrigation Management of Bananas in the Top End,” (May).

District, D. and Hararghe, E. (2011) “Community-based Irrigation Water Management System : the,” 1.

Dukes, M. D., Zotarelli, L., Liu, G. D. and Simonne, E. H. (2015) “Principles and Practices of Irrigation Management for Best Management Practices (BMP),” pp. 1–15.

Food and Agriculture Organization (FAO) (2015). Irrigation Market Brief in Ethiopia.

“FDRE, Ethiopian Water Resources Management Policy.pdf” (no date).

Hailesillassie A., Hados F., Agide Z., Tesemma E., Hoekstra D., Langan S. (2016), “Institutions for irrigation water management in Ethiopia : Assessing diversity and service delivery”.

Karamura, E., Frison, E., Karamura, D. A. and Sharrock, S. (1998) “Banana production systems in eastern and southern Africa,” *Bananas and Food Security. Proceedings of an International*

Symposium held in Douala, Cameroon, (January 2015), pp. 401–412.

Kassa M. and Onochie A. (2017). Joint Government and Humanitarian Partner's Document; Ethiopia.

Kuks, S. M. M. (2000) "What does governance mean ? From conception to elaboration," *Governance An International Journal Of Policy And Administration*, pp. 1–24. Available at: http://doc.utwente.nl/46217/1/Multiscale_Governance_-_from_Conception_to_Elaboration.pdf.

Rockstrom J., Karlberg L., SuhasP.,Jennie B., Nuhu H., Theib O., Adriana B., Jalali F., Zhu Q., Managing Water in Rain-fed Agriculture – The need for a Paradigm Shift. *Journal of Water Management, 97*(2010), 543-550.

Schütt, B. and Thiemann, S. (2006) "Kulfo River, South Ethiopia as a regulator of lake level changes in the Lake Abaya-Lake Chamo system," *Zbl. Geol. Paläont*, pp. 129–143. Available at: http://www.geo.fu-berlin.de/geog/fachrichtungen/physgeog/medien/download/bschuett/schuett_thiemann_2004.pdf.

Stoker, G. and Stoker, G. (1998) "Governance as theory : five propositions."

The Organization for Economic Co-operation and Development (OECD), http://www.oecd.org/agriculture/wateruseinagriculture.htm, last accessed on March 28, 2017.

The World Bank (1993) "OP 4.07 - Water Resources Management: A World Bank Policy Paper," p. 8. doi: 10.1596/0-8213-2636-8.

Tiruneh, T. (2005) "Water Quality Monitoring in Lake Abaya and Lake Chamo Region," 8, p. 362. Available at: www.uni-siegen.de/zew/publikationen/pdf/cicd_vol.1_lars_2007-08.02.10.pdf.

United Nations Environment Program (2012) *Status report on the application of integrated approaches to water resources management*. doi: 978-92-807-3264-1.

United Kingdom Audit Commission (2003). Corporate Governance: Improvement and Trust in Local Public Services.

United Nation Water Report (2012). The status report on Application of Integrated approach to Water Resource Management.

Unites States Department of Agriculture (USDA), (1997). National Engineering Handbook (NEH) Chapter 9, Irrigation water management

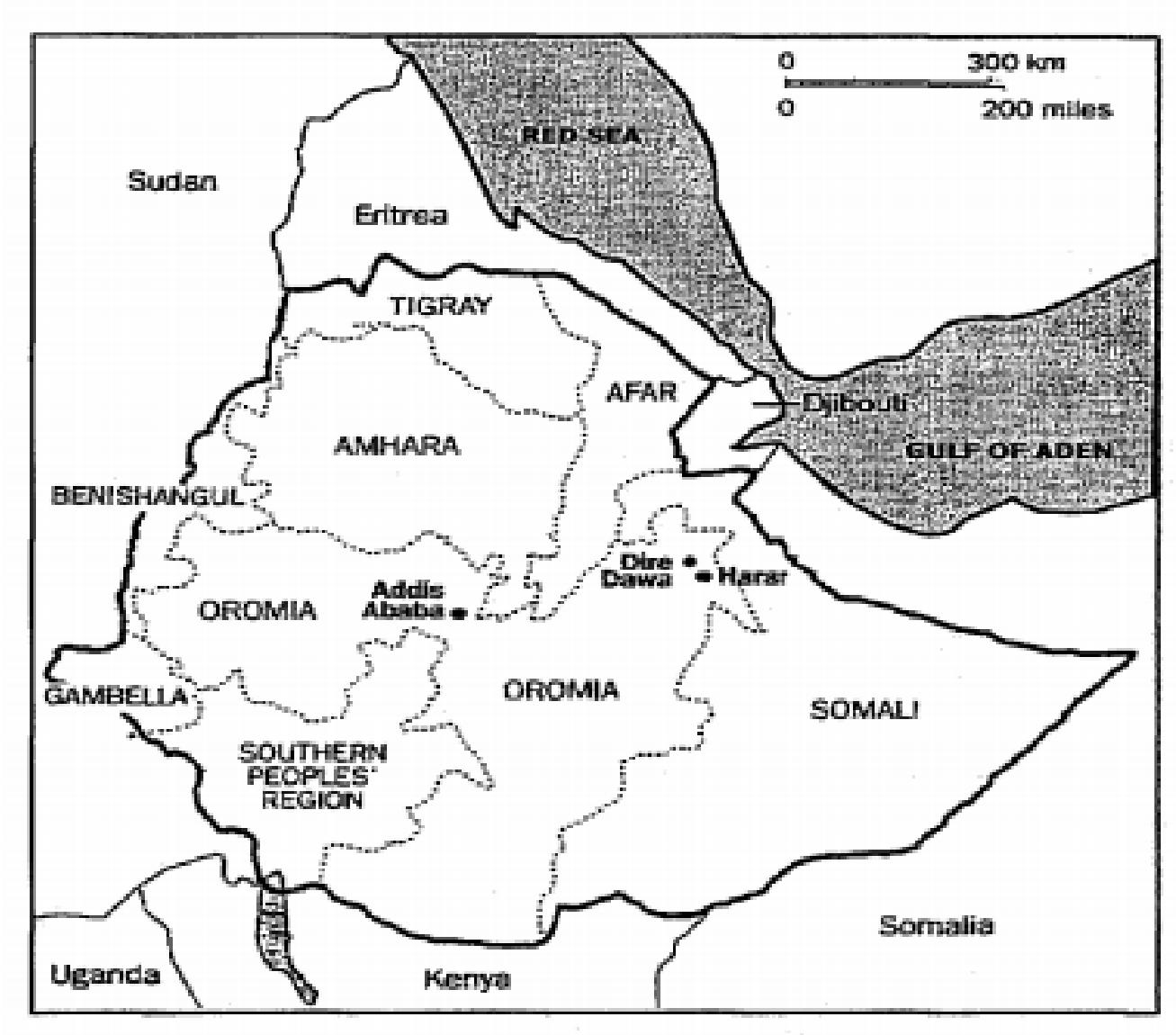
Woldu, Z., Mohammed, A., Belew, D. and Shumeta, Z. (no date) "Assessment of Banana Production and Marketing in," 4531, pp. 283–307.

World Bank (2005). Agricultural Growth for the poor. An Agenda for Development World Bank, Washington DC.

World Bank (2006) “Ethiopia Managing Water Resources to Maximize Sustainable Growth,” (36000), p. 119.

APPEDICES

APPENDIX 1: The Nine regions and two City Administrations of Ethiopia (Der Beken, 2007)



APPENDIX 2: Intercropping: Sugarcane and banana

APPENDIX 3: QUESTIONNAIRE FOR DATA COLLECTION

Questionnaire on Governing the irrigation water in Ethiopia

(Case study of Shelle village, ArbaminchWoreda)

These questions are prepared by Mr. Israel Jiregna Duguma, student of Master of Environmental and Energy Management (MEEM) at the University of Twente. It is to enable the Master Thesis to get data and information concerning irrigation water management in Shelle village. These questions covers the identification of water sources, water allocation system for irrigation purposes, existing situation in water governance system and the current conditions in banana production in the village.

The study aims to give recommendations to local administration of Shelle village how they can improve their irrigation water management system by improving the present irrigation water governance system for banana production in the village.

The questions are in three sections for three different respondents (informants)

1. Questions for the local water manager
2. Questions for local agricultural experts
3. Questions for local community

All the data and information collected will be treated in confidence. However, if the respondent or informant needs recognition for her/his input, that can also be effected.

Background of the interviewee

1. What is your role in water management in the village?
   a. Manager
   b. Expert
   c. User (farmer)
   d. Business man in banana market
   e. Other _____
   f. No role
2. If answer for Q 1. Is not f., then:
   a. For how long time have you been in the village serving by this role? _____
   b. What is your responsibility so far and what have you been doing in the village so far shortly? _____

Section 1: Questions for the local water manager

1. What is your role as a local water manager?
   a. What types of water sources are in the village?
   b. Where these sources do exists?
   c. Is the water use system separated as for irrigation purposes, drinking for animals and domestic water supply?
   d. How do people use the water (is there someone who controls the water supply for irrigation purposes)? Upstream and downstream water users?
   e. How do water is allocated for the production of bananas?
2. How is the structure of water governance system organized in the village?
   a. How many levels are involved in the water management of the village?
   b. Do the governance systems have specific water policy/plans/programs?
      Yes ☐ No ☐
   c. Are all relevant stakeholders involved?
      Yes ☐ No ☐

      If your answer for C is No, Who are excluded?
   d. If your answer for C is yes, who are the actors?
   e. What are the roles of these actors?
   f. And to what extent they work together?
3. What do you think about the quality of the water governance system?
   a. What are the problems (challenges) you face in water governance system in the village? And can you tell me any kind of specific problems in the village in irrigation water management system?
   b. If there are problems, in what way do you solve those problems (Instruments)?
   c. What are the strengths and weaknesses?
   d. Are all responsibilities clearly assigned and facilitated with resources?
   e. Are there any other approaches in water management that is not included yet and should be included in the policy document?
   f. How does the governance system solve conflicts in water allocation between upstream and downstream water users?
   g. How is the policy document affecting the stakeholders either positively or negatively?
4. How transparency and accountability practice looks like in Irrigation Water Management system in the village?
   a. And how are the resources better allocated and used?
   b. What can be learned from best practices in other areas?

5. How the irrigation water management enhance the banana production processin the village? In what way do the management system support changes from current status to better development?
6. Do you know some best water management practices that is being practiced in other villages?

   Yes ☐ No ☐

   If yes:
   a. What are best water management practices in that village(s)
   b. Why these practices were not adopted in this village yet?
   c. How do you think these practices can be copied to this village?
   d. What is your difference with this (these) village(s) in these issues such as water governance, water allocation, banana production and so on?
7. In addition to our discussion above, do you have more ideas that you want to tell me concerning water governance, banana production and stakeholders in these areas and so on?

Section 2: Questions for local agricultural experts

1. What is your role as a local agricultural expert?
   a. What types of water sources are in the village?
   b. Where these sources do exists?
   c. Is the water use system separated as for irrigation purposes, drinking for animals and domestic water supply?
   d. How do people use the water? Upstream and downstream water users?
   e. How do water is allocated for the production of bananas?
2. How the water allocation system is organized? What aspects do you take into account when you allocate water to each farmland? Are those aspects support each other?
   a. How many levels are involved in the water allocation in the village?
   b. Does the water allocation system have specific water policy/plans/programs?

      Yes ☐ No ☐

   c. Are all relevant stakeholders involved?

      Yes ☐ No ☐ If No, Who are excluded?

      If yes, who are the actors?
   d. What are the roles of these actors?
   e. And to what extent they work together?

3. What do you think about the quality of the water governance system?
    a. What are the problems (challenges) you face in water governance system in the village? And can you tell me any kind of specific problems in the village in irrigation water management system?
    b. If there are problems, in what way do you solve those problems (what instruments are used to solve these problems)?
    c. What are the strengths and weaknesses? Are there multiple options (ways) for farmers to attain their goals of high quality and quantity of banana production?
    d. Are all responsibilities clearly assigned and facilitated with resources?
    e. Are there any other approaches in water management that do you think is not included yet and should be included in the policy document?
    f. How does the governance system solve conflicts in water allocation between upstream and downstream water users?
    g. How is the policy document affecting the stakeholders either positively or negatively?
4. How transparency and accountability practice looks like in Irrigation Water Management system in the village?
    a. And how are the resources better allocated and used?
    b. What can be learned from best practices in other areas?
5. How the irrigation water management enhance the banana production process in the village?
    a. What is the commercial benefit the farmers have been gaining from banana per hectare?
    b. What are challenges (problems) that retard production of banana in this village?
    c. Is the banana production increasing or decreasing over the past few years?
    d. If increasing, what do you think are the best reasons behind?
    e. If decreasing, what do you think are the reasons behind?
6. Do you know some best water management practices that is being practiced in other villages?

    Yes ☐ No ☐

    If yes:
        a. What are the best water management practices in that village(s)
        b. Why these practices were not adopted in this village yet?
        c. How do you think these practices can be copied to this village?
        d. What is your difference with this (these) village(s) in these issues such as water governance, water allocation, banana production and so on?

7. In addition to our discussion above, do you have more ideas that you want to tell me concerning water governance, banana production and stakeholders in these areas and so on?

Section 3: Questions for local community

1. What is your role as a local person?
   a. What types of water sources are in the village?
   b. Where these sources do exists?
   c. Is the water use system separated as for irrigation purposes, drinking for animals and domestic water supply?
   d. How do people use the water? Upstream and downstream water users?
   e. How do water is allocated for the production of bananas?
2. What do you think about the quality of the water governance system?
   a. What are the problems (challenges) you face in water governance system in the village? And can you tell me any kind of specific problems in the village in irrigation water management system?
   b. If there are problems, in what way do you solve those problems (what instruments are used to solve these problems)?
   c. What are the strengths and weaknesses?
   d. Are there any conflicts among farmers concerning water allocation for irrigation purposes in banana production?
   e. How does the governance system solve conflicts in water allocation between upstream and downstream water users?
   f. Do you (farmers) obey the rules and regulations concerning water allocation?
3. How transparency and accountability practice looks like in Irrigation Water Management system in the village?
   a. And how are the resources better allocated and used?
   b. What can be learned from best practices in other areas?
   c. Do you have any suggestions that you think to be worked on in the future to get best irrigation water management and improved banana production?
4. What is the commercial benefit you (if farmer) have been gaining from banana per hectare? (this question can be adjusted based on the role of the interviewee in the community and the benefit she/he gains from banana production)
   a. What are challenges (problems) that retard production of banana in this village?
   b. Is the banana production increasing or decreasing over the past few years?
   c. If increasing, what do you think are the reasons behind?
   d. If decreasing, what do you think are the reasons behind?

5. Do you know some best irrigation water management practices that are being practiced in other villages?

   Yes ☐ No ☐

   If yes:

   a. What are best irrigation water management practices in that village(s)
   b. Why these practices were not adopted in this village yet?
   c. How do you think these practices can be copied to this village?
   d. What is your difference with this (these) village(s) in these issues such as water governance, water allocation, banana production and so on?

6. Do you have any more things to tell me in addition to our discussion above please?

Thank you so much for your time and openness!!!