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**CHALLENGES OF RAIN WATER HARVESTING PRACTICES: IN DODOTA  
WOREDA, OROMIYA REGION**

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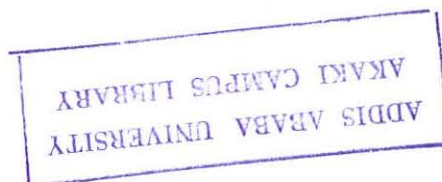
Presented in partial fulfillment of the requirement for the degree of  
Master of Arts (Water and Development)

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**ADDIS ABABA UNIVERSITY**  
**SCHOOL OF GRADUAT STUDIES**

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**Signed by examine committee**

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## *ABSTRACT*

### **CHALLENGES OF RAIN WATER HARVESTING PRACTICES: IN DODOTA WOREDA OROMYA REGION**

AZALECH SOLOMON

ADDIS ABABA UNIVERSITY, 2012

*Water is an essential element in every aspect of human life; hence no life is possible with out water.*

*MDG and ADLI are closely related with water to achieve the targeted goals. There fore, these program pressure on water. In arid and semi arid regions where rain fall is not sufficient and also surface and ground water is scarce to sustain domestic water supply and agricultural activities, rain water harvesting becomes the most alternative source of water.*

*Based on the developed conceptual frame work this study explores the challenges of rain water harvesting practices towards its benefits in Dodota woreda Arsi zone, Oromya region.*

*Results are based on data taken from the two sample kebeles. A total of 100(hundred) households were taken. These house holds stratified as users of rain water harvesting, none users and those who stop practicing of rain water harvesting (26 of them users, the rest 74 are non user and those who stopped practicing). The household head was chosen to fill the questionnaire. Both purposive and systematic sampling approaches*

were conducted to select sample surveyed households, focus group participants and key informants. Purposive was used to select users of rain water harvesting and simple random sampling approach was employed to select non users and those who stopped practicing of rain water harvesting. Simple descriptive statistical tools such as frequency, percentage and mean were employed through the program SPSS in order to analyze the quantitative and qualitative data. The study indicated that user of rain water harvesting are benefited in terms of income improvement and domestic water supply. For those who stopped practicing of rain water harvesting and non users, the main factors hindering them from sustain in and to adopt the technology are factors like economic, Social, environmental, management and technological factors are addressed here, however, further research is needed around which type of rain water harvesting technology is suitable for the study area.

To promote the adoption of rain water harvesting practices, it is necessary to work on the increasing of the awareness of users and potential users through continuous training and follow up, transferring the technology properly to the beneficiary is very important Accessing the farmer to credit in order to solve financial constraint to adopt the technology. And also strong coordination among stack holders is very vital.

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Anybody else who contributed to the completion of this study in anyway but may have been omitted is also acknowledged.

# **1. INTRODUCTION**

## **1.1. BACK GROUND OF THE STUDY**

Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the biodiversity depends.(Sivanappan2006). Lack of adequate quality and quantity of water is major constraint to development in many areas of the world. It affects every aspect of human life health, agricultural yields, food security, technical development, and the economy of states.

Water scarcity and water quality problems are of particular concern in the tropical regions of the world where many countries are less developed. In this region there is often a connection between poor water resources availability and poverty. (Aroka, 2010).

With the population of the world increasing rapidly coupled with dwindling readily available water resources alternative technologies to fulfill sustainable and adequate fresh water supplies to meet societal equitable access to water is the most urgent and significant challenge faced today, (Ahmed, 2009)

Millennium Development Goal (MDG) is closely related with water to achieve the targeted goals and it increases pressure on water. One of the UN MDG is to reduce by half the proportion of people without sustainable access to safe drinking water. Another goal is to reduce by half the proportion of people who suffer from hunger. In most of the developing countries both goals are far from being fulfilled until 2015,(Helmreich, et al, 2008). These

countries are characterized by low erratic rain fall, which results in high risk of drought intra-seasonal dry spells and frequent food insecurity, significant variation in the temporal and distribution spatial rain of fall usually results in serious shortage of soil water available to use.

In arid and semi arid regions where rainfall is not sufficient and also surface and ground water is scarce to sustain domestic water supply and agricultural activities, rain water harvesting becomes the most alternative source of water and the intervention will increase crop production, food supply, improve plant and thus poor crop and livestock production as well as scarcity of water for domestic income, domestic water supply and water and fodder for livestock (Helmreich, et al 2008).

It is evident that irrigation continues to play a major role in poverty alleviation by providing food security, protection against famine and expanded employment opportunities. However irrigation has only been possible where there are adequate developed water resources, in the absence of this RWH becomes a viable alternative (Ngigi, 2003). Harvesting rain water is possible to achieve sustainable drinking water supply for communities. Consequences of lack of safe water have tremendous implications in the lives of communities especially women and girl children who are forced to spend hours to fetch water and hence RWH becomes a very effective solution in addressing the problem. Much of evidence reveal that fresh water is dwindling alarmingly worldwide in general and in Arid and semi arid land (ASAL) in particular (Girma H., 2009).

Ethiopia is relatively vast country with over 1.13 million sq.km of area and population of over 80 million. Out of its total land mass some 55% falls under the arid and semi arid lands (ASAL) where rain fall is irregular and this area is at the risk of drought to human being, livestock and crop production which occur when rain fail(GirmaH., 2009) .

Currently, Ethiopia is one of the most food-insecure countries in the world. The existing national economic development strategy, which was formulated in 1994, is Agriculture Development Led Industrialization (ADLI). This strategy takes agriculture not only as the means of ensuring household and national food security, but also as the driving force for the transformation of the whole economy. However such kind of agricultural activities cannot be thinkable without adequate water availability to meet this demand; not because of insufficient amount of rainfall but also due to spatial and temporal variability.

With the variation shocks associated with rain fed agricultural production in Ethiopia for example, dry spells, droughts and floods; the potential contribution of rain water harvesting to stabilizing agricultural production is obvious. (Seleshi et al, 2005). Beside its contribution to improved food production and food security the impacts of rain water harvesting are also recognize in improving water availability for domestic use (Seleshi et al, 2005).

RWH as one of the essential element (component) requiring collective action to achieve a community based natural resources conservation and livelihood improvement of the rural



people in a sustainable way (Alemneh, 2003). The benefits of properly managed RWH quickly noticeable in terms of reduced distance and time on women and children in fetching water, improved nutritional status, ability to expand agricultural activities during the dry season, improved soil conservation and vegetative cover and environment around the homestead (Alemneh, 2003).

In response to water shortage and water supply access of the population in the Oromia region, the regional state of Oromia has a plan to address water supply schemes both at rural and urban areas specifically to attain MDG targeted goals and ensure safe drinking water supply to all people of the region by Promoting rainwater harvesting, promotion of small scale irrigation scheme run at household levels.

## **1.2. STATEMENT OF THE PROBLEM**

Like any semi arid and arid part of the country Dodota woreda is characterize by seasonal variability and erratic rain fall, drought and low soil moisture that causes for recurrent crop failure and recurrent prevalence of food insecurity in the area. In addition to this, during the dry season peoples of the study area suffer from insufficient water supply for domestic use

In order to cope-up with recurrent crop failure due to erratic rain fall that created insecurity for rain fed agricultural producers and livestock owners. Oromiya regional state planned RWH scheme in Arsi Zone Dodota Woreda and the government and NGOs have begun implementing RWH but no significant change is observed. Most of users stopped to practicing rain water harvesting. If the benefits of RWH have to be reaped to full extent the challenges of RWH posed to people in the woreda which forced them to abandon the schemes must be understood. For this reason there is a need to explore the challenge of rain water harvesting in the study area of Dodota woreda.

### **1.3. OBJECTIVE OF THE STUDY**

The general objective of the paper is to investigate the challenges of using RWH in Dodota Woreda

#### **1.3.1. Specific Objectives**

1. To investigate the relevance of RWH practices in the study area
2. To identify the factors that affect practicing of RWH in the study area
3. To explore the challenges that cause RWH practices not to be effective and successful

### **1.4. RESEARCH QUESTIONS**

1. What is the relevance of rain water harvesting in the study area?
2. What are the factors that affect practicing of RWH in the study area?
3. What are the challenges that cause RWH practices not to be effective and successful?
  - the challenges that put Sustainability of RWH practice under question

### **1.5. SIGNIFICANCE OF THE STUDY**

Rain Water Harvesting has undeniable contribution in mitigation water scarcity related problems for the areas of ground and surface water where sufficient quantity and quality not available. Therefore the finding of this study identifies the challenges that cause RWH practices not to be effective and successful. The finding can also serves as a spring board for concerned body (Practitioners in the area, GOs and or NGOs) for further investigation in order to mitigate the problems related to rain water harvesting practices adoption.

### **1.6. SCOPE AND LIMITATION OF THE STUDY**

The scope of the study delimited on assessing of Challenges that hindrance of the RWH practices from adoption and explores the contributions of GOs and NGOs in exercising rain water harvesting practices in the study area. The study focus mainly on the challenges of rain water harvesting practices, in the activity of improving agricultural activities (crop and live stock production) and in improving domestic water supply.

The main limitation in conducting this study is time constraint and lack of access to reference books and computer.

## **1.7 ORGANIZATION OF THE THESIS**

This thesis has five chapters. The first chapter gives an Introduction part, that is Back ground of the study, Statement of the problems, Objective of the study, Research questions .significant of the study. The Second chapter has literature conceptual and the third chapter contains related review of the literature and diagram of Conceptual frame work. The fourth chapter focuses on Back ground of the study area, Methods of Data collection, and methodology. Chapter five contains Analyses and interpretations. The final chapter shows the conclusion and recommendations part of the thesis

## **2. LITERATURE REVIEW**

### **2.1. DEFINITION OF RWH**

There is no universal accepted definition and classification of RWH (ngigi2003).

Rain water harvesting in its broadest sense defined as a method for inducing, collecting, storing and conserving local surface runoff for agriculture in arid and semi-arid regions. (N.Hatibu et al 1999).

Well managed rain water harvesting is the best alternative water source in areas where good quality fresh surface or ground water is lacking and also helpful to mitigation drought effects.

In the other way (Helmreich, 2008), define RWH as a technology used for collecting and storing rain water from roof tops, land surfaces or rock catchments using simple techniques such as natural sand or artificial ponds and reservoirs. After collecting rain water is a source in households for drinking, cooking, sanitation as well as for productive use in agriculture.

Rain water harvesting technologies are flexible and can be built to meet almost any requirements. Construction, operation and maintenance are not labor intensive.

Gould, (1999) viewed RWH as a general term which describes the small scale concentration; collection, storage and use of rain water runoff for both domestic and agricultural purpose.

The focus area of this research is not to compare and contrast different definitions which were those given by different authors. However, large size storage combined with efficient water application methods such as low pressure drip irrigation methods are useful means to overcome the recurrent erratic rainfall, dry spell and crop failures.



Rainwater harvesting yields numerous social and economic benefits, and contributes to poverty alleviation and sustainable development. RWH minimizes the risk of crop failure during droughts, intra seasonal droughts and floods and reduces women's burden of collecting water for domestic use, leaving time for other productive activities.

RWH gives opportunity for the female children to attend school and provides a relatively safe and clean source of drinking water. When applied at watershed level, it improves the environment and minimizes the effects of drought and floods. RWH is a decentralized water supply system encouraging community participation and self-reliance.

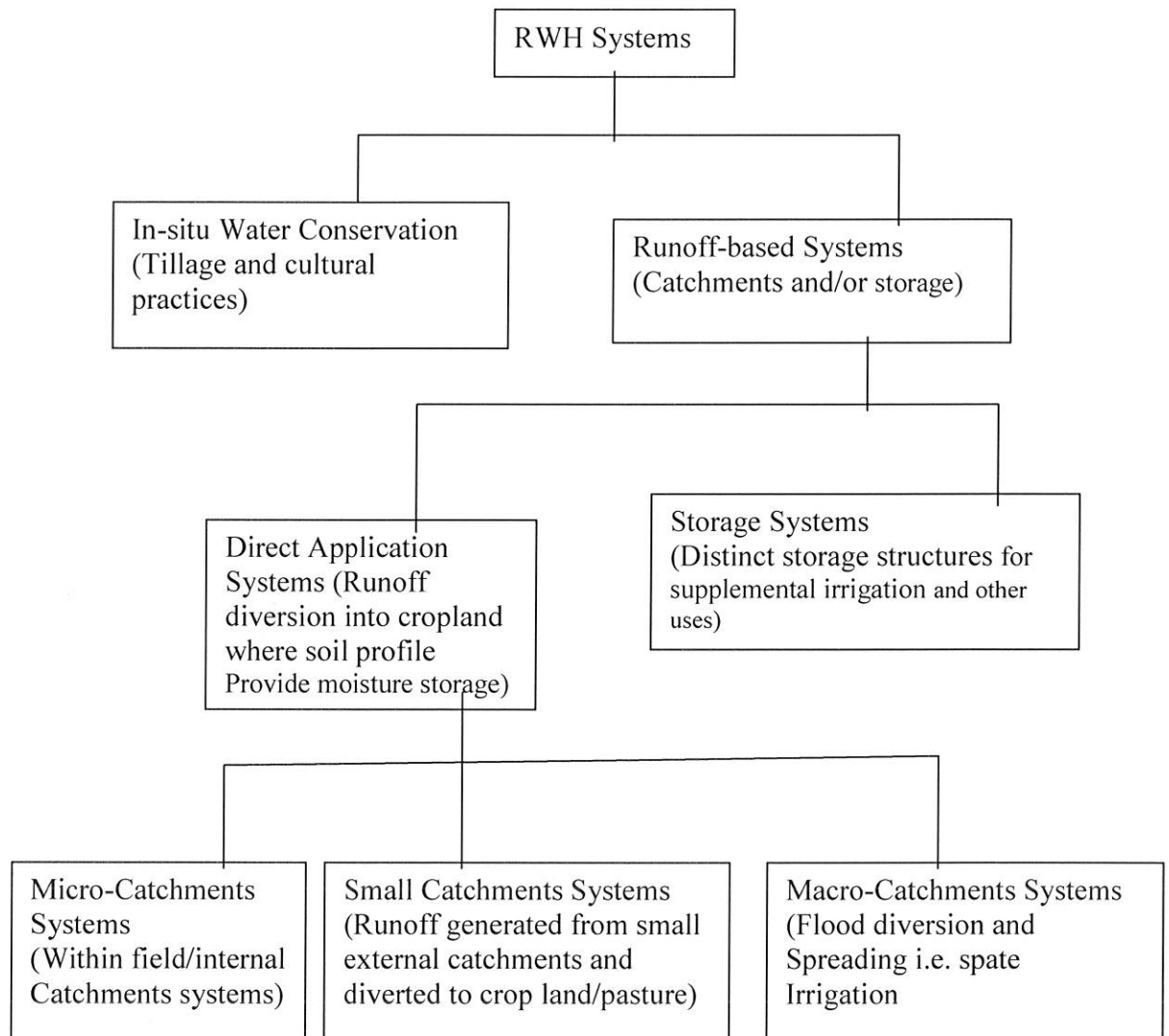
## **2.2. TYPOLOGY OF RWH SYSTEMS**

The term RWH is used in different ways and thus no universal classification has been adopted (Ngigi 2003).

According to Ngigi (2003) and N. Hatibu and H. Mahoo (1999) classification of RWH technology and systems as follows:

RWH is composed of a runoff producing area normally called the catchment's area (CA) and a runoff receiving and utilization area normally called cropped basin (CB) Therefore RWH systems for crop production are divided into different categories basically determined by the distance between CA and CB:

Each RWH system, except in situ water conservation should have the following components: runoff producing catchments, runoff collection (diversion and control) structures, and runoff storage facility (either soil profile in cropland or distinct structure (farm ponds, tanks, water pans, earth dams, sand dams, sub-surface dams, etc.).



**Fig.1** *classification of rainwater harvesting technology and systems, in sub-Saharan Africa (Ngigi 2003)*

As shown from above figure the water harvesting technology and systems based on  
 a) Run off generation system b) type of storage system and c) size of catchment.

## **2.3 BASIC COMPONENTS OF RAIN WATER HARVESTING**

*According to Malesu et al (2007) Basic components in rain water Harvesting are three*

- i. a catchment surface from which rainwater is collected;
- ii. a conveyance system to collect and transport water to storage facilities;
- iii. a storage facility or reservoir, and storage related inflow and outflow devices/facilities

### **i. Rain water Catchment Surfaces**

A catchment surface is the part of a RWH system that receives rainfall and drains the water into storage facility through a conveyance system. The size of a catchment surface varies from simple roof tops to large natural catchments that drain rainwater to dammed reservoirs from which water is either gravitated or pumped to treatment plants. Catchment surfaces do need to have some slope and impermeability in order to be able to generate adequate runoff. Another important requirement of catchments is that they should not contaminate water seriously with dangerous chemicals and microorganisms.

### **ii. Rain water Conveyance Systems**

Rain water conveyance systems are components of RWH systems that collect water from catchment surfaces and transport it to the inlets of storage facilities. Each type of rainwater catchment has a conveyance system that is appropriate to the specific type of RWH system.

It is understood that, a properly installed and well maintained conveyance system that leads water from a roof catchment to the storage tank is an important component for the proper functioning of a RWH system.

### **iii. Rainwater Storage Facilities**

There are three broad categories of rainwater storage facilities.

- a. Surface tanks or above ground tanks;
- b. Sub-surface tanks or underground tanks; and
- c. Dammed reservoirs and ponds

Rainwater storage tanks/reservoirs generally need to have facilities such as silt traps, filters, water abstraction means/devices, overflows/spillways, etc.

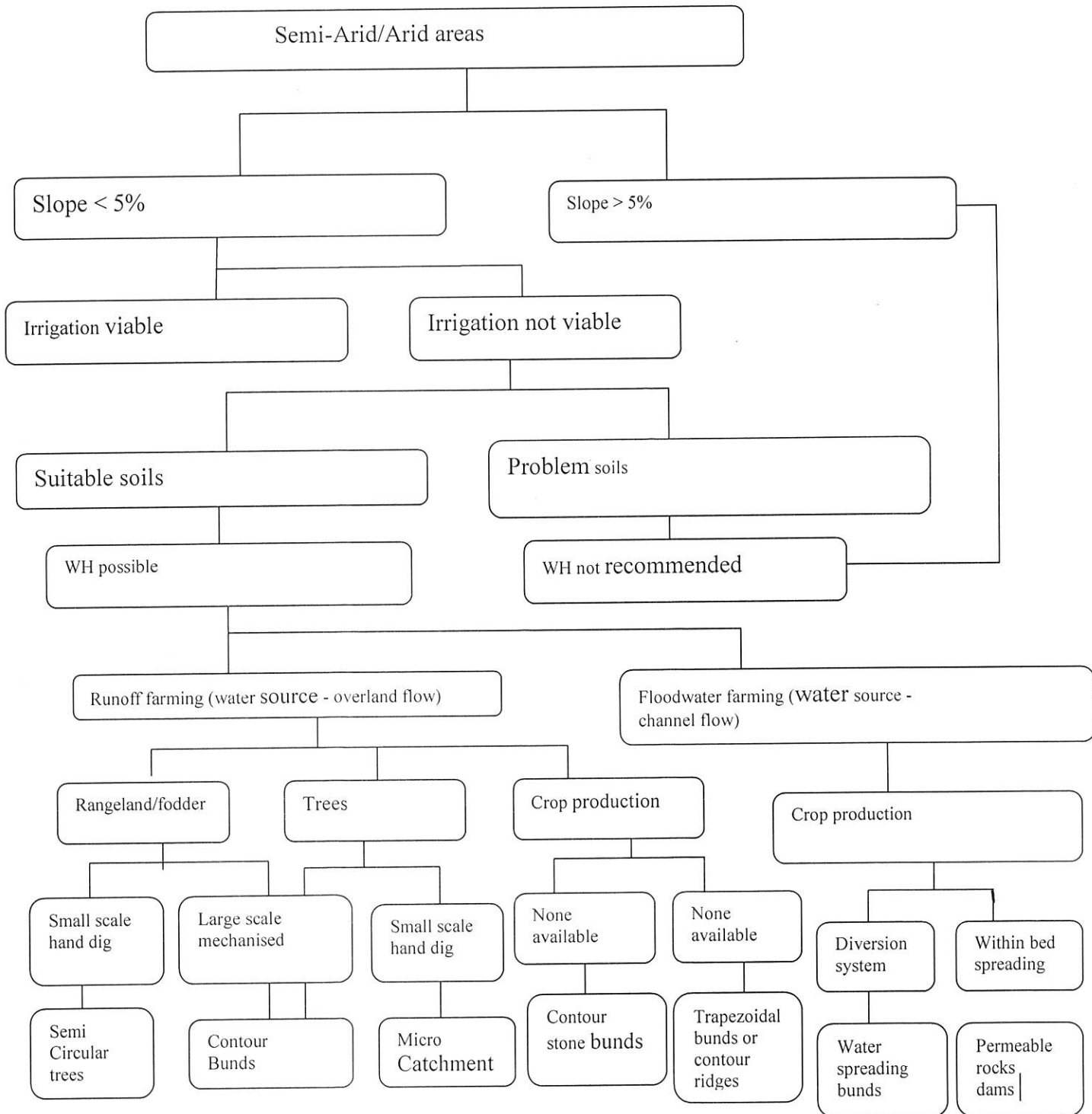
In principle, a water supply system is considered to be functioning properly when the various system/scheme components work in a coordinated/harmonized manner to harvest, convey, store and supply water that meets certain standards of quantity, quality and proximity to users.

## **2.4 SITE AND TECHNIQUE SELECTION**

Before selecting a specific technique, due consideration must be given to the social and cultural aspects prevailing in the area of concern as they are paramount and will affect the success or failure of the technique implemented. This is particularly important in the arid and semi-arid regions of Africa and may help to explain the failure of so many projects that did not take into account the people's priorities. In arid and semi-arid Africa, most of the population has experienced basic subsistence regimes which resulted over the centuries in setting priorities for survival. Until all higher priorities have been satisfied, no lower priority activities can be effectively undertaken

In addition to the socio-economic considerations, a water harvesting scheme will be sustainable if it also fulfils a number of basic technical criteria. IN Figure2 the chart shows the basic technical selection criteria for the different water harvesting techniques. (Hatibu et.al, 1999)

Figure 2.. System Selection or technical selection criteria (Hatibu et.al, 1999)



*As can be seen from the figure to harvest rain water in arid and semi arid areas it is recommended if the slop area is <math>< 5\%</math>, where irrigation is not practicable. In addition to this the soil must be suitable for rain water harvesting in order to grow fodder, Trees and crop production. And also flood water farming is possible for crop production.*

As can be seen from the figure-2 above to harvest rain water in arid and semi arid areas it is recommended if the slop area is <5%, where irrigation is not practicable. In addition to this the soil must be suitable for rain water harvesting in order to grow fodder, Trees and crop production. And also flood water farming is possible for crop production.

## **2.5 WHY RAIN WATER HARVESTING?**

There are a number of factors which limit other sources of water and rain water harvesting is the only choice. These are

- Limited catchments from where river can flow or recharge ground water
- High mineral content of ground water which makes it unfit for drinking
- Shortage of rain fall which limit availability of surface water(climatically dry area)
- RWH has Low O&M cost and easy to managed by users
- No conflict among users when system is owned individually
- RWH is a simple technology and improve water security
- RWH is the immediate hope for thousands of scattered small communities that cannot be served by centralized water supply scheme e t c.

## 2.6 THE CRITICAL FACTORS OF RAIN WATER HARVESTING PRACTICES

The integration of different forms of RWH structures would enable to maximize promotion and adoption of RWH systems. The best way of adopting RWH is either by improving or upgrading the existing type of system is the most viable option of technological innovation (Ngigi 2003).

It must be underscored, however, that the technology by itself is often not the problem for the low performance and adoption, but rather the poor implementation. (Girma M. 2009).

Along with economic justification, the promotion of rainwater harvesting projects requires an analysis of the eco-hydrogeology and human dynamics. Based on the case from Tanzania, rainwater harvesting for crop production showed the potential for poverty reduction which is evident in the results from two-seasons (2002 to 2003) yield monitoring for maize and lablab. According to the results obtained from the yield monitoring exercise, Rainwater harvesting for crop production has a great potential of poverty reduction given impressive returns to land and labor even during b-average seasons. The major constraints facing technology adopters were water distribution problems, labor shortage, and water-logging during periods of high rainfall and risk of injury to people and livestock as a result of some of the technologies,(Sultana 2007).

RWH for improved crop production has received great attention in the 1970s and 1980s mainly due to the wide variability of rain fall with the associated effects of crop failure reduced yield and threat to live stock and human life in semi arid and arid region .(Hatibu and mahoo,1999). It is advocated that RWH holds the opportunity to contribute to the equitable, efficiency, and



sustainable use of water resource by alleviating temporal and special water scarcity providing water beyond the basic human needs and hence enabling small scale productive activities.

In Dodoma district in the 1950's many earth dams were constructed for livestock and domestic water supply. Some of them are substantially large such as the Hombolo dam across the Kinyasungwe River. The waters of this dam are currently being used for full scale irrigation of maize and vegetables.

The major problem facing storage schemes has been the lack of maintenance. Most of them are silted up and their cost of rehabilitation is prohibiting. Silting is caused by poor utilization of catchment areas and lack of protection of the reservoirs.

Further to these, livestock walks directly, into the reservoir to drink, which increases the damage to the reservoir by puddling. (Hatibu et al 1999).

Rain water harvesting and storage reservoirs were found to suffer from lack of protection, care and maintenance.

The ongoing rain water is implemented under intense pressure to achieve quantitative results. On the speed and scale by which the program is being pursued, experience (Lack of suitable training programs in rainwater harvesting), with the most appropriate ones. Efficient monitoring does not exist due to capacity implementation these are lack of awareness among users, donor's dependent syndrome, lack of initial capital and lack of knowledge of technology (inadequate technological transfer to the beneficiaries). For instance, The RWH structures in

Amhara and Tigray face many problems, many of which originate from the speed and scale of implementation (Rami 2003).

Among the identified problems were (1) poor site selection; it was done hurriedly and without experience, with the consequence that many tanks do not hold water. Often the level of poverty was used as the most important criteria for selection of target beneficiaries, while the technical criteria of runoff and water collecting potential were neglected. Poor site selection is the most important reason for failures. (2) Leakage; Most of the tanks (cemented) were leaking due to cracks in the walls of the structured. This was attributed to the lack of skilled labour during construction, the poor quality of work as result of the quota system imposed by the regional government that put junior experts and development agents under pressure to construct tanks quickly.(3) Siltation and (4) Wastage and uneconomical use of water.

It must be understood that the technology by itself is often not the problem for the low performance and adoption, but rather the poor implementation. Proper implementation including area selection and design could improve the performance of RWH and improve the livelihoods of many poor. The identification of potential areas suitable for RWH is therefore the key for a successful RWH intervention.

One of the main reasons for failure of RWH structures is the lack of scientifically verified information which could be used to identify areas where RWH can be applied and for which type of RWH techniques. The potential of areas for RWH depends on a multitude of

parameters, either physical factors like rain fall, land use, soil and topography and/or the combination of the physical factors and socio-economic factors. (Girma M. 2009)

Various challenges and possibilities in making Rainwater harvesting a viable alternative to conventional water supply sources were identified and could broadly be classified as: - *policy issues, technical challenges and managerial constraints.*( Wanyonyi J.M,1998).

(Oweis et al, 1999 cited in Seleshi et al, 2005) reviewed water harvesting methods used in winter rainfall areas (>100 mm per year) and in summer rainfall areas (>250 mm). They give an excellent overview of the theory of catching, concentrating and storing of water, and how this relates to rainfall characteristics, landscape and crop demands.

The principles have been known and applied for millennia. Practical designs are given, yet the authors note that recent attempts to encourage more farmers in semi-arid zones are often disappointing, and give the following reasons: (i) people often do not understand the principles and get inadequate training, (ii) transaction costs are high, (iii) outside institutions are often needed to get started, (iv) too little focus on 'risk' and how to handle it, and (v) cooperation with different people (i.e., not worked with before) is difficult.

The fact that many farmers in semi-arid regions do not own the land they farm is another reason why investments in water harvesting are low. Not mentioned in the review but likely also a cause of slow uptake is that many of the farmers in semi-arid regions have more experience of being a herdsman than being a cultivator.

The other problems of RWH mentioned in (Nijhof et al.2010) that Women's involvement in community management of RWH systems is still weak. Women are the traditional water managers, responsible for household water provision, and yet it is not easy to genuinely involve them since decisions are often taken by men; and also the other obstacle is the Initial investment costs for RWH technology are relatively high, limiting replication driven by communities in challenging environments.

A sustainable way of financing seed capital for RWH could be the provision of micro-credit. Experiments with micro-credit for RWH are few to date on a global level.

## 2.7 CONCEPTUAL FRAME WORK

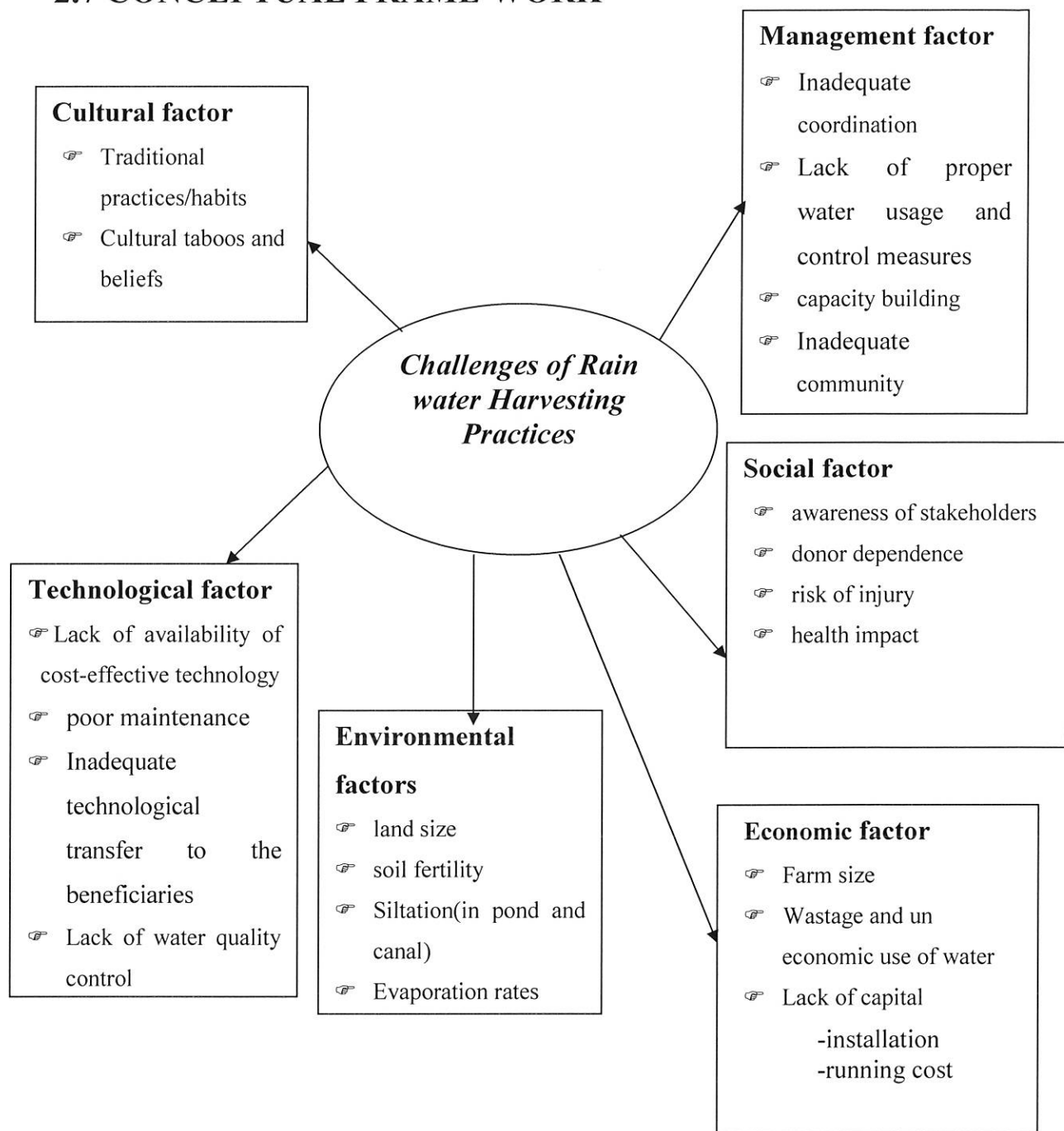


Figure-2, An overview of the challenges of RWH, (Adopted by the Author)

### **3. BACKGROUND OF THE STUDY AREA, METHOD OF DATA COLLECTION, METHODOLOGY**

#### **3.1 BACKGROUND OF THE STUDY AREA**

##### *Location*

Dodota woreda is located in oromya National regional state, Arsi zone .the capital of the woreda is Dhera town.

**Population:** Based on the base line survey of oromya water work Enterprise, the total population of the woreda is about 54,308.

**Climate:** The area is found in arid and semi-arid region with average elevation of 1500 m.a.s.l and Annual rain fall of between 450 – 850 mm, with erratic and un-reliable nature of rainfall distribution in which aridity strict crop production and animal husbandry. The land management practices developed over the years is not conclusive for long term soil productivity.

**Topography:** In the, area different land forms are existed. Flat lands (0-1), plain lands (with low to moderate slopes), hill tops and rugged places are the different land forms can be seen in the proposed and surrounding areas. However, flat land and the major portion (about 75%) of the whole land forms in the watershed

##### *Land Use:*

Mixed agriculture and stocking (animal raring) are conducted together. Most crops are cereals and dry land varieties, or local species. Peoples are settled either collectively or scattered the newly emerging families can get cultivable land through share cropping, rental basis or from their parents.

### *Agriculture*

As the system is mixed, both (animal& crop) productions are a livelihood of the living community. The winter season (June to early Sept.) receives unreliable and in-sufficient rainfall in which optimum crop yield is not possible. Major crops, like, cereals and pulses are grown. Wheat, teff, barley and haricot beans are the usual crops exercised in the project area. Some vegetables (tomato, onion, pepper and sugarcane) are cultivated in some areas of the Dodota- by traditional and modern development.

The most important domestic animals in the surrounding are sheep, goats, donkeys; camels (rare case).The animals are tolerant to the harsh climatic conditions. However, the availability of pasture and water is still a big problem for livestock keepers. Although pasture is readily available during and after short rainy season (June to Late August), it is exhausted within a short time. As the district agricultural and rural development office' information there is animal diseases, like black leg, anthrax, pasteriolosis and sheep pox.

(The above data adopted from base line survey of Dodota woreda for spat irrigation; it is unpublished).

## **3.2 METHOD OF DATA COLLECTION AND METHODOLOGY**

### **3.2.1 Methods of Data Collection**

To gather adequate information and to get individual experts, institutional view the Primary and secondary data will be generated by employing quantitative and qualitative method. The study explores the challenges of RWH practices towards its benefit. Thus the study will investigate different factors like social, cultural, environmental, management, and technical issues that potentially challenges the RWH practices; based on the developed conceptual frame work.

### **3.2.2 Data type and source**

#### **3.2.2.1 Primary data sources**

To get first hand evidence about topic under investigation the primary data sources were employed. The sources were sample households, focus groups, key informants and fields through instruments such as house hold survey, focus group discussions key informant interview, and field observation. The details are discussed here under.

#### **House hold survey**

This instrument is employed to collect information from sampled households. Structured survey questionnaires were prepared to gather both qualitative and quantitative data. The data captured through this instrument are the demographic characteristics of sample households, issues related to rainwater harvesting technology. User, those who stop practicing and non user of rain water harvesting were involved in the survey to obtain information about the relevance

of RWH from user and about factors hindering the adopting practices of RWH were acquired from non users and from those who stop practicing.

The three major domains that were covered in the questionnaire are socio demographic data, the relevance of the RWH practices to the community, the challenges of rain water harvesting practices.

In order to conduct the house hold survey enumerators, Development agents, who know the culture and are able to speak language of the study area, i.e. Afan Oromo, were assigned in the data collection process. The enumerators were trained by the researcher before launching the survey to make them understand the purpose of the survey and to familiarize them with the questionnaire. The interviews will be conducted with close supervision of the researcher.

#### ***Focus group discussion (FGD)***

Focus group discussion one of qualitative methods of data collection for the study and it was employed to complement the finding of primary and secondary information. The primary data collected from the sample households was enriched by additional information gathered through focus group discussion. Accordingly with the help of checklist discussion was held with participants in practicing RWH (users) and none participants (none user and those who stop practicing) of rain water harvesting practices having a total of 8-10 members in each group in two sessions. In this FGD the researcher was responsible to guide directions and to promote active group participation.

#### ***Key informant interview (KII)***

Key informative interviews was conducted with different experts and individuals at different levels of government and none governmental organizations. These include Oromiya Water &

Energy Bureau, Oromiya Bureau of Agriculture at zonal and woreda levels, NGO like JICA and other donors, Development agents(DAs) and kebeles chair persons of the respective sample areas . In addition two elders from each selected kebeles were interviewed to obtain a local experience and helps to understand the perception of the community after rain water harvesting. KII is particularly important in getting information pertinent to the institutional aspects of rain water harvesting.

### *Personal observation*

Personal observation was made to have an insight in to the functioning and performance of rainwater harvesting practices and cross check from other sources of information about the failures and success of the practices in the study, pictures were taken from the sight that is relevant and evident to the study.

### **3.2.2.2 Secondary data source**

Secondary data were obtained from books, publications, websites (internet sources), and previously done master thesis, documents obtained from offices of ERHA, woreda water desk, MoA and also from informal communication.

## **3.2.2 Samples and sampling procedure**

### **3.2.3.1 Selection of the woreda and sample kebeles**

Information obtained from experts in the Ministry of Agriculture show that Dodota woreda has experiences of erratic rainfall and drought prone, in addition to that surface and ground water is insufficient to fulfill agricultural and domestic water demand of the people. One of the best

alternative sources of water was rain water harvesting practices, therefore with the support of government and NGOs rain water harvesting was introduced; however the practice did not sustain long. But, recently in some pilot areas the farmers are adopting RWH practices and become beneficiary. Accordingly the two kebeles (i.e. Dodota Alem and Amigna Debeso) among the total 12 kebeles were selected because, there are relatively large households. This thesis explored the reason for recent success as well as the challenges encountered during the short outlived practices.

### **3.2.3.2 Sampling procedure**

Out of the total household size of the two kebeles (i.e. 1,443), 100 households were taken due to time constraints.

The study was employs both purposive and systematic sampling approach to select sample kebeles surveyed households, focus group participants and key informants to generate appropriate information for the study. Here beneficiaries were undertaken through purposive sampling. According to the information from the woreda Agricultural bureau in the two sample kebeles there are only 26 users of RWH. So, all users of RWH were including in the survey. In the case of non-users and those who stop practicing of RWH (i.e. the remaining 74 households), the sample was taken by simple random sampling approach based on the list available in the woreda Agricultural Bureau.

### **3.2.3 Methods of data analysis**

In order to address the specific and general objective of the study various data have been generated through quantitative and qualitative methods were analyzed using different techniques. The quantitative data was collected from household survey and then it was edited, coded and labeled and entered in the statistical package for social scientists (SPSS). Hence, simple descriptive statistical tools such as frequency, percentage, and mean were employed. On the other hand qualitative data was used primarily to strengthen the quantitative data.

## **4 ANALYSES AND INTERPRETATIONS**

### **4.1 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE HOUSE HOLD**

The average family size of households in the surveyed area was found to be 6. The minimum and maximum house hold sizes of the respondents were reported to be 3 and 9 respectively. The total household sample households include 89% male headed and 11% female headed household. The average family size of user of rain water harvesting (URWH) is 6, none user of rain water harvesting (NURWH) 6.7 and those who stop rain water harvesting (SRWH) are 6.9. Accordingly the average family size of user of the technology and none users have almost the same number of average family size. The message here is family size is not the obstacle to being user or not.

In addition to the sex composition of households with user of the technology is 76.9% male headed and , 23.1% female headed, none users 89.2% male and only 10.8% female headed and those who stop practicing are 81.1% male headed and 18.9% female headed. Sample households in URWH, NURWH and SRWH 76.9%, 94.6%, and 86.5% were married respectively. This can show there is a slight variation among them in family size and marital status.

In the study sample households those who received education and did not get education and also age of the household head are included by chance. The educational level of households with the technology is 69.2% illiterate, 3.8% read and write only and 26.9% attend primary school while NURWH is 35.2% illiterate, 27% read and write only and 27% attend primary

school and 10.8% secondary school completed and SRWH is 37.8%, illiterate, 32.4% read and write , 24.3% attend primary school and 5.4% secondary school completed.

As mentioned above educational status of the household head is not influential factor to involve in the practicing of rain water harvesting. As far as marital status of the respondents is concerned the majority (89%) of respondents were found to be married. the rest 11% were reported to be widowed and divorced.

The mean age for the head of the observed in the study area was 49. More over the result revealed that 65% of the head of households were found in the age group below or equals 49 years of age, while the remaining 35% were found to be above or equal 49years of age.

The table below shows frequency and percentage of the households' family size, sex composition, educational level, marital status and age of URWH, NURWH, and SRWH in the kebeles.

Table1.

Frequency and percentage

<i>Demographic characteristics</i>	URWH	NURWH	SRWH
<b>Family size</b>			
1-3	5(19.2%)	1(2.7%)	--
4-6	8(30.8%)	13(35.1%)	14(37.8%)
>6	13(50.%)	23(62.2%)	23(62.2%)
<b>Sex of the head of the house hold</b>			
-Male	20(76.9%)	33(89.2%)	30(81.1%)
-Female	6(23.1%)	4(10.8%)	7(18.9%)
<b>Age of the head of the house hold</b>			
15-49	11(42.3%)	28(75.7%)	26(70.3%)
50-64	8(30.8%)	8(21.6%)	7(18.9%)
>64	7(26.9%)	1(2.7%)	4(10.8%)
<b>Education level of the head of the house hold</b>			
-Illiterate	18(69.2%)	13(35.1%)	14(37.8%)
-read and Wright only	2 (7.7%)	10(27.0%)	12(32.4%)
-elementary	6 (23.1%)	10(27.1%)	9(24.3%)
-secondary school completed	--	4(10.8%)	2(5.4%)
<b>Marital status of the head of the house hold</b>			
-married	20(76.9 %)	35(94.6%)	32(86.5%)
-widowed	6(23.1 %)	2(5.4%)	5(13.5%)

Source ...Own survey2012

## 4.2 RAIN WATER HARVESTING PRACTICING OF THE AREA

For this research a total of 100 farm house holds classified in to three; these are URWH, NURWH and SRWH groups were, surveyed. Of the total sample house hold 26 of them are URWH farmers, 37 of them are NURWH and the rest 37 of them are SRWH.

The households who engaged in RWH technology in the area use the harvested water for domestic purpose and for different agricultural activities. 11.5% of users use the harvested water for Domestic water supply, 34.6% of users use water for farm land, 92.3% of users use the harvested water for Domestic water supply and for farm land and, 7.7% of users use the harvested water for other activities like for seedling. (See table2 below)

**Table2For what purpose are you using rain water harvesting?**

	Frequency	Percent
Domestic water supply	3	11.5
for farm land	9	34.6
For all of them	12	46.2
Others(seedling)	2	7.7
Total	26	100.0

Source ...Own survey2012

In the study area the highest responsibility to manage the rain water harvesting pond is given to the owner of the pond. And it is believed that this could increase their sense of ownership and further increase the pond efficiency.

URWH have different information sources before they engaged in the technology for the response to the question “who introduced rain water harvesting to you?” 15 users stated that extension workers and the rest 4, 1, and 6 users stated that neighbors, NGOs and woreda bureau of agriculture respectively, inform them about rain water harvesting. See the Table below that show the frequency and percentage of the respondent

**Table 3 who introduce rain water harvesting to you?**

source of information of URWH	Frequency	Percent
Extension workers	15	57.7
.Neighbors	4	15.4
NGOs	1	3.8
Woreda bureau	6	23.1
Total	26	100.0

Source ...Own survey2012

While those who stop rain water harvesting reported that 48, 6% have got adequate information from the woreda bureau of agriculture and extension workers and the rest of the (51.4%) involves in the technology by their personal initiative and also learn from neighbors.

**Table 4** frequency of SRWH source of information

source of information of SRWH	Frequency	Percent
The woreda bureau of agriculture	10	27.0
Extension workers	8	21.6
personal initiative	17	45.9
Learn from neighbors	2	5.4
Total	37	100.0

**Source- own survey 2012**

The information gathered from focus group discussion and from key informant interview the number of non adopter of the technology in the woreda is very high. This is due to lack of awareness, the risk of livestock and kids life loss, absence of land and low economic status of the farmer. Similarly As can be seen in table 5 below 45.9%of the farm households in the non users group did not adopt due to lack of awareness where as 32.4%, 5.4%and 16.2% of the non users of rain water harvesting did not adopt the technology due to absence of adequate land, risk of life loss and low economic status of the respondent respectively.

**Table 5** frequency and percentage of NURWH respondent for why they not adopt the technology

	Frequency	Percent
Lack of awareness	17	45.9
Absence of land	12	32.4
Risky	2	5.4
Low economic status	6	16.2
Total	37	100.0

**Source- own survey 2012**

The respondent of URWH revealed that all of them have got training on site selection, digging pond, purpose of rain water harvesting and other supporting consultation that help them to sustain the technology. Further more training on covering, lifting, application of the stored water and keeping the pond water clean were given for few of the User of rain water harvesting technology. While as can be seen in the table below 48.6% of those who stopped practicing rain water harvesting respondent have got training on site selection, digging pond and purpose of rain water harvesting but 51.4% of them did not got any training.

**Table 6** frequency and percentage of Users and those who stop rain water harvesting (comparing the training they have got)

**Have you got any training on RWH?**

	Yes	No
RWHU	26(100.0%)	
SRWH	18(48.6%)	19(51.4%)

**Source- own survey 2012**

As illustrated in table below (table 7) out of the total **non users** of rain water harvesting practices 64.9% of them thought that rain water harvesting has disadvantages (impact) on health, livestock loss and accident on human life.

**Table 7 Have you observed any disadvantages of RWH?**

	Frequency	Percent
Yes	24	64.9
No	13	35.1
Total	37	100.0

**Source- own survey 2012**

As far as water related problem of the area concerned, all rain water harvesting users believed that rain water harvesting practices is a main alternative source of water.

This safely tells us adequate training about rain water harvesting practices is very essential to be successful from and sustain in the technology.

Based on the information gathered from the focus group discussion, most of the farmers in URWH, NURWH, and SRWH sample households argued that rain water harvesting technology can support them to become food secured. This is because rain water harvesting helps the farmers to produce during dry season, increase the harvests time per year and increases yield by supplementing dry spell period.



*Figure-4. This farmer at his backyard grows different kinds of cash crops like coffee, orange and so on, as seen on the picture the plants are remain green even during dry season.*

This idea was supported by the key informant discussion with the woreda agricultural bureau and NGOs (JICA) coordinator. They argued that rain water harvesting technology is a very important to improve the food security of farmers in areas where there is rain fall variability and short dry spell.

Users of rain water harvesting of the house hold sample mentioned that they involved in rain water harvesting with different reasons. These are expecting income improvement to mitigate the problem food insecurity and for water availability increment. See table8.below:

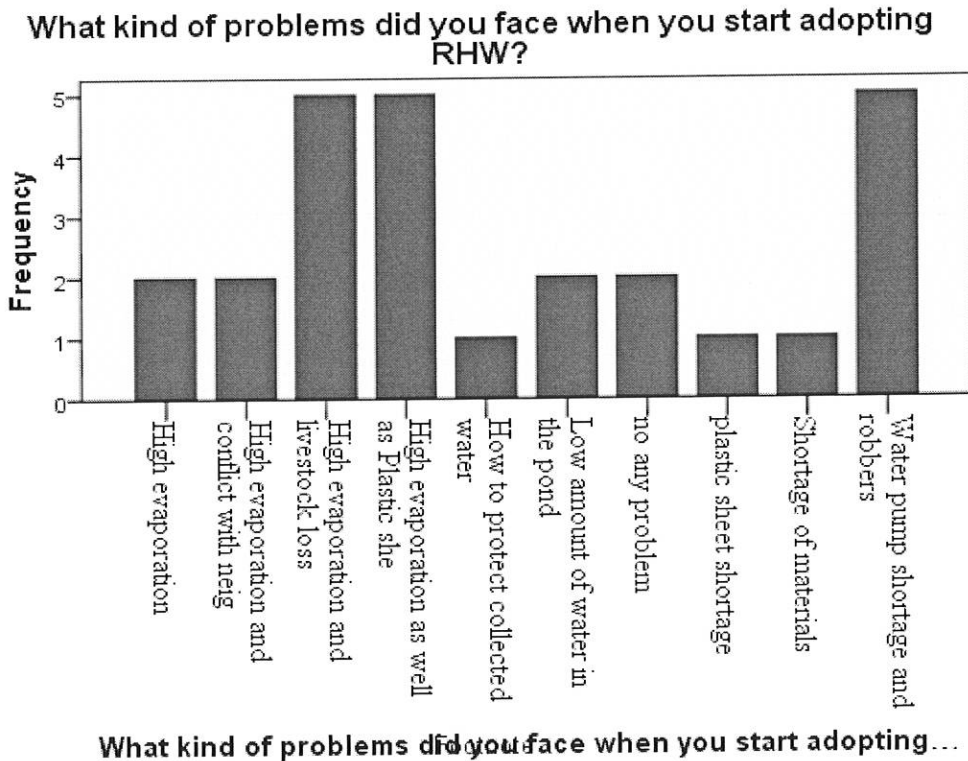
**Table 8 what was your expectation when you engaged in this technology?**

	Frequency	Percent
-Income improvement	1	3.8
-income improvement and food security	12	46.2
-to overcome water shortage problem	7	26.9
-to produce more	1	3.8
-water availability increases	5	19.2
Total	26	100.0

**Source- own survey 2012**

But the users of the technology revealed that rain water harvesting highly challenged by prevalence of higher evaporation, mainly due to lack of knowledge of how to cover the pond. The other challenges for the users are conflict with neighbors due to raising questions of owner on canals that bring water from catchments to the pond, materials shortage such as plastic sheet that spread in the pond and help the pond to hold water for a long period of time, shortage of

water pump, in addition to this there are robbers of plastic sheet in the study area. (See the figure below)



Figure\_5 Source- own survey 2012

Farmers especially at the beginning of the introduction of new technology should be supported by the government and or other development organizations. Because; lack of training and follow up could be the main reasons for the farmers to regret from practicing. About more than 50% of URWH and more than 80%of those who stop rain water harvesting in the sample households responded that the assistance given to them from the government and None governmental organization are not enough.

Focus group discussion with the selected farmers revealed that few farmers were developed hatred towards the rain water harvesting technology and this affect the expansion of the

technology due to the partiality done by the responsible body during the selection process. Later those farmers who need to have rain water harvesting pond began to involve by their own initiative and the responsibility of the experts were limited to only the farmers selected by them.



Figure-6 the owner of this pond explained that, He involved in the technology with his personal initiative, therefore, He lacks support from concerned organization, and as a result, due to lack of plastic sheet his pond cannot hold water more than three months after the rainy season.

As a result the farmers who have involved with personal initiative and learn from neighbors stopped practicing the technology, due to lack of proper training and adequate follow up.

In responses to the question “**why did you stop practicing rain water harvesting?**” 59.4% of those who stop practicing rain water harvesting stated that they have stopped practicing due to

absence of follow up and lack of awareness about how to sustain the technology, while the rest 16.2%, 8.1%, 13.5%, and 2.7% of the respondents replied that they stopped practicing due to financial problem, lack of materials, Robbers of plastics sheet and termite insect which destroy the plastic sheet that spread in the pond respectively. (See table 9),

Table 9

**Why did you stop rain water harvesting?**

	Frequency	Percent
Absence of follow-up	12	32.4
Financial problem	6	16.2
Lack of awareness	10	27.0
Lack of material	3	8.1
Robbers of plastic sheet	5	13.5
Termite( insect)	1	2.7
Total	37	100.0

Source- own survey 2012

As can be seen from the table 9, the prevalence of large number of farm house holds without any training can be taken as a draw back to the expansion of the rain water practices. This implies that there should be a need to give a continuous training and follow up for the mass of the farmers about rain water harvesting technology.

Non users were asked to indicate the reason why they did not adopt the technology. Lack of the awareness (knowledge) of the house hold stated as one of the basic reason for abstaining from adoption. Hence lack of awareness was cited by 45.9% of the respondent, followed by 32.4% absence of land, 16.2% low economic status, and 5.4% perception of respondent indicate that

the technology as risky for life loss were among the factors that affecting the adoption and promotion of rain water harvesting intervention in the study area. (See table 10)

Table 10

**Why you did not adopt rain water harvesting?**

	Frequency	Percent
Lack of awareness	17	45.9
Absence of land	12	32.4
Risky	2	5.4
Low economic status	6	16.2
Total	37	100.0

**Source- own survey 2012**

The above table (table 10), shows next to lack of awareness, absence of land of the respondent is mentioned as one of the basic reasons for the low adoption and promotion of the technology. Small holder farmers never venture to take risk, given that they predominantly depend up on the low income they obtain from their relatively small land size. This might indicate among other things the risk aversion behavior of farmers. It was learnt from focus group discussion that sometimes the ponds remain empty due to the nature of the soil that helps for the occurring of seepage, and also the discussant had been raising the very crucial of land. Farmers pointed out that farm land size is the main source of their income. The one who has relatively larger farm size than others can have better income.

In the discussion it was also noted that some lands less farmers were sustaining their livelihood by renting land but never venture to adopt the technology. This could be explained by the fact

that these landless farmers might not feel secure that the land belongs to them and that it could be taken away by the owner of the land at any given time.

The farmers do not own the land they farm is one of the reasons why investments in water harvesting are low.

To adopt rain water harvesting technology like any other investment part of farmer decision is constrained by its cost.

A study by Ngigi (2003) indicated that low economic status and miserable poverty of the households were found to be the biggest barrier to the promotion and adoption of rain water harvesting technology.

The information obtained from key informant revealed that the majority of the surveyed kebele area falls under kola agro climatic zone, shortage of rainfall a severe threat to farmers whose livelihood is extremely linked with agriculture. Agricultural production and productivity failure make the farmers vulnerable to drought; hence food security is a hot issue.

Farmers especially at the beginning of the introduction of new technology should be supported by the government and other concerned organization.

All the URWH, NURWH and SRWH were asked that to reveal whether the problem of rain fall shortage (water shortage) of the area can be solved by RWH technology or not, 100% of the households with the technology responded that it is possible to meet water shortage in the area by harvesting rain water properly. While those fail to practice the technology, the majority of them replayed the possibility of solving rainfall shortage problem is by using RWH technology. From this it is possible to say that advantage of RWH technology well understood by the community.

### **4.3 FACTORS AFFECTING PRACTICES OF RAIN WATER HARVESTING IN THE STUDY AREA**

As mentioned above rain water harvesting has a significant impact on increasing farmer's water availability and income. Despite these advantages there is no wide spread practices of rain water harvesting in the study area. In this section factors affecting practicing of rain water harvesting were discussed as 1) **Economic** factors, 2) **social** factors, 3) **environmental** factors, 4) **technological** factors, and 5) **Management** factors

Actually one factor is depend on another (they are interdependent)

#### **1) Economic factors:**

**Farm size** in the study area is an important indicator of the household economic status. Hence more farm land size signifies wealth and power. Small land size indicates being poor.

As it was noted from the focus group discussion rain water harvesting in the study area seemed to be affected by the size of farm land a house hold possess. Small farm land size holders were less adopters of the technology than large farm land size holders.

#### **Credit availability**

As table 10 above shows among other reasons for instance, low economic status of respondents is mentioned as one of the basic reasons for the low adoption and promotion of the technology.

It was plainly evident from the focus group discussion that the government used to subsidize farmers for the construction of cisterns and ponds. However many farmers could not afford to install plastic lined ponds and concrete tanks by themselves given their low economic status and the relative very expensive costs of cement and plastic sheets.

The prevalence micro credit institution therefore is instrumental inverting food insecurity in the area. Access to capital or credit is one of the biggest obstacles facing farmers who want to acquire as well as sustaining in better technology. During the key informant interview the information gathered from kebele chairman of both sample Kebeles, there are no adequate budget allocate for the construction and expansion of rain water harvesting.

Most banks and money lending institutions do not lend money to farmers who denote have any collateral to show in return, hence this lack of financial resource for capital formation plunged farmers in to extreme poverty.

A key informant interview reveals that in the study area one microfinance institution used to lend farmers money but as most farmers were not able to pay back the money due to crop failure by erratic rainfall, the institution ceased its operation. And also farmers have no well established tradition of saving. But this was partly aggravated by the weak performance of the government because in the area there is no as such strong micro finance institution.

Access credit enable the farmers to rent labor and construct ponds, and improve the pond quality, scale up the existing pond that helps the farmer to have enough water for preventing crop failure in order to improve food security and crop failure.

### **Market accessibility**

Rain water harvesting activates the production of horticulture. Horticultures are marker induced cash crops; therefore they can play a vital role to offset the dry spells associated with drought in the dry and semi dry areas. It is also importance to the food production and economic

performance of farmers. As a result, it encourages the farmer to harvest the rain water continuously and actively. However, horticulture crops are perishable so that heavy losses can be incurred within a short period of time, this is mainly distance to the nearby market and farmers have to travel along to reach a nearby market.

Information obtained from focus group discussion with non users this was one of the reason for them. So, they do not want to take risk of installing rain water harvesting technology.

## 2) **Social factors:**

Lack of trained man power inability of the expertise especially development agent to understand the technology and fail to harmonize the indigenous (local) knowledge with the modern technology, the feeling of over dependency on donors, lack of awareness among stack holders particularly farmers and carelessness of farmers.

One of the indicators of carelessness of the farmers is absence of pond cover that may result in a lots of problems like excessive evaporation and accident on animals and kids, this can a cause for the failure of the technology because the ponds with cover hold better amount of water as compared to those ponds that are without cover. Some farmers cover the water with algae plant but spread the plant in appropriately and leave opening that expose to the sun to evaporate. Some other farmers cover their pond with grass and plant leaf that in turn create problem. This is because the dried leaf began to accumulate within the pond and minimize the water holding capacity of the pond which makes the water dirty and causes bad odour.

In the study area the total numbers of ponds which have fence are greater than the total number of ponds which have cover. This may be due to the fear of farmers not to lose their livestock or their kids. So, from this it is possible to understand that rain water harvesting pond are considered as problem and farmers are more sensitive to negative outcome of the pond and this can also limit the expansion of the technology.

**3) Environmental factors:**

In the study area the moisture holding capacity of the soil is very poor and needs continuous watering for better production. This is mainly due to the climate condition of the area expose to high rate of evapo-transpiration.

The researcher personal observation revealed that the land slope of the study area ranges from medium to gentle slop type. Malesu et al (2007) pointed out that the medium slope is preferred for the rain water harvesting technology. Most part of the area is good to practice rain water harvesting, however, due to the lack of the skill in “how to select sit” in addition to this carelessness of the farmers the pond filled by silt during high rainy season.

**4) Technological factors:**

In adequate technological transfer to the beneficiaries is also a problem.

One of the technological problems is absence of roof cover design, accident on animals and most of the structure lack de-siltation system and the presence of poor maintenance. As a result most of the ponds found in the study area hold small amount of water due to evaporation, percolation (see page) of water to the group and sometimes the pond totally collapse since it is field with silt during the time of heavy rain and the other problem of the study area was

improper sit selection as a result the water that come from the catchments cannot reach to the pond.

The key informant interview with the woreda agricultural bureau revealed that due to shortage of skilled local planner wrong pond sit selection can also because for the failure of the technology. Due to the non conformity of the pond sit with runoff catchments and the poor quality of the pond most of the ponds remains to be either empty or only little amount of water they hold because local planners most of the time lack technical skills and experience the planning process of rain water harvesting technology. In addition to site selection they suffer from poor quality of ponds due to lack of skillful and trained manpower in the field of pond construction, lack of administrative coordination and financial constraint

**5) Management factors:**

The information gathered from key informant interviews the kebele chair man and the woreda agricultural bureau revealed that the most effective section of the society for the implementation of rain water harvesting practices especially after the construction of the pond are both men and women will be beneficiaries but if the pond is near to the home of the farmers as a result of their daily contract for watering and planting vegetables and seedling, women are more effective than men. Therefore based on the fact mentioned above both men and women can be effective implementers of the technology, however at this time the participation of women is very limited in the study area, particularly this because lack of awareness of the farmers prevent them from using the potential of women to manage the harvested water.

Lack of equipment (to make canal for runoff, water lifting equipment), absence of continuous and organized training or education on how to use and expand the technology in addition to lack of provision of improved seeds are the major challenges that make the technology unsuccessful in the study area.

The researcher had observed that some ponds remain unused this is partially because the intervention of rain water harvesting in the study area seems to be more of quota system and a onetime phenomenon. And also due to lack of serious follow up robbers take the plastic sheet from the farmers pond and sell it or use it for other purpose, in addition to this the plastic pond damaged by an insect called termite.

Lack of training and absence of continuo's follow up make the farmers abstain and or regret from.

## **5 CONCLUSION AND RECOMMENDATION**

### **5.1 CONCLUSION**

Most part of the study woreda falls under arid and semi arid climate and also the woreda nationally considered as food unsecured area. In order to cop up with the shortage of water and to prevent the crop failure during the dry season, rain water harvesting practices was found to be very vital alternative source of water and way of augmenting the degraded land.

The result from the demographic characteristics of the sample household revealed that there is slight difference among users, none users and those who stopped practicing. The message here is that the family size, educational level, marital status and sex difference are not the obstacle to being user or not.

The farmer households, who engaged in the technology, have used the harvested water for domestic water supply, water for farm land and for watering seedlings.

In the study area the highest responsibility to manage the rain water harvesting pond is given to the owner of the pond. This increases their sense of owner ship.

The researcher investigated that, rain water users have adequate information about rain water harvesting from different sources. The government and NGOs are the main sources of information and supporter of them.

The finding of the study indicated that there are number of challenges of rain water harvesting that need serious corrective action in order to be successful in this technology. The researcher categorized this challenges under Economic, social, environmental, technological and management factors. , *however, further research is needed around which type of rain water harvesting technology is suitable for the study area.*

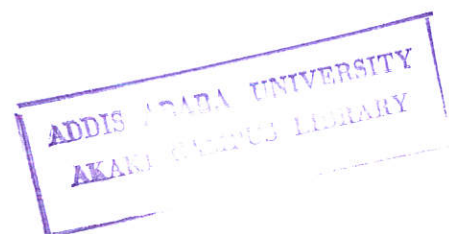
Under Economic factors the study indicated that harvesting rain water in the study area seemed to be affected by the size of farm land that a household possess. Those have small farm land size were less adopters of the technology than large farm land size holders.

Among other reasons low economic status of respondents is mentioned as one of the basic reasons for the low adoption of the technology.

Money lending institutions do not lend money to farmer as initial capital to harvesting rain water, this in turn prevent the farmers from adopting the technology.

The other economic factor is market accessibility for their products that were produced using harvested rain water. If they have enough access to the market, it will encourage them to harvest rain water. Therefore, access to market plays a vital role in the technology expansion. But the farmers are not accessible to transport. Due to this they have to travel a long journey on foot to reach to the market area.

Lack of trained man power inability of the experts, especially and fail to harmonize the indigenous knowledge with modern one, the feeling of over dependency on donors, lack of



awareness and work organizing among stock holders and in addition to this carelessness of the farmers; the researcher considered as social factors.

One of the indicators of carelessness of the farmers is absence of pond cover and protection that may result in lots of problems like expose to excessive evaporation and accident, the small amount of water, life loss and bad odour of the collected water. The other main challenge was a wrong pond sit selection.

Due to lack of skill in how to select site and carelessness of the farmers, the pond is filled by silt during rainy season.

The other most important finding revealed that inadequate technological transfer to the beneficiaries due to shortage of skilled local planners is also a problem. As a result most of the ponds found in the study area hold small amount of water due to evaporation, percolation of water to the ground, the pond filled with silt during heavy rain and improper sit selection.

In the study area the participation of women at this time is very limited; partly this is because lack of awareness of the farmers prevents them from using the potential of women to manage the harvested water. The other problem of the farmers that prevent them from adopting the technology is lack of equipment to make canals for runoff and the correct water lifting equipment like triddle pump.

Absence of continuous and organized training or education, absence of follow up, intervention of rain water practices of rain water harvesting in the study area seems to be more quota system and a onetime phenomena, and did not involve the willingness of the farmers, finally that make the technology un success full in the study area

Do you to absence of continuous follow up the robbers take the plastic sheet from the pond and sell it in Dhera town, and also the plastic sheet damaged by an insect called Termite.

## 5.2 RECOMMENDATION

Based on the main finding of the study for a better adoption of these technologies the following recommendations are suggested.

- Rain water harvesting technology is undoubtedly use full and main alternative source of water in the study area. Therefore, the government and /or other concerned development organization should work on awareness of farmers.
- One of the reasons preventing the farmers from practicing is financial constrains. So, the concerned organization and the government should provide loan for the farmer on time that can be return back in a long time.
- RWH can support the farmer to produce in dry season and potentially the income of farmers can be improved. So the farmer should have access to the market. (Market channel should be open to the farmers).
- The government and Experts should give adequate follow up to the farmers.
- Facilitation of technical assistance, continuous training, coordination among stake holders (government, farmers, NGOs e t c) should be available to the farmers.
- There must be adequate technological transfer to the beneficiary.
- Rain water harvesting intervention should not be a onetime phenomenon; instead it should be applied after the promotion of the technology, and also based on the willingness of the farmers.
- Women headed households should be supported by the concerned body that encourage them to participate and stay in the technology.

- The concerned organization should supply equipments like triddle pump, plastic sheet cement e t c, to solve the problem of farmers material shortage
- In order to be successful the government should establish responsible institution those who work around rain water harvesting in woreda level.

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APPENDIX-I

Questionnaire:

I. House hold characteristics

Information on house hold head

1. Age of house hold \_\_\_\_\_ yrs.
2. Sex of the house hold 1.Male 2.Female
3. Educational level of the house hold head
  1. Illiterate 2.Read and Wright only
  3. Elementary 4.secondary school completed
4. Marital status
  1. Married 2.widowed 3.Devorced 4.unmarried
5. Family size\_\_\_\_\_.

**II. Issues related to rain water harvesting**

**2.1 Users of rain water harvesting**

6. Who introduce rain water harvesting to you?
  1. Extension workers 2.Neghbors 3.Researchers 4.NGOs
  5. Others (specify) \_\_\_\_\_
7. Have you got any training on RWH? 1. Yes 2.No
8. If yes what kind of training have got?
  1. How to select sit location 2.how to dig pond
  3. Purpose of RWH 4. Others (specify) \_\_\_\_\_
9. For what purpose are you using rain water harvesting? (You can tick more than one)
  1. Domestic water supply 2. Livestock watering 3.for farm land
  4. For all of them 5.others (specify) \_\_\_\_\_
10. Would you tell me your convey system?  
\_\_\_\_\_
11. What kind of improvements have you seen in your economic activity after RWH? (You can tick more than one)
  1. Food security 2. Income generation 3.safe time and energy due to Domestic water supply 4.All of them
  5. Others (specify) \_\_\_\_\_

12. How do you protect collected rain water?

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13. What are the sources of run off to your RWH?

- |                              |                          |
|------------------------------|--------------------------|
| 1. Small external catchments | 2. Upstream catchments   |
| 3. Roof tops catchments      | 4. From direct rain fall |

14. What reasons forced (pushed) you to adopt RWH? (You can tick more than one)

- |                      |                                     |
|----------------------|-------------------------------------|
| 1. Shortage of water | 2. The need to produce more         |
| 3. Soil degradation  | 4. Pressure from development agents |

15. What kind of problems did you face when you start adopting RHW?

(Specify) \_\_\_\_\_

16. Does the problem still existing?

1. Yes 2. No

17. If yes, why does it still exist?

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18. Have you ever stopped practicing RWH in the past?

1. Yes 2.No

19. If yes, is your answer, **when** and **why** stopped practicing of RWH, and **how** do you return back?

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20. What was your expectation when you engaged in this technology?

---

21. Is the assistance given by the government and non governmental Organization for RWH practices adequate?

1. Yes 2. No

22. If you say yes, what kind of assistant have you got?

- |   |                     |
|---|---------------------|
| 1. Training about how to harvest rain water | 2. finicial support |
| 3. how to use the harvested water           | 4. Follow up        |

5. Others (specify) \_\_\_\_\_

23. Who is responsible to manage the harvested rain water in your area? (You Can tick more than one)

1. Community leaders? 2. Individual house holds 3. No responsible body  
4. Other (specify) \_\_\_\_\_

### **2.2 Non users of RWH**

1. Why you did not adopt rain water harvesting?

1. Lack of awareness      2. Absence of land  
3. Risky      4. Low economic status  
5. Others (specify) \_\_\_\_\_

2. Have you observed any disadvantages of RWH?

1. Yes      2. No

3. If yes what are these disadvantages?

1. Health impact   2. Accidents on human life   3 Livestock life loss  
4. Other (specify) \_\_\_\_\_

4. Can you say that RWH is the solution to water related problems?

1. Yes      2.No

5. If you say yes, what benefit do you observe on participant of RWH?

6. If No, what do you suggest as the best means of water source?

7. Are you ready start to practicing rain water harvesting?

1. Yes      2.No

8. If you say yes, why?

9. If you say NO, why?

### 2.3 For those who stopped RWH practicing

1. Do you have adequate information about rain water harvesting before you Engaged in practicing RWH?

1. Yes      2. No

2. If yes, who was your source of information?

1. The woreda bureau of agriculture   2. Extension workers  
3. Kebele officials

4. Other (specify) \_\_\_\_\_

3. If no, how do you get involved in the technology?

1. Personal initiative      2. Learn from neighbors

3. Other (specify) \_\_\_\_\_

4. Have you got any training on RWH?

1. Yes   2. No

5. If you say yes, what kind of training have you got?

1. How to select location   2. How to dig pond   3 Purpose of RWH

4. Others (specify) \_\_\_\_\_

6. What problems did you face when you practicing RWH?

1. Financial problem   2. Land shortage   3. Knowledge constrains   4. material shortage  
5. Absence of follow up

7. Other (specify) \_\_\_\_\_

8. Why did you stop rain water harvesting?

\_\_\_\_\_

9. What possible solutions would you suggest for the problems you mentioned?

Specify \_\_\_\_\_

10. If the problems corrected, would you return back to practicing RWH?

1. Yes      1. No

11. If you say no, why?

---

## APPENDIX-II

### **I. Key informant interview with the Kebele administrative officers**

1. How about the acceptance of the technology in your kebele?
2. Have you established RWH user association?
3. Who is the responsible in the selection of RWH participant HH and what are the criteria?
4. What are the major problems you face in implementing the technology?
5. In what way you give support to the HH to adopt the technology?
6. Who is responsible to give support for the implementation of the technology? And what kind of support they provide?
7. What do you say about the participation of women in management of RWH?
8. Why some of the participant of RW harvesting stopped practicing?
9. What measures have you taken to correct the problems and encouraging them to return back to practicing?

### **II. Key informant interview with the Woreda agriculture bureau**

1. What are the reasons behind the introducing of RWH?
2. Do the communities have good understanding about the benefit of the technology?
3. What are the major challenges you faced from the start up to the effectiveness of the technology?
4. How can limitations and challenges be overcome; which technology should be promoted or discouraged?
5. What is the reason behind stop practicing of RWH?
6. Who provide RWH materials for the implementation?
7. Do you have enough experts who give training in RWH for the community?
8. Can you say that RWH is the best alternative source of water for the study area?

### **III. Key informant interview with the Nongovernmental Organizations who are working to promote RWH technology**

1. When you have started in giving support in the adoption of RWH technology?
2. In what aspect you are helping the wereda about RWH?


3. What are the challenges and limitations that you faced when you perform your mission?
4. How do you see the performance of the woreda towards the implementation of RWH practices as compared to other weredas that you engaged in?
5. Do your contact with the wereda officials or with the end users?
6. What are the reasons for stop practicing among users?

**IV. Focus group discussion With Rain water User, None user and Those who stopped practicing rain water harvesting**

1. What are the challenges of rain water harvesting?

# DECLARATION

I, the undersigned, declare that the thesis is my original work, has not been presented for a degree in any other University and that all sources of material used for the thesis have been duly acknowledged.

Declared by Azalech Solomon Signature  email: azalechsol@yahoo.com

Approved by (advisor) Yohannes Abera Signature 