NATURAL RESOURCES SYSTEMS PROGRAMME

FINAL TECHNICAL REPORT[1]

ANNEX A.2

Project Number

R8088b

Project title

Improving Research Strategies to Assist Scaling-up of Pro-poor Management of Natural Resources in Semi Arid Areas. Scientific report.

Project Leader

Henry Mahoo

Organisation

Soil-Water Management Group,
Sokoine University of Agriculture

NRSP Production System

Semi-Arid

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ABBREVIATIONS

ARI	Agricultural Research Institute
ASDP	Agriculture Sector Development Programme
ASDS	Agricultural Sector Development Strategy
ASPS	Agricultural Sector Program Support
CARE	Cooperative for Assistance and Relief Everywhere
CBO	Community Based Organization
CPR	Common Pool Resources
DADP	District Agricultural Development Programme
DALDO	District Agricultural and Livestock Development Officers
DC	District Commissioner
DED	District Executive Director
DFID	Department for International Development
DRD	Department of Research for Development
FAO	Food and Agriculture Organisations
FGD	Focus Group Discussion
GIS	Geographic Information System
Ha	Hectare
HESAWA	Health, Sanitation and Water
HoDs	Heads of Departments
IFAD	International Fund for Agricultural Development
KATC	Kilimanjaro Agricultural Training Centre
KSP	Knowledge Sharing Products
MAFS	Ministry of Agriculture and Food Security
M&E	Monitoring and Evaluation
MIFIPRO	Mixed Farming Improvement Project
MPs	Members of Parliament
MRDP	Maswa Rural Development Programme
MWLD	Ministry of Water and Livestock Development
NGO	Non Governmental Organization
NRM	Natural Resources Management
NRSP	Natural Resources Systems Programme
IIRR	International Institute for Rural Reconstruction
PADEP	Participatory Agricultural Development and Empowerment Project
PIDP	Participatory Irrigation Development Project
PRSP	Poverty Reduction Strategy Paper
RBM-SIIP	River Basin Management- Smallholder Irrigation Improvement Project
R&D	Research and Development
RHAT	Rainwater Harvesting Association of Tanzania
RWH	Rainwater Harvesting
RELMA	Regional Land Management
RFA	Radio Free Africa
RTD	Radio Tanzania Dar-es-salaam
SCAPA	Soil Conservation and Agro-forestry Project Arusha
SG 2000	Sasakawa Global 2000
SNAL	Sokoine National Agricultural Library
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture
SWMnet	Soil Water Management Research Network

SWMRG	Soil-Water Management Research Group
TALP	Tanzania Agriculture and Livestock Policy
Tshs	Tanzanian Shillings
UK	United Kingdom
URT	United Republic of Tanzania
VAEO	Village Agricultural Extension Officer
VEO	Village Executive Officer
UNDP	United Nations Development Programme
WPLL	Western Pare Lowlands

1.0 INTRODUCTION

1.1 Background

Research and development (R&D) programmes are implemented to address emerging challenges that constrain agricultural development. Natural resources management (NRM) research is one of the areas that have received much attention in R&D. A number of NRM technological innovations have been produced and demonstrated in rural areas (Critchley *et al*., 1991; FAO, 1991; Tenge, 2005). Despite considerable efforts that have been made to demonstrate the importance of improved technologies to farmers, use of these technologies to improved productivity is still minimal. For example, studies in the Usambara and Pare Mountains in Tanzania indicate that soil and water conservation (SWC) practices were introduced in the1930s, yet problems of land degradation are still a major challenge in these areas. A number of social and economic factors influence adoption of improved technologies (Senkondo, *et al*., 1999; Semgalawe, 1998; Tenge, 2005). Tenge (2005) identified major factors that influence adoption of soil and water conservation (SWC) practices in West Usambara. They include among others, lack of technical knowledge to effectively implement the new practices; insecure land tenure; location of fields and lack of short term benefits from SWC. Lack of support by policy makers is said to have contributed to the failure to promote SWC measures in these areas and in similar environment (Hatibu *et al*., 2002; Tenge, 2005).

Similar observations were made in the Rufiji river basin, in Tanzania where by scientists were faced with difficulties in ensuring that well-informed solutions towards integrated water resource management were taken up by policy makers (Sokile *et al*., 2004; Lankford *et al*., 2004). This is a challenge which calls for a change in the way research projects are designed and communicated to end-users at all stages of research project implementation. Lessons can be drawn from India, where the success they have recorded in integrated water management (IWM) is due to direct government interventions in terms of providing guidelines, resources and monitoring and evaluation systems to assess impact (Samra et al., 2002). This happened because of the continued efforts by research to generate valuable technologies in NRM using participatory approaches and engaging government officials and private service providers in the whole processes right from the beginning (Grewal et al., 1995). Improving communication of research findings across a range of stakeholders in the R&D sectors would create an enabling environment to support use of information from research findings on a wider scale (Norrish, 2001).

The current practice is for researchers to disseminate research findings to farmers through the extension system. This system has produced minimum uptake due to the limited support by key stakeholders. Douthwaite *et al*., (2003) identified that low uptake of innovations is partly due to the fact that research findings often do not reach key stakeholders. Critical players in NRM other than farmers have also not been adequately addressed in the communication process. It has been realised, however, that for farmers to access, adopt and effectively utilise the knowledge from NRM research results, a lot need to be done by key stakeholders. Failure to reach stakeholders who are crucial for creating enabling environment to allow uptake of research findings by farmers contribute to low uptake of technologies from research (Ashby, 2003). Enabling environment includes policies, institutions and processes that would promote use of research products. Support is also required from key players including policy makers and planners at local and national and international levels, non-governmental organisations (NGOs), private services providers, financial institutions, manufacturers, and trade/stockists and development partners (Figure 1).

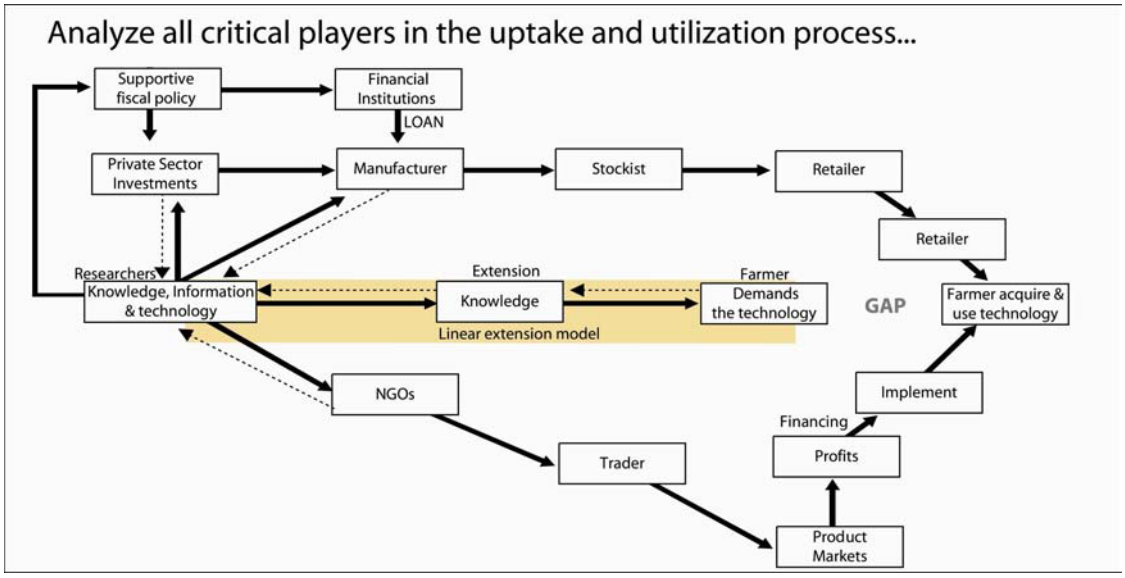

Figure 1: Key stakeholders in uptake and utilisation of knowledge (SWMnet, 2005).

Improving communication between research and key stakeholders would increase support to farmers in reducing constrains that influence negatively adoption of new innovations. Ashby (2003) advocated involvement of other key stakeholders in the communication processes who may have power to visualise and to realise the desired outcomes of interventions other than the researchers. Ashby (2003) urged researchers to recognise that due to the nature of NRM research, it takes long for outcomes and desired impact to happen. Therefore this requires continuous communication with relevant stakeholders to keep them informed of the development so that there is good environment for promoting these technologies.

1.2 Communication of research findings for change

Communication is an essential component of research and development processes in enhancing promotion and uptake of technologies. However, communication is rarely integrated into development strategies and programmes (Felsing et al., 2000). According to Rogers (2003), communication is defined as '*a process by which participants create and share information with one another in order to reach a mutual understanding*'. Rogers (2003) emphasised that communication must take place if the innovation is to spread. Deliberate efforts are therefore required to develop communication products that would create a common understanding and disseminate through a variety of channels in order to respond to information and training needs of various stakeholders in NRM (Garfoth, 1998). However, skills to package the existing body of knowledge for different stakeholders are a major limiting factor to most researchers (Start and Hovland, 2004; Lutkamu *et al*., 2005). Researchers should recognise that different stakeholder groups have specific information needs and delivery preferences (Chapman *et al.*, 2003). Identification and analysis of stakeholders' needs and delivery preference at the beginning of a research project intervention is currently missing in many research designs. This lead to limited understanding of the needs of different stakeholders and their capacity to absorb information generated by research, resulting into inappropriate and undifferentiated packaging of research products (Rogers, 2003).

Limited communication is also partly caused by the way research projects are designed. This is so because most guidelines for research projects do not demand a plan of how the research

project and its outputs will contribute to impact on the livelihoods of the targeted stakeholders. Further more research designs do not show the way research findings would be communicated and because of this shortfall, often there is an attribution gap between impacts and the contribution of research, thus making assessment of the impact of NRM research projects difficult (Douthwaite *et al* 2003). In addition, failure to communicate with all necessary players so as to build ownership of research findings lead to low appreciation for the value of research and hence limited uptake and scaling-up of research findings (Ashby, 2003). Knowledge is only valuable when it is integrated into development programmes for its effective implementation, which is basically the scaling-up process. Scaling-up is defined as the process of providing 'more benefits to more people over a wider geographical area more quickly' (IIRR, 2000 as cited by Gundel et al., 2001).

Another shortcoming in achieving impact of most research project in NRM is due to lack of M&E systems that set up baseline information needed to determine the changes that have occurred as a result of the research interventions. Where monitoring and evaluation (M&E) was carried out, the current approaches to M&E tend to assess outputs of the project within the project implementation period without necessarily linking these outputs to outcomes and impact on livelihoods. Therefore, the results from these evaluations fail to demonstrate the contribution of research to wider developmental goals of reducing food insecurity and poverty (Douthwaite *et al*., 2003). This does not mean that all research projects do not bring about changes and impact. The problem is to identify impact that can be attributed to or associated with project objectives. Moreover, research and communication processes that led to the impact are not well documented to enable its scaling-up. For example, for the past 12 years rainwater harvesting (RWH) research has been carried out in Tanzania, but it is only recently that it is receiving policy attention. RWH aspects have been incorporated in the Water Policy revised in 2004, Medium Term Plan of the National Agricultural Research System (MAFS, 2003); and RWH interventions are funded under the District Agricultural Development Plans (DADPs) in Same, Mwanga and Maswa Districts (SWMRG, 2002). However, the difficulty is to link these outcomes to the RWH research project objectives. Understanding of the processes that led to these outcomes and impact of such research will assist in scaling-up current and future research programmes in NRM.

1.3 Rainwater harvesting

This study, therefore, focused on increasing understanding of the relationship between promotion of NRM technologies and its impact on livelihoods using a case study of the rainwater harvesting (RWH) research that was conducted by the SWMRG of the Sokoine University of Agriculture. RWH is defined as the process of concentrating, collecting and storing rainwater for different uses at a later time in the same area where the rain falls, or in another area during the same or later time (Myers, 1975 as cited by Hatibu *et. al*., 1999; Frasier, 1994). RWH systems are classified in three categories based on type of use or storage, but the most commonly used classification is based on the catchment size.

The first category of RWH is on-farm systems or in-situ RWH. This is capturing of rainfall where it falls to enhance infiltration of rainwater into the soil (Mahoo, *et al* 1999). The system is accompanied with cultural practices such as deep tillage, ridging and mulching to ensure that crops make the most effective use of the scarce water. The second category of RWH is micro-catchment system that involves a distinct division of catchment area (CA) which generates run-off, and cultivated basin (CB) where the run-off is concentrated, stored and productively used by plants but adjacent to each other (Gowing *et al*., 1999). The major techniques of RWH in this system include pitting, strip catchment tillage, contour bunds and

semi-circular bunds. Micro catchment systems have a high potential for combining soil with water conservation. The third category is macro-catchment RWH and is characterized by having large catchments. The systems include intermediate components for collecting, transferring and storing the runoff. In the semi arid areas, RWH has increased farm yields two fold, raised household incomes and improved food security (Hatibu *et al*., 1999; Senkondo *et al*., 1999). Under different RWH systems, maize yields were reported to have increased up to 3,240 kg/ha in Same and Mwanga in the 2000/2001 season while in Maswa, paddy yields increased up to 3,228 kg/ha during the same season. Average maize yield without rainwater harvesting was 268 kg/ha and paddy was less than 1000 kg/ha. Apart from field crops RWH was also used for production of high value crops such as vegetables.

The case study tracked the RWH research and communication processes in order to understand what worked well and what did not work, and what needs to be improved. The research objectives of this study are as stated in the next section

1.4 Research objectives

The main objective of the study was to improve research strategies to assist scaling-up of pro-poor management of natural resources in semi arid areas. The specific objectives of the study were to:

1. Assess the interactions between the livelihood capitals and the institutions and processes of research and communication for RWH systems.
2. Develop better understanding of the efficacy of communication methods and media products for stakeholders across a range of levels and R & D sectors.
3. Establish and test best combination of methods for tracking RWH research processes, outputs and outcomes.
4. Elaborate and promote research and communication process for ensuring RWH research and, in a wider context, NRM research that can lead to positive outcomes and impact with target organisations at national and international levels.

In pursuit of these specific objectives the following overarching research questions were formulated to guide the research process:

i. Which forms of information on RWH are most useful for different types of stakeholders?
ii. What constrains and/or facilitates the use of information on RWH for different stakeholders?
iii. What is the relationship between the promotion of RWH and farmers' livelihoods?
iv. What constrains and/or facilitates the adoption of RWH for different categories of farmer?
v. What are the equity implications of the adoption of RWH technology?

Research questions (i) and (ii) are addressing specific objective (2) while research questions (iii), (iv) and (v) are addressing specific objective (1). Results of the specific objective 1 and 2 are used to answer specific objective (3). Design and implementation of the communication plans addresses specific objective 4. The presentation of the results follows the sequence of the research questions as discussed in the subsequent chapters.

2.0 METHODOLOGY

2.1 The study sites

Past and on-going research activities in RWH by the Soil Water Management Research Group (SWMRG) were conducted in three districts: Maswa, Mwanga and Same. These three districts constituted the main study sites, which are referred to as Lake Zone (Maswa) and Western Pare Lowlands (WPLL), for Mwanga and Same in the Northern Zone (Figure 2). The three districts, that is, Maswa, Mwanga and Same are referred to as target districts in the analysis. The other eight districts (that have the potential for utilising RWH knowledge) were included in the study and are referred to as non-target district. These include: - Misungwi, Kwimba, Bariadi, Shinyanga in the Lake Zone, and Rombo, Hai, Moshi and Handeni in the Northern Zone. The aim of discussing with district leaders in non-target district was to establish the spread and extent of use of information on RWH and its potential beyond the target districts.

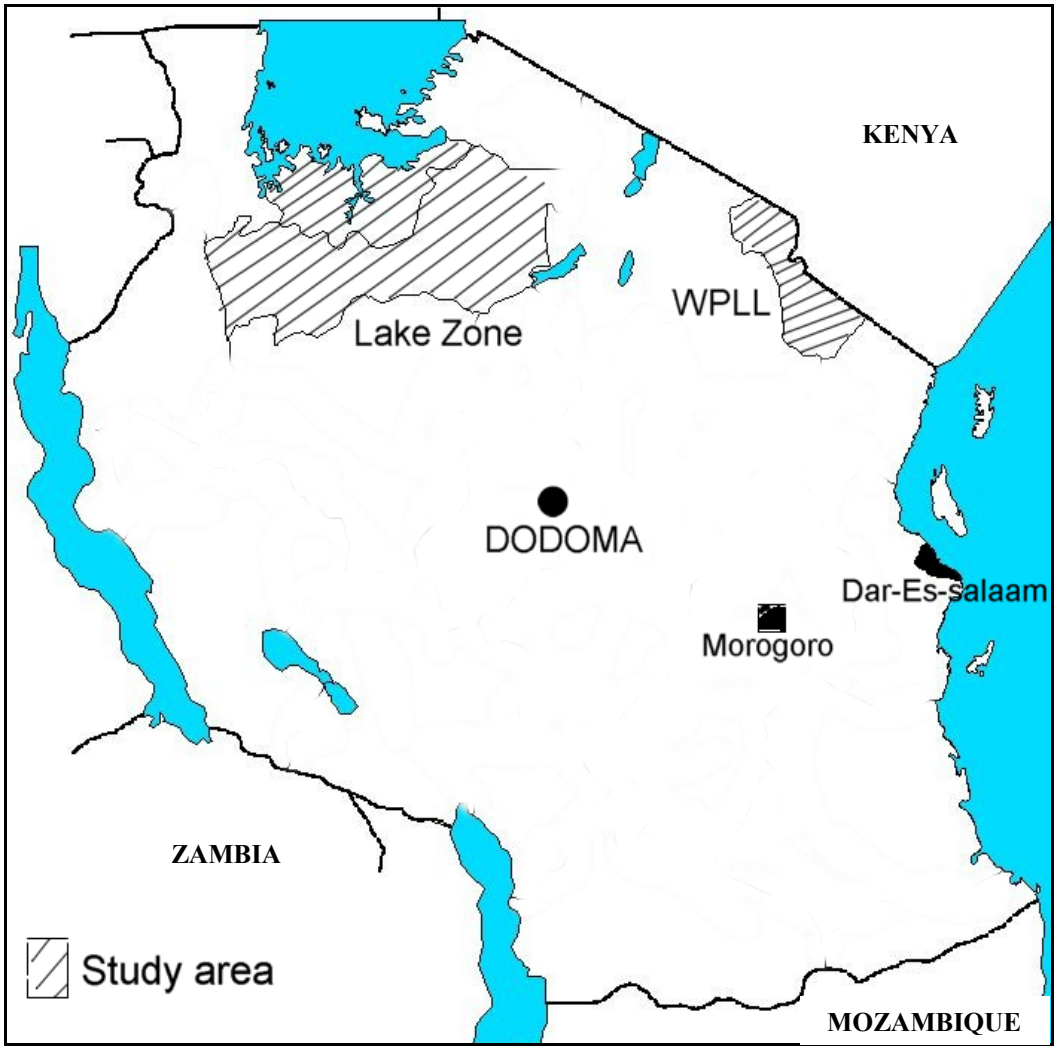

Figure 2: Map of Tanzania showing location of the research sites

At the Ministry's headquarters (MAFC) and SUA, discussions and interviews with researchers and policy makers were conducted in order to understand the way information about research findings are communicated to them, and the factors that facilitate and/or constrain use of information.

(i) The Lake Zone

The semi arid areas of the Lake Zone are mostly located to the south of Lake Victoria. Past research work in this zone was conducted in Maswa in Shinyanga Region and Misungwi and Kwimba Districts in Mwanza Region. These areas receive a total annual rainfall ranging from 650mm to 1000 mm. The rainfall pattern is bimodal, where the first rains start from October to December, followed by a dry spell between January and February. The second rains start from March to May and the period from May to October is dry.

The major livelihood support systems consists of agricultural and livestock production. Up to the 1980s, the production emphasis was on cotton and other drought resistant crops like sorghum and millets. However, in recent years, farmers' preferences have shifted in favour of maize and paddy as food and cash crops. Rice cropping system is based on RWH techniques involving excavated bunded fields locally known as *majaluba*. Other crops grown include beans, cowpeas, cassava, green gram, sweet potato, chickpeas, bambara nuts and pigeon peas. Major cash crops include cotton, paddy, and groundnuts. Vegetables and fruits grown include tomatoes, cabbages, amaranths, onions, mangoes, oranges and pawpaw and watermelon..

(ii) Western Pare Lowlands

Mwanga and Same districts are characterised by two agro-ecological zones, namely, the highlands and lowlands. The highlands form part of Pare Mountains, which are located south of Mt. Kilimanjaro between 600 and 2,424 metres above mean sea level. The western side of the mountains is the leeward side and receive low rainfall. The rainfall pattern is bimodal and entails short and long seasons. The short rainy season (locally called *Vuli*) start in November to January and the long rainy season (locally called *Masika*) start in March and extend to May. Annual rainfall is in the range of 400 to 800 mm. The potential evapo-transpiration is over 2,000 mm per year (SWMRG, 2001). The lowlands fall within the Maasai steppe agro-ecological zone, which is characterized by rolling plains with reddish sandy clay soils of relatively low fertility formed on basement complex rocks.

Frequent drought hitting the area prompted the government to promote drought resistant crops such as sorghum and cassava as a way to enhance food security. However, there is a lot of resistance from farmers in favour of maize. With increasing use of RWH farmers are producing maize as a common staple crop. Other food crops grown include lablab, beans, cowpeas, sweet potatoes, green gram and bananas. Cash crops are mainly oil seeds such as groundnuts and sunflower. Other cash crops include cotton, castor, sugarcane, pigeon peas, green gram and coconuts. Common vegetables grown are tomatoes, cabbage and onions.

2.2 Research design

The methods used to collect data at village, district and national levels included focus group discussions, community and resources mapping, key informant discussions, household interviews, consultations and workshops. At village level the methods used included key informant interviews, focus group discussions (FDGs), community mapping and natural resource mapping. At district level consultations were held with subject matter specialists in the DALDOs office and other district officials. Interviews using semi-structured questionnaire were conducted to district officials. At national level consultation, interviews and workshops were used.

A total of 12 villages were covered in the study. These included Bukangilija, Shishiyu, Lali and Buyubi in Maswa district; Kwanyange, Kifaru, Lembeni and Kisangiro in Mwanga district and Kavambughu, Hedaru, Mwembe and Bangalala villages in Same district. A multi-

stage sampling of households to be interviewed was conducted. First, the households were stratified based on whether they received training on RWH or not. Secondly, using community mapping methods, households were categorised according to their food security status, which was used as a proxy indicator for increased production as a result of practicing RWH. Therefore households were stratified into those perceived to be food secure and food insecure households. Thirdly, the male and female headed households were drawn from the list of households to ensure gender inclusion. The sampling procedure used is depicted in Figure 3.

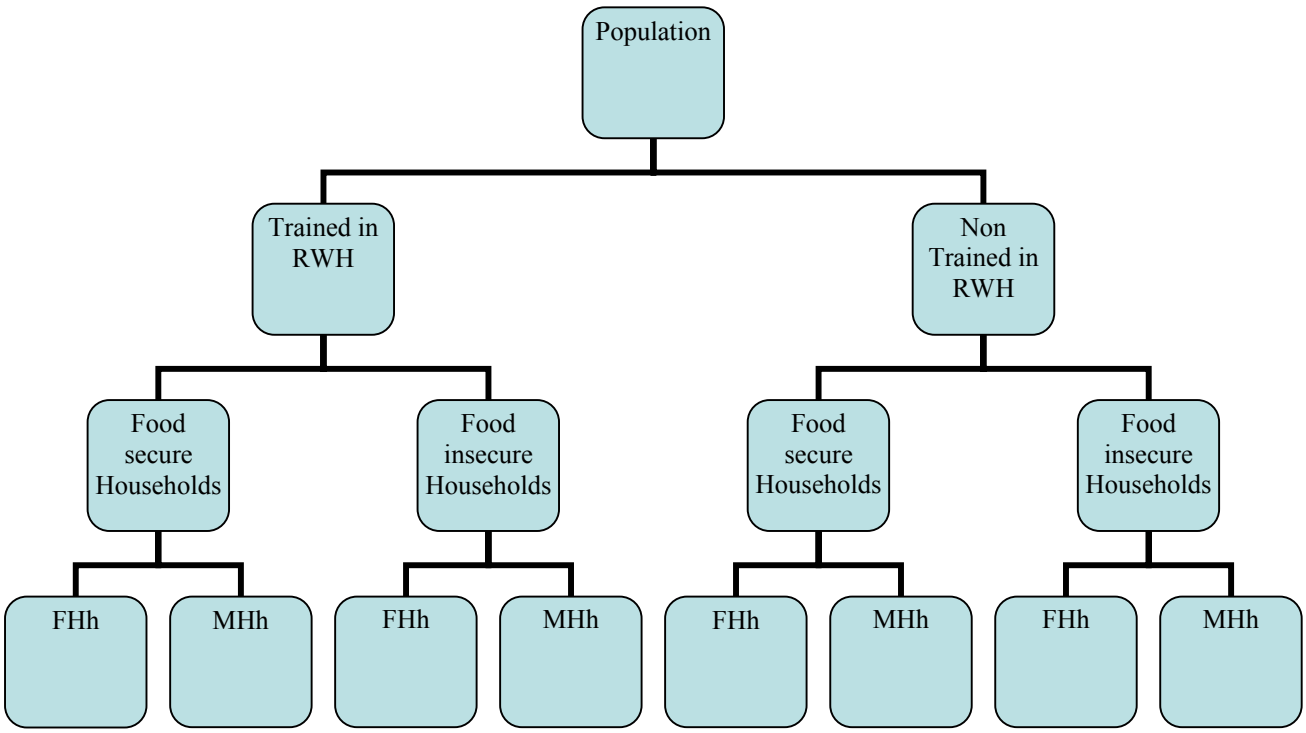

Figure 3: Sampling procedure
FHh = Female headed households, MHh = Male headed households

The head of households were targeted because it was expected these would provide households information such as decision to adopt a technology or not. The major limitation of this approach is that, it may not be able to reveal intra-households dynamics. However, the focus of this research was to study the processes in research and communication between researchers and stakeholders. At farm level the stakeholders were households' heads who were mostly targeted for RWH training.

Out of the population of 4,776 households listed in the 12 villages, 5 to 10 percent of the households were drawn to constitute the study sample. A total sample of 377 households was interviewed which include 118 trained and 259 non-trained farmers (Table 1). Trained farmers are those farmers who attended more than one-day training on RWH conducted by SWMRG, District Councils and/or projects. The list of purposively selected trained farmers was obtained from district, village and project offices. For the non-trained farmers, sampling was done at village level. The concept of training of farmers was the cornerstone for tracking the impact of RWH research and communication processes. Therefore, the 'with' (trained) and 'without' (non-trained) concept was used throughout the analysis.

Limitation of the method used

The 'with' (trained) and 'without' (non-trained) scenario requires that the project to have a set of households that are similar or very close in terms of food security status and assets ownership, but only differ in knowledge and practicing RWH. The major assumption in this approach is that before training farmers were similar in terms of food security status and assets ownership, which may not be the case.

Table 1: Composition of the respondents at farmers' level

Composition of respondents		**Maswa (n=146)**	**Mwanga (n=115)**	**Same (n=116)**	**Total (n=377)**
		%	**%**	**%**	**%**
Training on RWH	Trained	8	12	13	31
	Non Trained	31	19	18	69
	Total	39	31	31	100
Household food security	Food secured	25	21	23	69
	Not food secured	14	10	8	31
	Total	39	31	31	100
Gender	Men	28	19	23	69
	Women	11	12	8	31
	Total	39	31	31	100

In order to guide data collection, a field manual (Annex C4) was prepared. In the field manual, the process for data collection was elaborated and a checklist and questionnaire for collecting information at all levels were included. The household survey was conducted in November to December 2004.

Six enumerators were recruited and trained to understand the processes to be carried out using the field manual. Pre-testing of the field manual was carried out in Mwabayanda village in Maswa district, where the research team practiced the whole process of data collection as stipulated in the field manual. Mwabayanda village was selected because it was previously involved in the past research by SWMRG and there were a number of farmers who received training on RWH. Necessary adjustments in the checklists and household questionnaire were done before the actual survey was conducted. During training it was realised that some enumerators could not handle participatory processes like focus group discussions on their own. This led to changes in the programme whereby the principal investigators had to be present in all villages to provide the required backstopping during discussion with farmers. The team did not split as envisaged at the planning stage; instead they worked in one village at a time.

2.3 Secondary data collection

Literature review was carried out and involved the review of several policy and strategy documents, and research guidelines. The aim was to gain insight into policies on NRM and the pathways through which policies were received and implemented. Policy documents and information were collected from institutions including the Directorate of Research and Development (DRD) in the Ministry of Agriculture, Food and Cooperatives (MAFC), Sokoine National Agricultural Library (SNAL), The Directorate for Research and Post Graduate Studies and projects such as the Tanzania Agricultural Research Project II and Agricultural Sector Development Programme (URT, 2003). Other national policy and

strategy documents reviewed included the PRSP (URT, 2000) and the National Strategy for Growth and Reduction of Poverty (URT, 2005) and the Water Policy (URT, 2000).

2.4 Primary data collection

2.4.1 At village level

Activities carried out included meeting and discussing with the village leadership, that is, the Village Chairman, Village Executive Officers, Sub-village leaders, members of various development committees in the villages and the Village Agricultural Extension Officers (VAEOs). The FGDs were conducted in all the 12 villages including community mapping, assessment of the communication aspects with trained farmers, sharing and use of information by farmers and natural resource inventory and mapping. The composition of the participants is summarised in Table 2.

Table 2: Composition of FGD participants by gender

Focus Groups	No. of discussions	No. of Participants		
		Men	Women	Total
Village leaders	12	92	28	120
Community mapping	12	204	122	326
Trained farmers	12	112	48	156
Non-trained farmers	12	68	59	127
Natural resource inventory and mapping	12	32	22	54

Community mapping
This activity was also carried out in all the 12 villages. The aim was to assess household food security status and assets accumulation and establish the number of farmers who received training on RWH. A checklist was used (Appendix 1). The groups agreed on the criteria to be used to assess household's food security status and livestock ownership status. The criteria is summarised in Table 3.

A village map was drawn by the farmers. Elderly men and women farmers assisted. These were regarded to know very well the village boundaries. Maps were presented to the whole group to agree on the village and sub-village boundaries (Plate 1). The group was then divided into smaller groups of representatives from each sub-village (Plate 2). The subgroups, with reference to the village map, drew the sub-village map. Sub-village groups located each household on the map to make sure that they recognised all households.

The group then assessed the food security status of each household using the agreed criteria. They also indicated the status of livestock ownership. The results for each household were recorded in a card prepared by the research team using registers, which were available in all sub-villages. After sub-village group discussions, there was a plenary session whereby the whole group shared the results and provided an opportunity for feedback to the village leaders who led the process. Thereafter, a list of households to be interviewed were drawn and given to the sub-village leaders for setting appointments with the selected heads of household. Interviews were conducted on the agreed date. Interviews were held at their homesteads, which helped to confirm some of the information provided.

Table 3: Criteria for categorising household based on food security status

Criteria for categorising households perceived to be food secure	Criteria for categorising households perceived to be food insecure
i. Cultivating large farm land (more than 1.5 ha) ii. Practice RWH systems iii. Hard working farmers who practice good farming (use FYM, plough, weeding) iv. Educated (at least primary school education) v. One or more member of the family is a salaried employee vi. Own business vii. Own livestock viii. Access to irrigation water e.g. *ndiva*[2] ix. Grow drought resistant varieties x. Have food storage facilities xi. Cultivate cash crops xii. Healthy family members xiii. Own irrigation facilities e.g. a pump xiv. Own farm implements such as plough/oxcarts	i. Own small farm land (1/2 ha located in marginal area) ii. Households not practicing good farming practices iii. No enough labour force due to very old age, disabled, long illness or orphans iv. Use of only hand hoe v. Not practicing RHW techniques vi. Lazy people or drunkards vii. Persistent casual labourers viii. Do not own livestock (not even chicken) ix. Farmers practicing *kitang'ang'a*[3]

Natural resource inventory mapping

Focus group discussions were carried out in all the 12 villages. The aim was to identify and assess available natural and physical assets that were important for RWH and their current status. A checklist was used (Appendix 2). A group of at least four to six farmers, men and women who knew the boundaries and natural resource features in the village participated in this discussion. Farmers with facilitation from the research team drew a village map and indicated on these maps what and where different assets were located. They further discussed about their potential for RWH and established extent of use/non-use of RWH technologies and where they were not used the reasons were given. Resources included in the maps were both natural and physical and included ephemeral rivers, gullies, culverts and houses (roofed with corrugated iron sheets). The group then visited some of the sites to see the features and discussions continued to clarify some of the issues. With facilitation from the research team, participants revisited the maps to include other information disclosed by the field visits.

Discussion with farmers who were trained on RWH

From the lists of households, farmers who received training on RWH were requested to participate in FGDs. Guided by a checklist (Appendix 3), participants provided information on experiences in using knowledge on RWH from research, and how it was linked to their indigenous knowledge and its usefulness in farming. Farmers were also asked to mention peers whom they shared information with after the training, benefits and impact of practicing RWH and challenges faced in using the knowledge received.

Farmers listed methods and media to communicate information on RWH. Using pair-wise matrix, farmers ranked the methods and media used to indicate their preferences and accessibility and assessed the effectiveness of the communication processes. In some cases farmers visited the fields to see actual RWH systems practiced and problem faced by farmers (Plate 3, Plate 4, Plate 5 and Plate 6).

[2] *Ndiva* is a storage pond

[3] *Kitang'ang'a* is a practice whereby farmers do not plough land, they dig holes to plant maize and carry out weeding so early. The practice is common in WPLL.

	
Plate 1: FGD participant presenting a map	Plate 2: Community mapping exercise in Mwembe
	
Plate 3: Tree planting using RWH at Bangalala village	Plate 4: Roof-top RWH with a storage structure in Bangalala village
	
Plate 5: Maize field under RWH at Mwembe village	Plate 6: Widening gullies at Kifaru village limit RWH

Discussions with farmers who did not receive training on RWH

FGDs were also held with non-trained farmers in all the 12 villages. The aim was to assess their understanding of RWH and whether they received information from trained farmers and the way they practice improved RWH systems thereafter. Information was also collected to establish use of resources with a specific focus on livelihood capitals that were required for practicing RWH technologies. The livelihood capitals are human, natural, physical, financial

and social capital as described in the field manual. They also discussed factors that facilitated and/or constrained use of information and adoption. A checklist was used (Appendix 4).

Household survey
Most of the trained and non-trained heads of households were interviewed at their homesteads using a questionnaire (Appendix 5). In few cases, however, interviewees were interviewed at their farm fields. A total of 146 households were interviewed in Maswa, and 115 and 116 in Mwanga and Same district, respectively using a questionnaire. Table 4 shows the composition and number of households interviewed in each village.

Village Agricultural Extension Officers surveys
Seventeen VAEOs working in the target villages and those who received training on RWH were interviewed using a semi-structured questionnaire (Appendix 5).

2.4.2 District level interviews

At the District level, the host institution was the District Agricultural and Livestock Development Office (DALDOs). The District leaders interviewed included District Commissioners (DCs in Maswa, Bariadi, Misungwi and Mwanga) and District Executive Directors (DEDs in Maswa, Shinyanga, Hai, Rombo, Moshi, Handeni and Same). Heads of Departments (HoDs) for agriculture & livestock, water, community development, land-use and natural resources, sectors related to management and utilisation of land and water resources. Councillors in Maswa, Mwanga and Same districts were sensitized through workshops so that they could assist in the promotion of RWH technologies in their respective capacities and areas. In Maswa, Mwanga and Same districts, Councillors were interviewed using a semi-structured questionnaire (Appendix 7). Discussions were also held with extension officers who were trained on RWH and were involved in the promotion of RWH.

Other leaders included the Coordinators for Projects and NGOs involved in water resources management. In Maswa, the Project Coordinator for an IFAD-funded Participatory Irrigation Development Project (which is mainly involved in promotion of small irrigation projects using RWH systems) was consulted. In WPLL, coordinators for the Mixed Farming Promotion Project (MIFIPRO) and Same Agricultural Improvement Project (SAIPRO) were also contacted. In Maswa the research team visited a radio station known as SIBUKA FM. Discussions focused on understanding the role and potential of local radios in uptake promotion of technologies in agriculture.

2.4.3 Interviews with researchers at zonal research level

In data collection at Zonal research level, focus group discussions and interviews using semi-structured questionnaire (Appendix 8) were used. Data was collected in three research zones, namely: ARI Ukiriguru, ARI Selian and Mlingano National Soil Services Centre. Additional data and feedback was obtained during paper presentation at the East Africa River Basin conference held at SUA in March 2005. Further comments were also collected at the Training of Trainers' course held at SUA from 29th August to 2nd September 2005.

Discussions with researchers
Discussions were held in ARI Ukiriguru with a team of 11 scientists and at ARI Selian where 18 scientists participated. The aim of these discussions was to understand the processes while conducting natural resources management research. Typology of the researchers who participated in the discussions is as summarised in Table 8.

Semi-structured interviews for researchers
A total of 31 researchers were requested to respond to the semi-structured questionnaire at ARI Ukiriguru (10), ARI Selian (11) and Mlingano National Soil Services Research Centre (10). The research team also conducted face-to-face interviews with researchers.

Workshops with researchers
Additional responses were collected during the East Africa River Basin Management Conference, where a paper was presented to share results from the field and preliminary findings on communication constraints and barriers. Furthermore, comments were collected during the professional development course on Training of Trainers Course in Communication and Knowledge Management conducted at SUA in October 2005. Research findings were shared with participants to appreciate the extent of the problem of communication of research findings from NRM and other research programmes. This stimulated discussion, which enriched understanding of the constraints to communication among the participants.

2.4.4 Interviews with policy makers and research managers

Methods used to collect data at national level were consultations and semi-structured interviews. A total of 25 respondents were interviewed at MAFC headquarters and Sokoine University of Agriculture. In this study, policy makers refer to Directors and Head of departments at the Ministerial level and research managers refers to directors of research at Zonal level. Most of the policy makers and research managers started as researchers or trainers in research stations and agricultural colleges. Some research managers and policy makers are involved to a limited extent in conducting research.

Consultation workshop with policy makers
The consultation with national level policy makers was carried out through a workshop conducted in April 2004 in the Ministry of Agriculture, Food and Cooperatives (MAFC). The aim was to sensitize and inform them about the potential of RWH in improving rainfed agriculture. High level staff of the MAFC attended the meeting. These included the Director for Irrigation and Technical Services, Director for Research and Development, Director for Crop Development, Director for Training and Senior officers from the Policy and Planning department. There were also Assistant Directors responsible for promotion of irrigation and technical services.

Interviews for policy makers
A semi-structured questionnaire was used during interviews with research managers and policy makers (Appendix 9). The aim was to get information on policy issues and sources of information used to review and reformulate policies on NRM. These were selected based on their involvement in providing guidance in NRM research and development.

2.5 Data analysis

Respondents were stratified into trained and non trained farmers as previously explained. This formed the basis of data analysis. However, in few cases where necessary, analysis was done to compare the three districts. In other cases like equity issues, livelihood capitals such as labour and training, analyses were done based on gender. Household survey data was entered into Statistical Package for Social Sciences (SPSS) and analysed. Descriptive and quantitative analyses were used on key variables. In these analyses, means, frequencies,

percentages, cross tabulations and graphics were used to present analytical results. In principle the quantitative analyses are based on the data collected through questionnaire survey.

The information collected through qualitative process such as FGDs were summarised in debriefing documents, coded and entered into SPSS and analysed to give the qualitative description of information.

3.0 RESULTS AND DISCUSSIONS

3.1 Characteristics of the respondents

The respondents included farmers, village agricultural extension officers, district level officials, researchers and policy makers at national level. The characteristics of these respondents are briefly reported in the following sections

3.1.1 Households Characteristics

Farmers' characteristics have an influence on access to and use of RWH information. Important characteristics considered were age, education level, family size and land holdings. Elderly farmers may have access to resources like land compared to young farmers. Likewise, education levels can influence access and use of information on RWH technologies. These are briefly discussed in the following sections.

Age

Age distribution of the respondents according to status of training and gender is shown in Table 4. Seventeen percent (17%) of the young male headed households and 12% of young female headed households received training. This indicates that few women and young farmers got an opportunity for training compared to middle aged and elder farmers. This differential access to RWH information may be attributed to the fact that it is difficult for women farmers to attend training conducted outside their villages for a long time as they are tied up with household chores. From focus group discussions, it was noted that young farmers had limited access to potential land for RWH and thus not involved in farming. However, they acknowledged that young farmers, when trained, they utilised the knowledge received more effectively. They are stronger and can mobilise their labour to engage in activities like construction of contours bunds and terraces, which required physical strength to implement.

Table 4: Age of responding households by gender and status of training

Age groups of heads of hhs (yrs)	Male Headed Households (n=259)		Female Headed Households (n=118)	
	Trained	Non-trained	Trained	Non-trained
	%	%	%	%
- 18 to 35 years	17	32	12	23
- 35 to 50 years	39	35	54	33
- 50 to 65 years	36	16	31	23
- More than 65	9	18	4	21

Source: Household questionnaire survey

Education level

The research results presented in Table 5 show that on average most of the households head (73%) had primary education. Only 5% had secondary education, and 1% received tertiary education.

Table 5: Education level of Head of households by districts

Education level	Maswa (n=146)	Mwanga (n=115)	Same (n=116)	Total (n=377)
	%	%	%	%
No education	38	16	5	21
Primary	58	74	91	73
Secondary	3	10	3	5
Tertiary	1	0	0	1

Source: Household questionnaire survey

However, 21% of all head of households did not get primary education although in Maswa district there were more heads of households (38%) with no formal education compared to Mwanga (16%) and Same (5%) districts. This has implication on the choice of information delivery methods. While printed messages may be suitable for WPLL, in Maswa face-to-face methods could be the best option in conveying RWH information. This may guide researchers and extension agencies to select delivery methods and media to effectively deliver best management practices information to other key stakeholders.

Family size

Table 6 shows percentage of households with number of adults and children in the household. A total of 73% of the male headed households and 54% of women headed households had between 2 to 3 adults. In addition, 79% and 86% of the male headed households (MHh) and female headed households (FHh) had 1-5 children. During focus group discussions, one of the criteria for characterising a household that was food insecure was the total number of children in the households. This has implication of labour availability and food requirement as will be discussed in section 3.4.

Table 6: Household size

Number of people	Male Headed Hhs (n=259)	Female Headed Hhs (n=118)	Total (n=377)
	%	%	%
(a) Number of adults (above 18yrs old)			
1 adult	5	31	14
2 to 3 adults	73	54	66
More than 3 adults	22	15	20
Total	100	100	100
(b) Number of children			
1 to 5 children	79	86	79
6 to 10 children	18	14	17
More than 10 children	2	0	4
Total	100	100	100

Source: Household questionnaire survey

Land holdings

All heads of households interviewed had access to land for cultivation. Assessment was done to compare size of land holdings by district to show the site specific differences. Results in Table 7 show that the number of fields varied from one hectare to more than five hectares. The size of farms also varied, where 54%, 50% and 53% of respondents in Maswa, Mwanga and Same respectively cultivate between 1 and 3 ha (Table 7). Generally there is land shortage in Same and Mwanga districts in WPLL compared to Maswa district (SWMRG, 1994). This study also shows that 33% and 24% of farmers in WPLL cultivate less than one hectare, compared to 10 percent of respondents in Maswa district.

Table 7: Cultivated land holding by district

Area cultivated	Maswa (n=146)	Mwanga (n=115)	Same (n=116)	Total (n=377)
	%	%	%	%
Less than 1 ha	10	33	24	21
More than 1 but less than 3 ha	54	50	53	53
More than 3 but less than 5 ha	23	12	15	17
More than 5 ha	12	5	8	9

Source: Household questionnaire survey

3.1.2 Characteristics of Village Agricultural Extension Officers

Seventeen Village Agricultural Extension Officers (VAEOs) were interviewed. Out of the 17, four were women and 13 were men extension staff. Fourteen VAEOs were diploma holders while three were Certificate holders (Table 8). Out of the 17 VAEOS, 9 were trained in agriculture and 5 in livestock production. Other specialisations, such as, irrigation, horticulture and Range management had one specialist each. However, all VAEOs had more than 15 years of experience in the field. Table 8 shows the VAEOs characteristics.

Table 8: Characteristics of VAEOs

Characteristics		Districts			
		Maswa (n=4)	Mwanga (n=9)	Same (n=4)	Total (n=17)
		Count	Count	Count	Count
Sex	Male	4	7	2	13
	Female	0	2	2	4
Qualification	Certificate	2	1	0	3
	Diploma	2	8	4	14
Specialisation	Agriculture	3	3	3	9
	Livestock	1	4	0	5
	Irrigation	0	1	0	1
	Range management	0	1	0	1
	Horticulture	0	0	1	1
Years of experience	>10	1	0	0	1
	Nov-15	3	3	1	7
	16-20	0	2	1	3
	21-25	0	0	0	0
	26-30	0	2	1	3
	31-35	0	2	1	3

3.1.3 Characteristics of the District level officials

The study team reached a total of 72 district officials including four District Commissioners, District Executive Directors, Councillors and Heads of Departments involved in natural resources management (Table 9). It should be noted that the final data from district officials summarised in this study exclude one respondent, a new DC for Mwanga district, who did not respond to certain issues in the questionnaire. The results in Table 9 show that male respondents dominated the district level officials. All the DCs, and DEDs are appointees of the President while most of the HoDs are appointed by the Minister responsible. These results show some kind of gender imbalance in the appointments.

Table 9: Characteristics of the District level Respondents

District	Designation				Gender		Total
	DC	DED	HoDs	Councillors	Male	Female	
Maswa	1	1	7	8	15	2	17
Kwimba	-	-	8	-	7	1	8
Misungwi	1	-	5	-	6	-	6
Bariadi	1	1	5	-	6	-	6
Shinyanga	-	1	2	-	3	-	3
Same	-	-	1	10	9	2	11
Mwanga	1	-	1	7	6	2	9
Rombo	-	1	3	-	3	1	4
Moshi	-	1	3	-	2	2	4
Hai	-	1	-	-	1	-	1
Handeni	-	1	2	-	3	-	3
Total	4	7	37	25	62	10	72

3.1.4 Researchers and Policy Makers at zonal level

A total of 31 researchers from ARI Ukiriguru, Selian and Mlingano responded to the questionnaire at zonal level. The typology of the respondents is presented in Table 10. The results indicate that about 72% of the respondents were male while 28% were female.

Table 10: Typology of researchers who participated in the discussions

Position/Specialisation	Selian	Ukiruguru	Total	Gender	
				Men	Women
Zonal Director	-	1	1	1	-
Zonal Research Coordinator	1	1	2	2	-
Soil scientists	4	1	5	4	1
Agronomists	5	3	8	4	4
Livestock scientists	5	2	7	5	2
Meteorologists	1	-	1	1	
Plant breeders	1	1	2	1	1
Research Extension Liaison	1	2	3	3	-
Total	18	11	29	21	8

3.1.5 National level research managers and policy makers

At policy level, 25 respondents were interviewed using a semi-structured questionnaire (Table 11). These respondents included Directors and Assistant Directors of different department in the Ministry of Agriculture Food and Cooperatives, Research Managers and executives from SUA and other research institutions.

Table 11: Typology of national level research managers and policy makers

Institution	Number of respondents (Total = 25)
Ministry of Agriculture	13
Sokoine University of Agriculture	7
Other (NEMC, TAFORI, COSTEC, DDCA)	5
Role and responsibility	
Research managers	6
Policy makers	10
Both	9
Gender	
Male	23
Female	2

3.2 Efficacy of communication methods and media products

The communication methods and media used to disseminate research findings included training, meetings, demonstration plots, printed materials (such as leaflets, scientific reports and papers), field days, field visits and lobbying and advocacy. Interactive methods such as training, direct contact with VAEOs and researchers and discussions in the farmers groups were found to be the most effective form of receiving information and mostly preferred by farmers compared with written methods.

In trying to explore the factors that facilitated and/or constrained the use of RWH information by different stakeholders, the analysis looked at the following key stakeholders: -farmers, and VAEOs. At district level, use of RWH was assessed by looking at the ways information was incorporated in the district agricultural development plans (DADPs). At national level, research managers and policy makers were targeted and the assessment was made based on the contents of the policy documents and programme contents and the policy maker's perception on the uptake and promotion of research findings from RWH research. Detailed results are discussed in the following sections.

3.2.1 Communication of RWH information at Farmers level

(a) Methods and media used to communicate RWH information to farmers

Farmers received information through different communication methods and media as shown in Table 12. Farmers received information about RWH through interactive methods such as meetings, contacts with extension agents, farmers' group discussions and training. Farmers indicated that interactive methods were more effective in delivering information from research. A total of 118 (31%) heads of households received training on improved RWH techniques.

Table 12: Responses (multiple) on methods and media of information dissemination on improved RWH techniques

Methods and media of information dissemination	Trained farmers (n=118)	Non-trained farmers (n=259)	Total (n=377)
Methods	%	%	%
Meetings	65	51	55
Contact with Extension agents	72	38	49
Farmers groups	61	24	36
Training by SWMRG & Partners	100	-	31
Exchange visits	46	5	18
On-farm trials/demonstrations	46	5	18
Media			
Radio	72	44	53
Magazine	19	5	9
Booklets	24	3	9
Leaflets	18	3	7

Source: Household questionnaire survey

Study visits and demonstrations were used to a limited extent. In some cases, for example, Lembeni village, in the WPLL, on-farm trials and demonstrations could not be differentiated, but led to more understanding of the RWH techniques, which influenced uptake.

Radio was the medium in which a large proportion of farmers (53%) received information on RWH compared to printed media such as leaflets. During focus group discussions (FGDs), farmers informed that meetings conducted by village leaders and development agents helped to create awareness on RWH over a wide audience. This prompted farmers who wanted more information to contact extension agents for details. The results in Table 11 also show that trained farmers had more contact with extension agents (72%) compared to non-trained

farmers. This indicates that after gaining some knowledge farmers went to seek more information to implement the technologies. The difference is also revealed on the media of information and dissemination where more of trained farmers (72%) listened to radio compared to 44% of non-trained farmers.

During the FGDs, trained farmers revealed that printed materials were provided during training sessions, thus making them have more access to information. On the other hand, discussions with non-trained farmers indicated that they did not have access to printed materials and even when available some of the printed materials were not very clear and that they needed support of extension agents to clarify. This implies that interaction with extension agents is still important even when you have printed materials aimed at enhancing the understanding and uptake of information.

Trained farmers in the entire three districts indicated that the training sessions conducted covered many aspects of RWH and provided more hands-on skills. The aspects covered include techniques like deep tillage, contouring, ridging, terracing, tie-ridges, use of mulch, and digging pit-holes. Other techniques included rooftop rainwater harvesting, construction of storage tanks, digging of small charco-dams, diverting water from rangelands, culverts, gullies and ephemeral rivers; and construction of improved excavated bunds for paddy production. During the training sessions, participants were given an opportunity to visit some farmers who were already practicing RWH. This enabled farmers to learn by doing and seeing. Sometimes the training included field demonstrations conducted by researchers and VAEOs to demonstrate some of the RWH systems in the fields. The only limitation was that sometimes a training was provided only once and there was no opportunity for providing feedback to trainers of the difficulties faced in the implementation. In some cases, there were no VAEOs to provided support during implementation. This posed a serious challenge and a lesson too, in that promotion of technologies should not end with the dissemination of information without a follow up. Researchers and extension officers have the responsibility to ensure that information is useful.

(b) Preference on the type of communication media and delivery methods

Responses from the questionnaires indicated that a large proportion of farmers appreciated the usefulness of messages received through different media and methods. However, one of their major concerns was their inability to access the preferred methods and media. The preferred methods and media did not reach farmers. During FGDs farmers were asked to indicate preferences and accessibility of methods and media in order to assess their effectiveness. The results are shown in Figure 4.

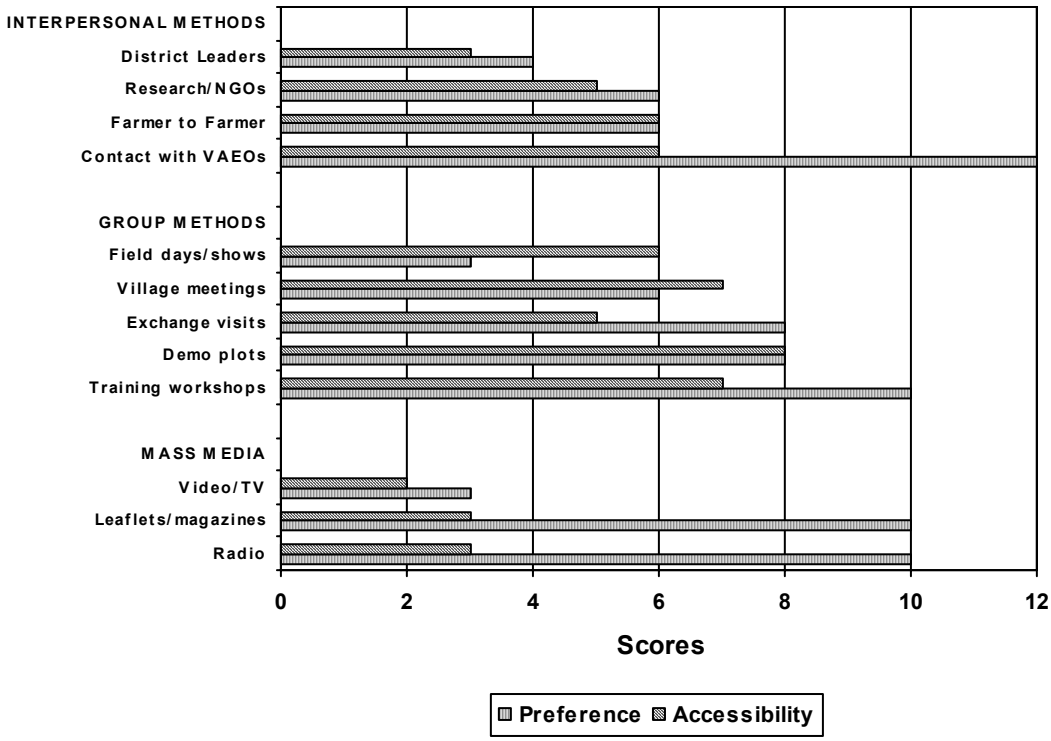

Figure 4: Preference and accessibility of communication methods and media
Source: Focus group discussions

The most preferred communication methods in the order of importance were: contacts with VAEOS, training workshops, leaflets/magazine and radio. Although most respondents ranked these methods high, their effectiveness in delivering information to the end users was limited. For example, contact with VAEOs was preferred in all villages, although not all villages had VAEOs. Generally there are few VAEOs in the majority of the districts and those available are not well equipped to reach all farmers as envisaged. Likewise, radio, were reported to be less accessible in conveying RWH information to farmers, although they were among the highly preferred communication methods for creating awareness. Farmers said that magazines and leaflets are not available in the rural areas. These divergences between preference and accessibility were attributed to remoteness of some villages. This situation was exacerbated by poor roads and lack of transport by the extensionists.

Generally mass media like radio was thought to be good in creating awareness. For example many farmers acknowledged that they heard about RWH in the BBC radio programme that interviewed farmers from their area. In both the Northern and the Lake Zones, available radio stations include Radio Free Africa (RFA) and Sibuka FM, Radio One, Sauti ya Injili and Radio Tanzania Dar-es-salaam (RTD). With the exception of RTD, the rest are privately owned. The privately owned stations broadcast mostly entertainment programmes, which are more attractive to listen (especially by the youths) when compared to programmes broadcasted by RTD. Most extension programmes use the national radio RTD to broadcast messages on agriculture. Due to the fact that people listen more to private radio stations, they miss important messages broadcasted by RTD. The other limitation when radio is used as a media of communication is the fact that the airtime is not known to farmers. During FGDs, some women farmers complained that it is very difficult for them to listen to radio because during the time of broadcast (18.30) they are engaged on households' cores. They proposed that it would be better if programmes were broadcasted when they are resting.

Further analysis indicated that there is limited use of mass media such as radio and TV by researchers in the dissemination of research findings. This was raised during discussions with researchers and one of the reasons given was that preparation of radio programmes on agricultural message delivered to farmers was the mandate of the extension department. To reach key stakeholders a mixture of media is required and this is a challenge to researchers to tackle in scaling-up research findings.

As discussed earlier, written materials like leaflets, booklets, magazines and newsletters were preferred as a good form of information dissemination, but they were not easily accessible by farmers in the villages. When available they were not user/reader friendly and therefore they were ranked low indicating low preference. Moreover, discussion with farmers indicated that they still needed to consult the VAEOs even when written materials were available. This has implications in scaling up strategies, because printed materials that could be widely distributed to share research findings, if not well prepared can fail to send the message to end users.

Similarly, training is not accessible to many farmers because it is costly and when opportunity arises only few farmers are selected to represent others. Non-trained farmers expressed their concern that most trained farmers did not share information when they came back from training. Farmers proposed that methods like demonstration plots were more effective because they are conducted in the village. When conducted well they provide a good opportunity for them to see and learn. In Shishiyu village, for example, farmers referred to the past efforts to promote cotton, whereby VAEOs were supported to demonstrate the whole package, and as a result it had a lot of impact in terms of adoption by farmers.

(c) Factors that facilitate and/or constrain use of information by farmers

Farmers use information to improve their farming practices and to train others. Farmers mentioned several factors that facilitated and/or constrained use of information. The most important ones are briefly discussed in the following sections.

i) Number of sources of information by farmers

During focus groups discussions, farmers indicated that trained farmers were more knowledgeable in practicing RWH. Further discussions revealed that such farmers who had more exposure either through training and other sources used various RWH techniques. A comparison of the number of sources of information between trained and non-trained farmers was made and the results are shown in Table 13. The results show that trained farmers (92%) had more sources of information compared to non-trained farmers (13%) who had only one or two sources of information. On average, trained farmers had almost six sources of information while non-trained farmers had only one or two sources of information. This may be due to the fact that most printed materials were provided during training sessions and included notes and printed materials such as booklets and leaflets. Discussions with non-trained farmers indicated that trained farmers who utilised the information produced more crops and therefore the community felt that they were more food secure.

Table 13: Number of source of information for trained and non-trained farmers

Number of source of information	Trained (%); (n=118)	Non-trained (%); (n=259)	Total (n=377)
One source	3	52	40
Two sources	5	35	28
More than two sources	92	13	33

Source: Household survey

ii) Information sharing amongst farmers

Results in Table 14 show that in both groups, (trained and non-trained) farmers learned for the first time about RWH practices from their parents (63%) and fellow farmers (19%). Therefore information sharing among farmers and especially from parents to children is one of the most effective methods that facilitated use of information. Further discussions with farmers revealed that after training, spouses shared information and later they trained their children how to practices RWH in the farms. When trained farmers did things differently and neighbouring farmers saw the difference they normally became keen and wanted to learn from the trained farmers. However, during discussions with non-trained farmers, they complained that trained farmers were not always sharing information with fellow untrained farmers. A follow up to this with the trained farmers revealed that, the majority of the trained farmers shared information in their farmers' groups. Unfortunately most non-trained farmers were not members of such groups.

Table 14: First source of RWH information as indicated by farmers

Source of information	Trained (%) (n=118)	Non-trained (%) (n=259)	Total (n=377)
Parents	58	66	63
Fellow farmers	14	20	19
Researchers	16	6	9
Extension officers	11	5	7
Do not know	-	3	2

Source: Household questionnaire survey

Some farmers had the opinion that passing on knowledge from parents to children is becoming more difficult because nowadays very few parents have time to talk to their children. Reasons given included the fact that many children spend most of their time in schools and they do not learn about agriculture like in the past. After schooling most youths are attracted to businesses that fetch quick money like petty business. This makes them become disassociated from farming and thus do not learn about improved practices from their parents.

iii) Provision of technical support

Farmers who received information through training or other sources sometimes needed technical support to be able to use and practice some of the techniques. For example, after village meetings or listening to radio programmes on RWH, awareness was created. This prompted farmers to seek for more information from extension agents in order to get more information on how to construct diversion channels into their fields. This was confirmed by 88 percent of VAEOs interviewed who said that more farmers were seeking support for improved RWH practices. Farmers preferred individual contacts so that they could interact with VAEOs and asked for clarification and demonstrations on how to practice. For example, they requested for technical support

in measuring and demarcating contours and locating appropriate sites for diversion channels so that they could abstract water without destroying their fields.

The major concern of many farmers was that currently there were few VAEOs in the villages resulting into limited access to extension services. During discussions with farmers in Lali village in Maswa district, they complained that they did not get advisory services from the VAEOs. This was confirmed while interviewing the VAEO for Lali village whereby he informed that he was working in two villages (Malampaka and Lali), which were very large. As a result he could not meet all the farmers' demands and therefore farmers had limited access to extension services.

Another constrain was that some of the VAEO available were not very conversant in handling RWH challenges. The VAEO for Lali and Shishiyu villages in Maswa district were not trained on RWH techniques while pursuing their diploma courses and did not receive training provided by SWMRG. Therefore, they admitted that they were not very conversant in handling RWH challenges. The problem of large area coverage was also mentioned by VAEOs in the Western Pare Lowlands (WPLL). The few village agricultural extension officers sometimes were unable to visit farmers regularly, thus denying farmers of the needed support. Absence of VAEOs discouraged farmers from trying new innovations. Farmers also complained that they lacked basic equipment for surveying such as A-frames and line levels for measuring contours. During focus group discussions farmers informed the research team that where a village extension officer was not available, farmers failed to get clarification on information received through other media. Therefore farmers thought that availability of extension agents to provide technical support after receiving information is very important.

iv) Existence of indigenous knowledge on RWH

Farmers in the study areas have been practicing RWH even before the RWH research programme started in the area. Traditionally, farmers in the Lake Zone area, including Maswa district have been producing paddy using harvested run-off which is collected in the lowlands in the systems locally called *majaluba*. In WPLL, farmers in the highlands knew about terracing and contour farming as erosion control methods. In the lowlands, farmers collect run-off for the production of maize and other crops. Results from this study showed that there was little difference between trained farmers and non trained farmers in terms of their experience with RWH practices. Sixty six (66) percent of the farmers who received training and 60 percent of the non-trained farmers had known about RWH for more than 10 years (Table 15).

Table 15: Period within which farmers knew about RWH

For how long have you known about RWH?	Trained farmers (n=118)	Non-trained farmers (n=259)	To (n=3
	%	%	
not before today		8	
very recently	3	7	
less than five years	18	10	
five to ten years	13	15	
more than ten years	66	60	6
Total	100	100	10

Source: Household questionnaire survey

In tracking past research work it was revealed that the initial research work carried out by SWMRG and its partners tried first to understand these traditional systems in order to establish knowledge gaps (SWMRG, 2001). With the understanding on the knowledge gaps, the SWMRG research was built on the existing indigenous knowledge and focused on intensification of the existing RWH systems. In crop production, improvement was made on effective use of run-off and its management to increase production. During the focus group discussions, in Lali village in Maswa, for example, one farmer said *"... in the past we were waiting for run-off to come to our fields when it floods, but nowadays after the coming of SUA researchers they taught us how to dig channels so that we can direct water flowing on the road sides, culverts and gullies into our farms...*".

Improvement in knowledge on RWH also helped farmers to realise the benefits of some of the practices like contour farming in water management. Farmers said *"...we have been practicing contours but we never realised that we are harvesting rainwater, rather we associated it with soil erosion control…".* Therefore after realising that deep tillage and contour farming are RWH techniques, there were more acceptances of the practices. Farmers are now associating the benefits from RWH and production, unlike in the past where farmers could not quantify reduced erosion in economic terms. In addition, research in RWH assisted farmers in increasing understanding on the socio-economic aspects of RWH, e.g. the improvement in institutional arrangement in management of common pool resources. Farmers also learnt that they could diversify into production of high value crops like paddy, maize and vegetables in these areas in which traditionally they used to grow drought tolerant crops like sorghum and millets.

3.2.2 Communication methods and media at village extension officers' level

(a) Methods and media used to communicate RWH information to VAEOs

Village Agricultural Extension Officers (VAEOs) in the study districts received information about RWH through training of trainers' courses (ToTs), seminars, workshops, and study visits (Table 16). Training of trainers' courses was mentioned to be the main source of RWH information delivery to extension officers (10). Most of the interviewed VAEOs who attended ToTs were from Mwanga (7) and Same (3). Extension staff interviewed in Maswa did not attend any ToTs because they were yet to be employed. Unfortunately, those VAEOs were also not adequately trained during their certificate and diploma courses. Training of Trainer's (TOT) courses were conducted in 2000 by SWMRG. Seminars and workshops were also conducted by SWMRG either directly funded by the RWH projects or through collaborative activities with District Councils and other development partners like MIFIPRO, IFAD/PIDP and GTZ-funded Tanzania Forestry Project (TFP).

Table 16: Source of information for VAEOs

Sources of information	Maswa (n=4)	Mwanga (n=9)	Same (n=4)	Total (n=17)
	Count	Count	Count	Count
Training of Trainers	0	7	3	10
Seminars	1	4	3	8
Workshops	1	3	1	5
Study visits	0	0	1	1
No training received	2	0	0	2

Through discussions, some VAEOs revealed that they were involved in participatory surveys conducted to understand IK in Mwanga and Same districts. Furthermore, on-farm trials conducted at Kisangara and Kifaru villages in Mwanga district and field days conducted for farmers and VAEOs around the field sites enabled them to observe and learn about performance of different RWH systems. In addition, demonstration plots were placed in Hedaru and Mgwasi villages where RWH technologies were validated in farmer's fields and in all these VAEOs who worked very closely with researchers and farmers learned more about RWH. Information was also received in the form of training manuals, booklets and leaflets distributed during training, seminars and workshops.

During these interactions with researchers, VAEOs received information in the form of training materials, booklets and leaflets. The assessment of the different forms of information indicated that the majority were useful and provided VAEOs with theoretical understanding of the concepts of RWH as well as practical training in various RWH systems. Training manuals and booklets (in Kiswahili) were good reference materials.

(b) Factors that facilitated and constrained use of information by VAEOs

VAEOs who received RWH information used it to train and advise farmers in their respective areas. However, the following factors facilitated their use of the information on RWH.

i) Hands-on skills

The VAEOs who got trained on practical skill on RWH felt more competent than those who were not trained. Practical skills are required where farmers need demonstration of techniques such as laying out of contours and terraces. VAEOs who received ToT training felt more competent and confident than those who did not receive ToT training. In addition, knowledge in RWH systems provided them with more options for improving rainfed agriculture in their areas. In the case of VAEOs who did not get practical training, sometimes they could not use the information they received to support farmers to practice improved RWH. The importance of hands-on skills is shown by the respondents in Table 17 where by 6 (35%) VAEOs felt that lack of practical training constrained them in the use of RWH information. This was explained further during group discussions, that VAEOs especially those who did not specialise in land-use or irrigation courses were not trained on RWH during their diploma/certificate courses.

Table 17: Factors that constrain use of RWH information by VAEOs

Constraints	Count (n=17)
Limited practical skills in RWH	6
Lack of transport to by VAEOs	6
Inadequate knowledge sharing products, e.g. booklets, leaflets	5
Poor funding support	4
Difficult to change attitudes of farmers	4
Farmers not organized in groups	3
Limited use of methods and media to disseminate information	2
Some farmers are demoralized (not willing to learn new technologies)	2
Political interference (failure to mobile labour to construct canals)	1
Some farmers are old and illiterate	1

ii) Lack of transport

Most VAEOs interviewed (6 out of 17) did not have transport. The fact that some of them are serving in more than one village, provision of transport such as a motorbike would have

helped them to reach more farmers in order to provide advise on improved technologies. The few VAEOs who had transport, they complained that they did not get financial support in terms of fuel from the district councils. This also limited the extension staff from reaching a big cross section of farmers who are spread over large geographical locations. For example, the VAEO for Lembeni village in Mwanga district informed that he is covering five villages in the whole ward. The VAEO for Lali village in Maswa is covering two villages (Malampaka and Lali), which are big with more than 1000 farm families. In such cases, the VAEOs provided advise to very few farmers who demanded for such extension services.

iii) Provision of funds

Provision of funds to conduct demonstration plots facilitated VAEOs to promote RWH. In most extension projects and in villages with support from NGOs, like Bukangilija (under Christian Relief Services - CRS), Lali under World Vision, Buyubi under PIDP and Kwanyange under MIFIPRO, funds were provided to conduct demonstrations on improved seeds under rainwater harvesting. These helped in the promotion of RWH technologies. VAEOs acknowledged increased support in district agricultural development plans (DADPs) for infrastructural development. However, some VAEOs felt that lack of funds constrained them from promoting RWH techniques through practical demonstrations to impart skills to farmers. They argued that if more financial support would be availed by the district councils, promotional activities in villages would increase the impact of RWH on farmers' food security Therefore there is a need for lobbying and advocacy to district councillors to allocate more funds for training of farmers and demonstrations to promote of RWH.

iv) Provision of knowledge sharing products:

VAEOs need support in terms of extension materials that are user/reader friendly as reference materials so that when faced by challenges they can quickly consult. Production of knowledge/communication sharing products (KSPs) such as leaflets and booklets for VAEOs and farmers provided support in absence of researchers. Some of the VAEOs said that sometimes they felt that farmers knew more issues about RWH than themselves because farmers were given more opportunities like attending seminars where technical issues were discussed. They challenged researchers to provide printed materials to update their knowledge. They also advised that KSPs produced for farmers could be more meaningful if they were produced using simple and easy to understand language. The products must be reader friendly. Involvement of extension workers in the production of such KSPs would help to achieve better results.

v) Communication between VAEOs and researchers

Where communication between VAEOs and researchers was good it facilitated use of information from research. Communication leads to active involvement of extension officers and as partners leading to ownership of the process. During discussions with VAEOs, they indicated that, when they participated in the research activities such as on-farm trials or meetings, it become much easier for them to make follow ups with farmers after the researchers had left. They complained that there is a tendency for researchers to conduct research activities in their absence. When farmers needed support it became embarrassing on their part that they did not know what the farmers discussed with the researchers. This may delay or hinder uptake of technologies because farmers get discouraged if they do not get the support required from their closest advisers, the VAEOs .

vi) Provision of technical backstopping to VAEOs

Follow-up and monitoring by researchers helped to regularly facilitate discussions with VAEOs and farmers on constraints limiting practicing of RWH systems in the study area. For example, some of the farmers who constructed small charcodams to harvest run-off for livestock and domestic use in Makanya village had problems to control silt from filling their dams. Follow up activities by researchers facilitated correction of this problem by construction of sand traps. This was not included in the initial design, and would have forced farmers to remove sand from the dams every season. Similar problems were experienced in paddy fields in Maswa where excavated bunded basins were filled with sand, which farmers could not control. A visit by researchers generated a discussion that helped to solve the problem by using sand trap structures.

vii) Farmers' attitudes towards new technologies

Some VAEOs were concerned that sometimes farmers are sceptical of trying new technologies unless they see other farmers who practice succeed. For example, digging of diversion channels was felt by some farmers that it could lead to degradation of their land. Since VAEOs did not have funds for setting demonstrations, they felt that it delayed uptake of RWH technologies in areas where this was not an indigenous knowledge. For example, in Rombo district the trained VAEO tried to advise farmers, but the response was low, until they managed to get funds to take few farmers on a study visit where they saw it working.

viii) Involvement of Youths in training

Some VAEOs felt that young farmers did not get priority in training activities because most of the time, the selection of farmers targeted heads of households (who are normally the old and middle aged). Experience shows that where young farmers were involved in training activities, up-take of RWH was high. For example, the VAEOs for Kwanyange village (in WPLL) who is also covering more than four villages deliberately involved young farmers in training activities. He realised that up-take of RWH was high because young farmers were eager to harvest run-off and store it for producing tomatoes. He associated this with the fact that most young farmers know how to read and write, and when convinced about the new technology they went to seek for more information. Furthermore, they are more energetic and are able to provide the labour required for digging of furrows compared to the old farmers who sometimes had to hire labour. Some of the limitations, which these young farmers mentioned, were lack of enough land for farming and lack of financial capital to invest in good seeds and other farm inputs.

ix) Support by other stakeholders

VAEOs who are working in areas where there are development agencies like the PIDP project felt that trained farmers demanded to get advise on how to implement improved techniques on RWH. Since these VAEOs were facilitated with transport and training materials they easily provided the support demanded by farmer, and this enhanced uptake of RWH technologies. For example, in WPLL, the area where MIFIPRO is working, farmers from ten villages visited Makanya where they learned about RWH techniques. Upon their return, they demanded assistance from the VAEO on how to layout diversion channels. The activity was facilitated by the project. Currently, farmers in these areas are motivated to practice RWH, which make the VAEO to be very busy. Another example from Maswa and Misungwi districts in the Lake Zone, is the assistance by APROTEC.APROTEC is a private company, and is involved in the promotion of the use of treadle pumps and drip irrigation for vegetable production. This has increased efficiency in use of rainwater captured through

RWH systems such as small charco dams and shallow wells. Similarly, in Makanya village (WPLL), the SASAKAWA GLOBAL 2000 project supported farmers who were trained by VAEOs in the construction of rainwater storage facilities. The VAEO who was trained in construction of these storage tanks used his knowledge to construct tanks for farmers.

x) Use of participatory approaches in communication activities

Most VAEOs appreciated the use of participatory approaches during the RWH research implemented by SWMRG. This enabled VAEOs to own the process and gain more understanding of different RWH systems and a better interaction with farmers. A village extension officer at Lembeni village was quoted saying "*.... I participated in the research that was carried out at Kisangara site and that enabled me to use the research plots to train farmers. Farmers from my village also participated during field days organised by SWMRG researchers in collaboration with the District Council which helped to improve farmers' knowledge and confidence".* VAEOs who were closely involved in the research processes created the sense of ownership of the technologies generated by research and thus felt more responsible to promote these technologies.

Other factors that were perceived to constrain the use of RWH information included poor farmers organisations, limited use of media for transacting information and poor farmer motivation due to lack of institutional support. In addition, political influence, though mentioned once can have far reaching consequences. VAEOs complained that sometimes the agricultural sector is given low priority, e.g. in terms of budgetary allocation, by local politicians (Councillors), compared to health and education. Furthermore, politicians sometimes act as technocrats and give misinformed advices that contradict VAEOs messages.

3.2.3 Communication methods and media used to communicate RWH information at district level

(a) Methods and media used to communicate for district officials

At district level, the respondents indicated various sources of information through which RWH information was received (Table 18). Responses from District officials show that interaction with researchers through meetings, seminars and workshops was high (65%) in the target districts (Maswa, Mwanga and Same) compared to non-target district (Rombo, Moshi, Hai, Handeni, Misungwi, Kwimba and Shinyanga districts. . However, in the target districts, direct contact with researchers from SWMRG-SUA was indicated as one of the main source of communication (76%), while in non-target districts it was only 33% of the respondents who had contact with researchers. Contact with researchers in the non-target districts was possible due to the demands made by farmers in the use of RWH technologies. These demands arose especially where the farmers had development projects issues related to water availability. In some cases, district officials contacted researchers informally after reading information through printed materials.

Table 18: Responses (multiple) on sources of knowledge on RWH for district officials

Sources of knowledge on RWH	Target district (n=36)	Non-target districts (n=35)	Total (n=71)
	%	%	%
Meetings/seminars/workshops	66	62	65
Contact with SWMRG researchers	76	33	63
Study visits organised by Projects	48	62	52
Booklets	42	67	49
Knowledge from past interactions	22	48	30
Professional Training	16	62	30
Visit places	30	19	27
Visit individuals practicing RWH	24	14	21

Source: Questionnaire survey with district leaders

Study visits mostly organised by development agencies/projects to other areas where other farmers were already practicing RWH was also rated high by respondents (52%) as a source of information for both target and non-target districts. Study visits made them see the potential for RWH and got convinced that the techniques can improve rainfed farming and hence supported project interventions. Although 49% of the total respondents indicated that they received information through booklets produced by SWMRG, there were differences between the targeted and the non-targeted districts. Table 17 shows that 67% of the respondents from the non-target districts highly appreciated that the booklets on RWH were a good source of information compared to the target districts (42%). This may be due to the fact that target districts had direct interactions with researchers, while non-target district had to seek for more information from printed materials wherever available.

Some officials, particularly District Commissioners and Councillors, challenged researchers to use more interactive approaches like demonstrations so that farmers as well as leaders could learn more by seeing and use these demonstrations to promote technologies. Further discussions on the issue of demonstration created awareness to district councillors that they could allocate more resources to extension activities for promotion of technologies. Since some of the Councillors are also farmers they could provide good demonstration sites for other farmers to learn.

Some district leaders raised concern about the reports from research that researchers use very technical language and hence remain in the shelves because they could not make use of the information. They urged researchers to produce printed materials that are more reader friendly with simple to understand language so that they could easily grasp information and use it. For example, the District Commissioner (DC) for Mwanga district challenged researchers to use the DCs because they are very good conduits for promotion of research findings. However, the findings should be practical and well packaged in simple language. . Discussion with researchers revealed that experience from past interventions showed that political leaders if well informed they could support promotion of new technologies. However, researchers are sceptical in using politicians in promotion of technologies because they may also cause distortion. This poses a challenge to researchers and requires re-examining the way they package research findings for wider promotion using other key stakeholders.

(b) Factors that facilitate and/or constrain use of RWH information by district officials

The most important factors that facilitated and/or constrained the use of information by district officials include: (i) knowledge on the potential of RWH (ii) presence/absence of development agencies/projects, (iii) funding; (iv) lack of feedback from some researchers during and after completion of research projects. These factors are briefly discussed in the following sections.

i) Knowledge on the potential of RWH

Increased understanding of the potential of RWH (or what RWH can do) prompted some of the districts to use the information received by incorporating RWH activities in their district development programmes. In addition, they also looked for support from the Ministry of Agriculture and Cooperatives (MAFC), NGOs and externally funded projects. Discussions with district leaders indicated that they attracted more funding to the district from the Central government and projects by including uptake promotion activities in the District Agricultural Development Plans (DADPs). For example, in the Lake Zone, RWH promotion is supported by projects like the Participatory Irrigation Development Project (PIDP) and Rural Water Supply and Sanitation Projects (RWSSP). In the non-target districts like Rombo, the district executive director (DED) attended a workshop where the potential of RWH was discussed. As a result of this the district initiated a programme to promote the construction of water tanks at household level for domestic water supply as an alternative to gravitational and underground water systems. The programme is supported by UNDP and UNICEF which provide grants to households who are willing to contribute 20% of the cost. Other sectors supporting RWH interventions include Health (the programme aims to reduce Trachoma eye disease in pastoralist communities in Hai, Mwanga and Same) and Education (ferro-cement tanks are constructed in primary schools to avail drinking water to pupils). This indicated the potential for promoting and utilising knowledge on RWH beyond the agriculture sector.

ii) Presence/non-presence of development agencies or projects

Through interviews, respondents indicated that the presence of development partners and or projects with similar objectives in their districts facilitated dissemination and uptake of RWH technologies. Development agencies identified in the district include NGOs as shown in Table 19. Projects and NGOs provided funds to train more farmers and support field activities in the use of RWH techniques.

One of the implications of this finding is that districts with few development agencies were constrained in promoting RWH activities due to funding levels and possibly limited interactions. Respondents appreciated that many farmers who practiced RWH succeeded in increasing production of various crops and hence increased income. The District Commissioner for Misungwi district associated changes in farming practices with knowledge they received from research that created demand for support from district councils to develop more structures for RWH.

Table 19: Development partners in the target and non-target districts

District	Development partners
Target districts	
Maswa	• CRS, World Vision, CARITAS, IFAD-PIDP, MRDP
Same	• SAIPRO, VECO, SWMRG-SUA, RELMA, TIP, World Vision, CARITAS, SNV, WWF
Mwanga	• MIFIPRO Trust Fund, TIP, SARI, SWMRG-SUA, WORLD BANK
Non-target Districts	
Misungwi	• HESAWA, IFAD-PIDP, CARITAS, Misungwi Food Security Project (MIFOSE), CARE, Kituo cha Mafunzo ya Kuboresha Mazingira na Kilimo Adilifu (KIMKUMAKA), Misungwi Rural Housing Programme, CSPD
Bariadi	• RWSSP, TASAF, World Vision, CRS, TANAPA
Shinyanga	• World Vision, IFAD-PIDP, TASAF, KKKT, AIC
Rombo	• KILIWATER, TIP, UNDP, TASAF, SWMRP-SUA, PADEP, TRACOMA, RELMA, REHA
Moshi	• RELMA, SCAPA, TEACA, FAO, TIP, KEDA, HEM, COMPACT, PADEP
Hai	• UNICEF, PHC-Ambassador, World Vision, PADEP
Handeni	• Germany Development programme, SEUTA Women Group, HIAP-GTZ, Organic Farming Programme – UK, World Vision, RWSSP-World Bank

iii) Funding

Availability of funds was mentioned as one of the important factors in communicating and utilisation of information. For example, District officials in Maswa, Same, Mwanga, Misungwi and Kwimba districts responded to demands from trained farmers in RWH by constructing charco dams and weirs because they had allocated funds for constructing the structures in their district budgets. The demands for support by farmers were prompted by their knowledge on RWH. On the other hand, without funds district officials wouldn't have been able to support farmers. However, there is a general concern of lack of funds in many districts to meet the demands from farmers.

Similarly, district extension officers need funds to be able to communicate information to farmers. Even where they have knowledge, if funds are a limitation, they would not be able to disseminate the information to end users. This difference can be bridged by the presence of researchers and development agents who have funds to hasten communication processes in the target districts.

iv) Lack of feedback from researchers

Researchers are expected to introduce themselves when they enter a new district of when they have a new research programme in the district. They are also expected to give progress reports during the implementation of research projects to district officials. District officials had concerns on the tendency of some researchers who are not informing the district authorities when they enter their districts. In addition, they did not provide feedback on the research progress (during implementation) and findings after completion of the projects. This was a concern in many districts, and was specifically noted by the District Commissioners in Mwanga, Maswa and Bariadi to mention a few. As a result districts were not aware and well informed of what is happening in the field. In addition, where reports were provided to districts staff, the reports mostly contained information with very technical language that was not easily understood by them. This constrained the use of the information to a large extent. The district officials therefore urged researchers to rethink of their approaches when working with farmers and other stakeholders.

v) Presence of skilled extension agents

In the non-target districts, officials argued that if extension agents were adequately trained, they would be appropriate channels for conveying information to farmers. However, results from the semi-structured interviews with district officials in the target districts, (particularly Councillors) indicated that the training, which the extension agents had, was not enough. The Councillors were of the opinion that since VAEOs are few and not well equipped to advice farmers. They suggested that it would be more effective for projects and development agents to impart skills directly to farmers through training and conducting demonstrations.

3.2.4 Communication methods and media used to communicate RWH information at national level

(a) Communication methods and media for policy makers and research managers

This group of respondents included research managers and policy makers at NARES and academic institutions (specifically SUA) who sometimes play both roles (as researchers and policy makers). The research managers and policy makers received information from researchers through methods and media like leaflets and booklets (31%), radio programs (21%), posters (15%) and scientific meetings (9%) as shown in Figure 5.

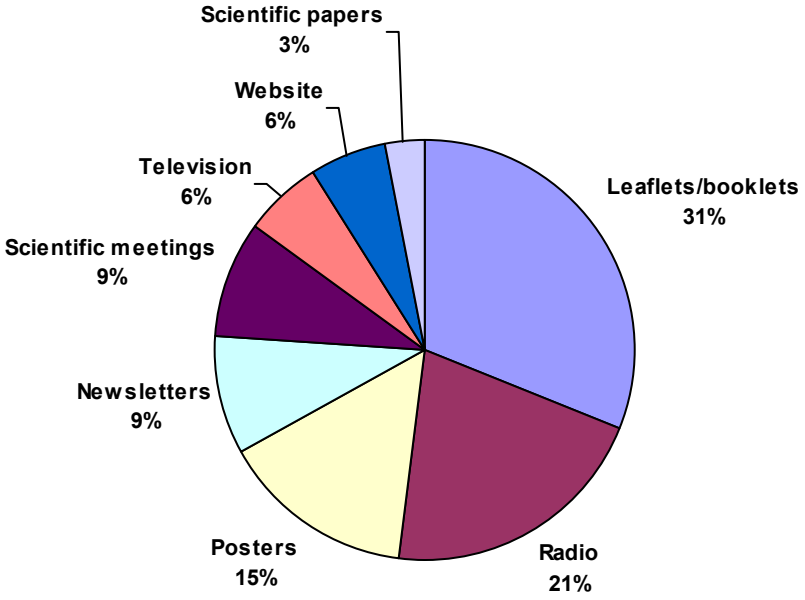

Figure 5: Sources of information received by policy makers (n=21)
Source: Survey data

Policy makers also interacted with individual researchers directly when the policy makers visited research stations. Most policy makers, however, admitted that interaction with researchers was limited because most of the time they received information through Zonal directors. This was confirmed through discussions with researchers who also indicated that they rarely had contacts with policy makers because they communicate more directly with their superiors even when visiting their institutions.

At institutions of higher learning, researchers produce summaries/abstracts, which are published periodically and hence research managers, get to know about research findings from various studies. However, research managers raised concern that most of the time research funding is limited and thus most researchers end up producing few copies of their reports (for the funding agent and for the university library). For example, postgraduate students who produce limited copies of their thesis conduct the bulk of research in institutions of higher learning. Researchers publish research findings in scientific journals and are rewarded (through promotions) for publishing in international journals. Although some researchers produce knowledge sharing products, they indicated that this is done on own researcher initiative through projects and as required by the funding agents. This implies that most research findings do not reach end-users and other key stakeholders who could promote the findings.

(b) Factors that facilitate and or constrain use of RWH information by policy makers

Policy makers at national level indicated that the factors that facilitated use of RWH information included the scientific evidence on the technology being promoted and its demand in solving farmers' problems. When research findings are addressing immediate needs of the clients it is easy for leaders to promote such technologies. For example, when the Ministry of Water was reviewing the National Water Policy (URT, 2000) it was easy for policy makers to contribute towards production of the policy because there were good evidence of the potential of using RWH information. Most policy makers were convinced that RWH has the potential to provide water, not only for agriculture, but also for domestic use. They reviewed the water policy and incorporated RWH systems to mitigate drought and improve livelihoods. Policy makers admitted that there is limited promotion of research findings. The reasons for limited communication to key stakeholders by researchers are summarised in Table 20. The results show that inadequate funding (63%) was one of the major constraints perceived by national level policy makers and research managers that limit communication by researchers and hence limiting the use of research findings.

Table 20: Responses (multiple) by policy makers and research managers on constraints for promoting research results

Constraints	% of Respondents (n=21)
Inadequate finance	63
Lack of communication equipments	32
Inadequate promotional skills	26
Low use of information technology	21
Lack of researchers motivation	16
Lack of coordination and institutional arrangements	11
Language used in scientific reports is not user friendly	5

Source: This survey data

Others included lack of communication facilities (32%) and inadequate promotional skills by the research managers (26%). Inadequate finance and promotional skills were found to be a problem in all research institutions. In the past most research funding did not provide for dissemination of research findings. As a consequence it limited the choice of methods to be used by researchers to only publishing papers and submit to international journals. Other key stakeholders such as policy makers and research managers were rarely informed. Lack of coordination and institutional arrangements also affected promotional activities. This is

because some institutions think that the role of informing stakeholders is not within their mandate.

Policy makers generally felt that communication of research findings and up-take promotion was limited in the whole national agricultural research system. In those cases where researchers communicate, the language used was very scientific and thus most research reports were not read and were simply left on the shelves. Use of summarised communication documents prepared as policy briefs in simple language is not common currently. The argument put forward is that there is need for creating awareness amongst researchers, research managers and policy makers on the need to improve communication for wider promotion of research findings.

3.2.5 Communication methods and media used by researchers to communicate

The results of the interviews with researchers on the methods they used to communicate research findings are discussed in this section. The aim of the interviews was to understand the research and communication processes and discuss constraints they face in communicating with different stakeholders. More discussions were carried out during the feedback workshops and ToT courses, which provided more light to the constraints in promoting research findings (Annex C7).

(a) Methods and media used by researchers to communicate research findings

Results in Table 21 show that among the methods and media used by researchers to share information included farmer field days and on-farm trials/demonstrations and farmers' research groups in the villages. Workshops/seminars and meetings were the next important methods of communicating research findings.

Table 21: Responses (multiple) on methods and media of dissemination of information used by researchers

Form of information	Lake zone (n=10)	Northern zone (n=21)	Total (n=31)
	Number of responses		
Methods			
Farmer Field Days	2	10	12
Workshops/seminars	1	11	12
On-farm trials/demonstrations	0	12	12
Farmers research group	7	3	10
Meetings	3	4	7
Exchange visits	1	6	7
Agricultural shows	1	5	6
Training	4	1	5
Contact individual farmers	0	2	2
Traditional dances	0	2	2
Media			
Leaflets	3	4	7
Reports	0	3	3
Posters	1	2	3
Radio Programme	1	0	1

Source: Survey data

Other methods used included training, exchange visits and agricultural shows. These were used when funds were available because researchers felt these methods were expensive.

Media such as radio was not commonly used by researchers because as discussed earlier radio programmes are normally prepared by the extension department. Printed materials like leaflets and posters were also rarely used. Through discussions with researchers and when they were visited at their research stations, most researchers produced leaflets and booklets, but their distribution was limited due to problems of funds. Technical reports were used to communicate research findings to peer researchers and research managers locally and internationally. Use of innovative methods such as policy briefs and news highlights in TV (that could catch the attention of key stakeholders like policy makers) were not common. At SUA there is a local TV, although its coverage is limited, very few researchers use this opportunity to promote research findings. Lobbying and advocacy to national level policy makers, research managers and politicians that was done by SWMRG-RWH researchers was rarely used by other researchers. This is a challenge to researchers that requires a change in mindset in order to increase the impact of research in Tanzania.

During focus group discussions and training of trainers' courses on communication and knowledge management conducted by Project R8088B, it was also realised that researchers were not carrying out stakeholders' analysis to determine information needs for different stakeholders (Annex C7 and C8). This sometimes led to poor targeting and packaging of research findings.

(b) Factors that facilitate and/or constrain communication of research findings

Factors that facilitate and or constrain researchers to communicate research findings to key stakeholders included limited communication skills and capabilities; inadequate allocation of resources (time and funds) and lack of linkage of research to policy. These are briefly discussed below.

i) Limited Communication skills and capability

In general, researchers admitted that they had limited communication skills and capabilities (Table 22). Furthermore, they admitted that their capability and skills to communicate with different stakeholders also differed. For example, 92% of researchers responded that they had high capability to communicate with farmers compared with 25% who indicated to be capable to communicate with policy makers.

Table 22: Response (multiple) on capability of researchers to communicate with stakeholders

Stakeholder groups	Percentage of respondents (n=29)		
	High	Medium	Low
Farmers	92	8	-
Fellow researchers	92	8	-
Village Extension staff	84	16	-
District extension staff	72	28	-
Research managers	72	24	4
Input stockists and traders	46	25	29
District leaders	33	42	25
Policy makers	25	46	31

Source: Survey data.

This can be explained by the fact that most researchers are natural scientists trained in their specialised fields and very few had training in communication skills. A similar study by Lutkamu *et al*., (2005) reported that more than 50% of researchers were not trained in communication skills. Assessment of the curriculum of seven post graduate courses carried

out at the Sokoine University of Agriculture indicated that out of seven post-graduate courses offered; only one (i.e. Management of Natural Resources and Sustainable Agriculture) had aspects of communication skills. This implies that researchers are not well oriented towards promoting their research findings due to the traditional thinking that dissemination of new technologies is the role of the extension system.

During discussions with researchers at Selian Agricultural Research Institute (SARI), for example, they said that for them to communicate research findings to policy makers at district and national level was very difficult. The reasons given were that policy makers had no interest and time to listen to researchers even when the researchers visited their offices. At Ukiriguru Agricultural Research Institute (UARI), some researchers claimed that researchers should remain with the mandate to generate technologies while the dissemination of technologies to end users should be the job of extension services. This further shows the old thinking of some of the researchers.

ii) Inadequate allocation of resources for communication activities

Most researchers admitted that when designing research projects their major focus is to allocate enough resources for fieldwork, data analysis and report writing. When a research project is completed, the researcher normally produces few copies of the technical reports targeted to the donor, their institutions and for themselves. In addition, it was found that they write scientific reports for publication in scientific journals. Few researchers attempted to produce leaflets. This shows that activities such as production and distribution of knowledge sharing products and providing advice to key stakeholders were being done on an ad-hoc basis when need arise. Similar observations were made by Hatibu *et al* (2005) in the NRSP project R8381. This also concurs with observations made by district officials that researchers do not provide feedback during project implementation and after projects end. Limited distribution of results hinders uptake promotion and scaling up by stakeholders such as district and national level leaders.

iii) Limited awareness and access to national policies and strategies

The results in Table 23 show that a large proportion of researchers (67%) were aware of the Agricultural and Livestock policy, but only 30% indicated that they had high access to the document. For other policy documents, the awareness and accessibility were rather low. Low level of awareness and poor access to various policy documents by researchers is one indication that there is inadequate linkage of research projects to national policies and strategies. That is why researchers also did not feel the need to inform policy makers of findings because their objectives may not directly address and contribute to policy objectives. Consequently, this narrows the window through which research findings could be spread. During discussions, researchers also indicated that they felt it was not necessary for them to read policy documents. One of the reasons given was that, calls for research proposals from funding agents provided guidance and requirements to be fulfilled. At the end of the project reports are prepared and submitted to these financiers. Progress about these researches is given to Zonal directors who have the responsibility to report to the national level authorities. Lessons drawn from this debate were that researchers had no culture to promote the products from their research work. There is a need of changing the thinking or mindset of such researchers, because use of information by key stakeholders other than farmers may help to create conducive environment for farmers to adopt new and improved technologies.

Table 23: Responses (multiple) on awareness and accessibility of policy and strategy documents by researchers

Policy/Strategy Documents	**Awareness (%) (n=29)**	**Accessibility (%) (n=29)**		
		High	Medium	Low
Policies				
Agriculture and Livestock Policy	67	30	20	17
Land-Use Policy	20	7	7	7
National Environmental Policy	10	3	7	0
Water Policy	10	0	0	7
Livestock Policy	7	3	0	0
National Forestry Policy	7	3	0	0
Gender Policy	3	0	0	3
Strategies & Guidelines				
Poverty Reduction Strategy Paper	37	17	7	3
National Strategy for Growth and Reduction of Poverty (NSGRP)	33	17	10	7
Agricultural Sector Development Programme	30	13	7	7
Tanzania Development Vision 2025	10	10	0	0
Agricultural Extension Guidelines	7	0	3	3
National Irrigation Master Plan	3	0	3	0
Coastal Environmental Conservation Strategy	3	0	0	3
Others (Strategy for HIV/AIDS, NEPAD)	20	0	13	7

Source: Survey data

3.3 Interaction between the research and communication processes and farmers livelihood capitals

An assessment was carried out to in order to understand farmers' perception on the use of knowledge received as a result of the research and communication processes in transforming livelihood capitals to improve farmers' livelihood. Factors that facilitated and/or constrained the adoption of RWH techniques were discussed. The analysis used food security status and assets ownership as proxy indicators for determining the impact of improved RWH practices at household level. Food security was assessed as perceived by the community during community mapping and farmers own assessment during households' interviews. Due to lack of baseline data, the study could not compare before and after scenario (section 2.2). Instead, the 'with' (trained) and 'without' (non-trained) scenario was used with the assumption that farmers who were trained used the knowledge gained to improve their livelihood capitals through increased production and hence improved their food security status. The following sections summarises the results and discussions on factors that facilitated and/or constrained adoption of improved RWH techniques by farmers and its impact on food security and assets ownership.

3.3.1 Assessment of livelihood capitals and communication processes

The following factors were identified to be among the most important in influencing adoption of improved RWH practices: (i) knowledge of the farmer (human capital); (ii) labour and/or ability to mobilise labour (human capital); (iii) availability of fertile land and water (natural capital); (iv) membership to various social groups (social cohesion/capital); (v) access to finance (financial capital), (vi) physical infrastructure (such as water tanks and charcodams). These factors are briefly discussed below.

i) Knowledge

Knowledge is an important factor that facilitates or constrains adoption of RWH practices. Trained farmers confirmed that by using the knowledge they received, they improved their indigenous knowledge (IK), which led to better utilisation of resources such as land and labour. During FGDs, it was indicated that training exposed farmers to various techniques, and the advantages and disadvantages of these different techniques. On the other hand, discussions with non-trained farmers revealed that lack of technical know-how was a constraint to adoption of RWH technologies. For example, while digging diversion channels, farmers could not follow the contours. As a consequence, they constructed channels that had big bed slopes resulting into destruction of their fields by the diverted runoff. In-field water management was another common problem.

In Kifaru village (WPLL), a farmer used a lot of labour and other resources to divert water into his field, but then the run-off was spread so thinly over a big piece of land to the extent that the crops did not get enough water. If that water would have been used on a smaller area using sunken beds, possibly this farmer could have harvested some crops. This implies that information on RWH would be useful if accompanied with a complete package to emphasise on intensification of the available water and the choice of crops to be grown to enhance water productivity. Some trained farmers, who had exposure to information and were more knowledgeable, used the scarce water resources by choosing crops or seed varieties that matured early, while the non-trained farmers did not.

In accessing information, a comparison based on gender indicated that 22 % of the trained respondents were from female headed households. This indicates that research and communication intermediaries have not been able to reach as many women in terms of training as they do for men, and thus women farmers rarely access information on improved technologies. Access to information improves ability to make informed decisions on the use of other capitals available to them. Knowledge acquired enables farmers to convert these other capitals into more valuable ones. For example, the knowledge that use of contours increase productivity of run-off diverted into the fields helped farmers to increase productivity of water. Denying women farmers with information on improved technologies and innovations, while they are performing most of the agricultural activities in the farms, is likely going to lead to low production of food.

During discussions with researchers during the Communication and Knowledge Management (CKM) training of trainers' course it was revealed that women were more involved in production of food crops. Therefore providing improved information on RWH to women farmers will enhance improvement in food security.. From discussion with researchers and extension officers at district level a concern was raised that few women were reached during the research and communication processes. Although many development agents, researchers were urged to put emphasis on reaching women farmers, more efforts should also be given in the research processes. Scaling-up of RWH and other NRM technologies should actively

involve more women farmers to achieve wider impact on livelihoods. Similar observations were made regarding young farmers that they also had less opportunities in accessing RWH related information compared to older farmers.

ii) Labour availability and/or ability to mobilise labour in practicing RWH

Once farmers accessed knowledge and had access to land and water, labour availability was an important determining factor in adoption of RWH practices. Usually, RWH activities are labour demanding. In most cases farmers depend on family labour for all the farming activities and RWH in particular. Results in Table 24 show that 66% of the total respondents experienced problems in mobilising labour for activities such as digging furrows, contour ditches or ridging. There was no difference between trained and non-trained farmers in their responses. Both trained and non-trained respondents indicated that the main source of labour is family members. On average, most households had 2 adult members who were full time engaged in farming activities. A large proportion of households indicated that there is shortage of labour and only few farmers (8%) were able to hire labour. Inability to mobilise family and/or hire labour led to delayed land preparation and failure to capture first rains which are very important in the semi arid areas.

Table 24: Responses on availability and sources of labour for trained and non-trained households

Labour availability	Trained farmers (n=118)	Non-Trained farmers (n=259)	Total (n=377)
	%	%	%
Is labour a problem in adoption of RWH? (Yes)	66	66	66
Responses (multiple) on source of labour			
Household members	90	92	90
Hired labour	8	6	8
Reciprocal labour	2	2	2
Total	100	100	100

Source: Household questionnaire survey

During FGDs farmers explained that in the past, households were able to mobilise labour through reciprocal arrangements where a group of farmers agreed to help each other by working in ones field and move to the next. In return, the households that are assisted would prepare meals and drinks on the day the work is in their field. This system is commonly known as '*Ifogong'ho*' (in the local Sukuma language) in (Maswa district) while in the WPLL it is known as '*kiwili*' or '*kiwia'* (in the local Kipare language). Farmers claimed that these systems are disappearing thus making it difficult to mobilise labour if one does not have a big family or money to pay casual labourers.

In Maswa district, many farmers use ox-drawn implements like ploughs. During discussions, farmers informed that most soils at the beginning of the season are so hard that it necessitates waiting for the first rain (to soften the soil) before land preparation is done. Due to this, it limits the acreage that farmers can put under production if land preparation has to be done in advance, before the on-set of the rainy season.

In addition, during peak period of farm operations, there is usually competition among field operations that reduce household labour force. These times normally coincide with periods of

food shortage, causing households that are food insecure to engage in casual labour in order to earn income or in exchange of food. As a result, food insecure households fall in a vicious cycle of shortage of food for a long time. For those households, which are well off and with large farm land, they are able to mobilise labour, which is sometimes paid in kind in-terms of food. Few farmers indicated that the income they get from remittances and non-farm activities were used to support practicing of RWH to solve problems of labour.

Access to labour or ability to mobilise labour for RWH activities have shown that women headed households faced more constraints than the men headed households. Women headed households depended more on households member as a source of labour and only 2% indicated that they hired labour to supplement available family labour compared to 9% of men headed households. Observations in other studies conducted by SWMRG (R8116) indicated that women may incur more cost in accessing run-off compared to men (SWMRG, 2005).

iii) Land availability

Land availability included not only the access to the land, but also the location of the land in relation to access to run-off and land quality in-terms of soil fertility. These factors are very important and are discussed in the following sections.

iv) Land ownership and accessibility

In the study areas, land is accessed through inheritance, buying, renting, borrowing or allocation by the village government. Means of acquiring land are presented in Table 25. The results show that 55% of total respondents acquired land from their parents and there was no difference between trained and non-trained farmers. Adoption of RWH technologies involves investing in physical structures such as contour ridges, digging of diversion channels and construction of storage facilities. In the cases where farmers cultivated in own land, willingness to invest in the development of such RWH structure was high. Through discussions, it was revealed that when farmers cultivated on a rented or borrowed field, the owners of the land would not allow the tenants to put permanent structures for fear of loosing their ownership to that piece of land. This implies that land ownership influenced adoption of RWH techniques.

Table 25: Response on land acquisition by trained and non-trained households

How did you acquire land?	Trained Farmers (n=118)	Non-trained farmers (n=259)	Total (n=377)
	%	%	%
Inherited	55	56	55
Rented/Borrowed/Village Govt.	26	24	25
Bought	16	15	15
Don't know	3	5	5
Total	100	100	100

Source: Household questionnaire survey

v) Location of the farm plots in relation to access to run-off

The location of the field plots in the toposequence was another important factor in practicing RWH because it also influenced access to run-off. Farmers were asked to indicate in relative terms the location of their farms in the toposequence with reference to the topography of the areas. Results in Table 26 show that, most farmers had their fields located in the middle or downstream, which was associated with high possibility of accessing run-off. Few

respondents had their farm fields located upstream and in this case if there was no source of run-off nearby they had to dig a long furrow to divert run-off from the source which needed high investment.

Moreover, upstream fields were prone to erosion and frequent breakage of furrows leading to frequent repairs. In extreme cases farmers had to abandon their farms. This led to many farmers in Kwanyange village in the WPLL, for example, to stop digging furrows for diverting run-off into their fields. In Table 26, the no response is due to the fact that in Maswa district some respondents could not clearly say whether their farm fields are located in the midstream or downstream due to the fact that large tracts of land appear to be flattish.

Table 26: Response on relative location of farm fields in the toposequence for trained and non-trained households

Where is your farm field located?	Trained farmers (n=118)	Non-trained farmers (n=259)	Total (n=377)
	%	%	%
Middle stream	34	44	40
Downstream	47	29	34
Upstream	8	4	5
Don't know	10	23	21
Total	100	100	100

Source: Household questionnaire survey

Limited access to land located close to the run-off source limited the potential for adopting RWH practices. In Kisangara village (WPLL), most youths had abandoned farming and opted to digging sand for selling. When discussions were held with these youths, they claimed that their parents allocated them marginal land, which was difficult to access run-off. Meanwhile, their parents kept to themselves the good land. This led to low adoption of RWH practices by the youths since the returns to resources did not justify investment. In extreme cases many youths are shying away from farming and are engaged in petty business.

There were cases where trained farmers could not practice because of lack of access to run-off. A lady farmer in Kwanyange village in WPLL, who received training, had problems to implement what she had learnt. She was quoted lamenting and saying that *"... my field is located in the middle of other fields and these farmers are not practicing RWH. I need to dig a furrow to convey water from a gully but this channel has to pass through another field and my neighbour refused to allow me because he is sceptical that the furrow will turn into a gully and destroy his field. I tried to dig pot-holes to collect available water but it was not sufficient because we did not receive enough rains"*. Many farmers may have knowledge on RWH and are willing to practice, but would not utilise the knowledge because of not being able to access run-off. In this case run off becomes the limiting factor.

In adopting RWH, the most critical capitals are land and labour (natural and human). Discussions with farmers indicated that ability to access these capitals differ from one place to another and from one farm family to another. The study revealed that although most farmers have access to land and labour, in semi-arid areas, the most determining factors of production include the ability to capture run-off and the location of the field. Table 27 shows that 58% of women headed households had farms located in the lowlands where they received run-off easily.

Table 27: Location of farm fields in the toposequence by gender

Location of farm fields	Men headed households		Women headed households	
	Count	%	Count	%
Upstream	133	53	65	58
Downstream	119	47	47	42

Source: Household questionnaire survey

It was also observed during field visits that in Mwanga and Same districts, where there is already land shortage, young farmers complained that their parents gave them land that had problems of access to run-off. This is an equity issue. As a consequence the young farmers were discouraged, sometimes abandoning farming at the expense of migrating to towns and cities.

vi) Soil fertility

Quality of land in terms of soil fertility was another important factor in RWH. This aspect was reported in NRSP Project R8115 (SWMRG, 2005). However, through discussions, farmers perceived that their land was still fertile and farmers with fields downstream and in the lowlands believed that their land was receiving enough organic matter and sometimes fertilisers drained from the upstream fields.

vii) Group membership

Normally farmers form groups in order to address felt needs but sometimes also as a result of influence by development agents. Farmers groups that were common include women, youth and traditional groups. Purpose of forming groups varied and some had multiple objectives. Farmers informed that during training sessions, they were usually encouraged to form groups as a way of sharing knowledge and the implementation of improved RWH practices. Status of membership to groups by respondents is shown in Table 28.

Table 28: Response on status of group membership for trained and non-trained households

	Trained farmers (n=118)	Non-trained farmers (n=259)	Total (n=377)
	%	%	%
Are you a member of a group? (Yes)	62	25	37
	% response of yes to group membership		
If yes, does it help you to:	(n=83)	(n=139)	(n=222)
Practice RWH?	90	82	86
Mobilise labour?	56	63	59
Access information about RWH?	63	40	52

Source: Household questionnaire survey

Results in Table 28 show that 62% of trained farmers were members of farmers groups compared to 25% of non-trained farmers. From the discussions with farmers who were members of groups, they indicated that the groups were very useful in mobilising labour, accessing information and training from change agents. The groups also facilitated adoption of RWH practices especially where common pool resources were involved. For example, in Bukangilija village, farmers who were diverting run-off from the Ndala River were encouraged to organise themselves into a water users association so that they could be supported by development agents. Through the groups, farmers were able to mobilise labour and other resources to construct a temporal weir and dig a 3km canal from the river to divert

runoff. All these activities were carried out before they received support from the Maswa District Council to construct a permanent weir.

During FGDs in most villages in WPLL, farmers indicated that with time the spirit of working together was getting low. Many reasons were given by farmers to explain this situation. For example, they revealed that where there were socio-economic differences between members of the farmer group, those farmers who were better-off tended to use alternative means of acquiring labour which further contributed to reducing the spirit of togetherness.

viii) Availability of farm tools and implements

Tools and implements are required for land preparation and construction of RWH structures.. In land preparation most farmers use hand hoes, ox-drawn ploughs and tractors (Table 29). The results show that more than 93% of respondents used hand hoes in farm operations including RWH activities. In the case of animal drawn implements, respondents in the Lake zone indicated a higher use (73% to 100%) compared to respondents in WPLL (17% to 40%) for both trained and untrained farmers. The difference on the use of animal drawn technologies between the Lake zone and the WPLL was mainly due to the terrain, culture and beliefs. In the WPLL, the terrain is relatively steep making the use of animal draught power difficult. Further more, there are general cultural beliefs that animals should not be used for draught power. However, recent interventions by development agencies like MIFIPRO, SAIPRO and SUA in WPLL have helped to break these beliefs and there is now increasing use of animals especially among trained farmers.

Table 29: Responses (multiple) on tillage implements used by trained and non-trained households by district

Types of implements	Trained farmers (%)			Non-trained farmers (%)		
	Maswa (n=28)	Mwanga (n=43)	Same (n=47)	Maswa (n=118)	Mwanga (n=72)	Same (n=69)
Hand hoe	96	98	98	93	99	100
Animal drawn implements	100	23	17	73	4	0
Tractor	-	56	43	1	49	12

Source: Household questionnaire survey

The use of tractors in Maswa was very limited compared to WPLL. During the focus group discussions in the Lake zone, farmers explained that most households owned oxen that are used for ploughing and other farm operations. They further revealed that tractors were not easily available and when available the cost of hiring was high. Other activities like digging of furrows, ridging and contouring were done using simple hand tools such as hand hoes, spades and mattocks.

ix) Access to finance for investing in RWH

Agricultural activities that required financial capital included hiring a tractors or oxen drawn implements for tillage, construction of storage tanks and charco dams (Table 30). The results show that there are little differences between trained and non-trained farmers on the activities that required financial inputs. A large proportion of farmers who said they needed finances for deep tillage explained that land preparation needed to be carried out immediately after the onset of the rains so that the farmers could plant early. Therefore, if a household did not have own pair of animals for ploughing or a tractor such a household needed money for hiring tractors or animal draught power.

Table 30: Responses (multiple) on the use of finances to undertake RWH activities

Activities	% of respondents with financial constrain		
	Trained farmers (n=83)	Non-trained farmers (n=140)	Total (n=223)
Deep tillage *(kutifua)*	57	48	51
Digging diversion furrows	19	16	17
Digging of wells	10	6	7
Constructing excavated bunds	8	6	7
Construction of storage tank	8	-	3
Ridging	5	3	4
Irrigating fields	1	1	1
Construction of charcodams	-	1	1

Source: Household questionnaire survey

In Same district, some farmers made a study tour to Kenya where they saw water storage structures. On return, they wanted to construct similar structures. They had to mobilise finances for buying inputs such as cement and steel. Due to these initial efforts, those farmers who could not meet all the costs got financial support from development agencies like RELMA and SG 2000. Generally most macro RWH systems like construction of communal charcodams involve use of materials and sometimes equipments and thus perceived to require high financial investment.

x) Physical structures

Physical infrastructures like storage tanks, culverts and bridges facilitate collection of run-off. Access to run-off especially from ephemeral streams requires construction of weirs to raise the level of water from deep gullies. In many cases, construction of structures such as weirs needs investment that most farmers cannot mobilise. In this case institutional support from the district councils or development projects are sought. Districts through support from DADPs and project like PIDP, PADEP and NGOs have supported farmers' efforts. Where farmers are supported the increase in production is tremendous as the case of Bukangilija in Maswa, Mahiga in Kwimba and Iteja in Misungwi districts and many others. However, the potential for tapping RWH is larger than the support provided so far.

Plate 7: Construction water storage tanks in Mwembe villages by RELMA

Plate 8: Ndiva constructed at Bangalala village for supplementary irrigation

Plate 9: Small charcodams owned by Mzee Mshitu in Makanya village used for domestic and livestock water

Plate 10: Water from the charcodams is pumped into reserve tank where a water trough is placed to reduce accidents to users

xi) Critical combination of the livelihood capitals for adoption of RWH

During feedback workshops, participants analyzed the livelihood capitals that enabled adoption and utilization of RWH technologies (Annex C5, C6 & C8). Farmers understanding of the livelihood capital encompassed the following elements under each capital:

- *Natural capital*: include land, rainwater, fertile soil, natural vegetations, improved seeds, streams and springs.
- *Physical capital*: include canals, dams, wells, good houses (with corrugated iron sheet roofing), ox-drawn plough, good roads, culvert, water tanks and or jars, water pumps, tractors, bridges and pipes.
- *Social capital*: include membership in social groups, family/clan relationships, relationships with extension and government leaders, customs and culture.
- *Human capital*: include knowledge, education, skills, healthy, willingness and ability to work.
- *Political capital*: include good strategies, laws and regulations, participatory policy development, leaders to ensure proper implementation of policy and strategies, ability to monitor and evaluate, and use of scientific evidences in decision making.
- *Financial capital*: include cash, savings in banks, SACCOS, livestock, loans and crops (e.g. rice, cotton).

Table 31 summarises critical combination of these capitals that enabled adoption of RWH technologies.

Table 31: Critical combinations of livelihoods capital for adoption of RWH

District	Critical combination

	Two capitals	Three capitals	Four capitals	Five capitals
Maswa	A,D	A,D,F	A,D,F,B	A,D,F,B,E
Mwanga	A,D	A,D,B	A,D,B,C	A,D,B,C,E
Same	D,F	D,F,B	D,F,B,E	D,F,B,E,C

Key: A=Natural capital; B=Physical capital; C=Social capital; D=Human capital; E=Political capital and F=Financial.
Source: Farmers workshops in Maswa, Mwanga and Same

There was agreement in all the three districts that human capital development is the most critical in facilitating adoption of RWH. There was also agreement between Maswa and Mwanga that the second most important factor is natural capital. In Same district, financial capital was the second important factor and was ranked third in Maswa. In Same, farmers argued that a natural capital such as water is a God given resource, but having skilled manpower and enough financial resources can convert natural capital to be favourable for adoption of RWH. Generally farmers in Maswa gave low priority to social capital indicating that social capital is not limiting. This is partly caused by the fact that there is high social cohesion in Maswa compared to WPLL. For example, In Maswa, there is a system locally known as *Malika*, where a number of households mobilise their oxen and family labour to form groups which cultivate large areas of land within a short time. On the other hand, in Mwanga district, financial capital scored low. The reasons given were that financial capital cannot be effectively utilised if human and social capital are not well developed.

From this discussion, it is clear that there are variations between sites in the priority of capital and capital combinations that influence adoption of RWH. Therefore, when designing for uptake promotion and scaling-up strategies context specific issues are important and should not be ignored.

3.3.2 Impact of research and communication processes on livelihoods

Farmers in both Maswa and WPLL indicated that there is improvement in terms of household food security, income, improved housing, and ownership of assets like ox-carts, bicycles, radios and livestock as a result of interventions in RWH. Based on the discussions with farmers, proxy indicators were used to assess impact of RWH in the study area. The proxy indicators included perceptions on the (i) increase in production of crops (ii) impact on household food security, and (iii) ownership of assets and (iv) ownership of livestock. The study acknowledges the problem of attribution of the impact explained by farmers that other factors may have contributed to this impact. The results of farmers' perception on the impact of practicing RWH are briefly discussed below.

(i) Increase in production of crops

There was a general perception among farmers that the use of RWH techniques resulted into increased yields of crops grown as shown in Table 32. A large proportion of the trained and non-trained farmers claimed that the increase contributed in the improvement of household food security and income, which contributed to increased asset ownership.

Table 32: Responses (multiple) by trained and non-trained farmers who perceived RWH to have increased crop production

Has adoption of RWH led to increased crop productivity? (Yes)	Trained farmers (n=118)	Non Trained farmers (n=259)	Total (n=377)
Crop	%	%	%

Maize	90	83	81
Paddy	23	43	34
Beans	37	20	24
Vegetables	25	9	14
Lablab beans	21	10	13

Source: Household questionnaire survey

With RWH practices, farmers were able to produce high value crops such as maize, paddy and legumes instead of the traditional crops (sorghum and millet) grown in the semi arid areas. Twenty five percent (25%) of trained farmers and 9% of non-trained farmers responded that production of vegetables increased. Normally, vegetables fetch higher prices compared to other traditionally grown crops. For example, previous studies conducted by SWMRG in the WPLL indicated that farmers in Hedaru village earned up to Tsh 2,583,259 (equivalent to US $ 2583) per hectare of onions compared to maize where farmers earned Tsh 379,669 (equivalent to US $ 379) per ha (SWMRG, 2001). Furthermore, farmers in Bukangilija village, Maswa District reported that yields of paddy doubled from 1000 kg per ha to more than 2000 kg per ha. Farmers reported that paddy is now replacing cotton as a cash crop in the Lake Zone (SWMRG, 2005).

(ii) Impact on food security

Results in Figure 6 show the responses on the perceptions of community on household food security status for trained and non-trained farmers. As a result of improved knowledge on RWH, most respondents perceived that due to increased crop production, their household food security had improved. During the community mapping whereby the food security status of households was assessed, it was felt that more trained farmers were food secure than non-trained farmers. Apparently as Figure 6 shows, households with trained farmers were more food secure (85%) compared to households from non-trained farmers (62%).

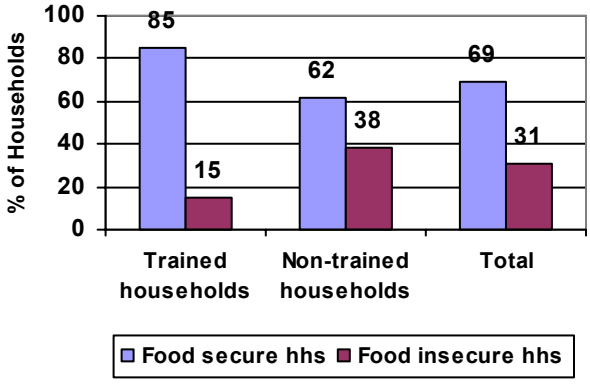

Figure 6: Household food security status as perceived by the community

The results from the community mapping were compared with responses from household interviews. The results (Table 33) show that a large proportion of trained farmers (54%) agreed that they were food secure, while 31% denied that they were not food secure. Similarly, 7% of households that were rated food insecure by the community, responded that they were food secure. However, there is close agreement of the responses for households that were perceived by the community that they are food insecure with their own responses. The diverging responses from trained farmers can be explained by the fact that knowledge

received enabled them to produce but there could have been other limitations such as lack of suitable land or availability of run off.

Table 33: Response from respondents on the perception of household food security status

Is your household food secure?				
Household response	Community rating	Trained (n=118)	Non-trained (n=259)	Total (n=377)
Yes	Food secure	54	34	40
	Food insecure	7	7	7
No	Food secure	31	28	29
	Food insecure	8	31	24
	Total	100	100	100

It can also be observed from Table 33 that a large proportion of households that were food secure indicated that they produced enough food in the previous season. In case of food shortage, the food insecure households revealed that they used different strategies to cope with that situation. For example, a large proportion of food insecure households (46%) bought food from local markets after selling some of their assets and/or labour. Other coping strategies included borrowing from neighbours, food loans and few received food aid from the government or food relief organisations.

(iii) Assets ownership

Improvement in yields of crops under RWH resulted in increased household income that was converted into different assets. During FGDs, farmers listed assets acquired as a result of increased income. Owned assets included bed and mattresses, radio, bicycles, improved housing with corrugated iron sheets, ox-plough and ox-carts and water storage facilities. Table 34 shows the results of the assets owned by farmers.

Table 34: Responses (multiple) on assets owned by trained and non-trained households

Do you own the following assets? (Yes)	Trained farmers (%) (n=118)	Non-trained Farmers (%) (n=259)	Total (%) (n=377)
Bed and mattress	97	77	83
Radio	90	64	72
Bicycle	75	58	63
House with corrugated iron-sheets	74	51	58
Animal drawn plough/ridgers	31	15	20
Water storage facilities	22	9	13
Ox-carts	13	8	10

Source: Household questionnaire survey

Generally trained farmers responses reflected improvement in assets ownership. The proportion of trained farmers who owned water storage facilities and animal drawn implements was higher compared to non-trained farmers. Although there was no baseline data on these indicators, district officials, both in target and non-target districts supported farmers' argument that improved practices in RWH resulted in improved well-being of the farmers. In Misungwi district, the District Commissioner boasted that, as a result of rainwater harvesting farmers are producing a lot of tomatoes to feed Mwanza City. This resulted in increased farmers' income that is partly seen from the increased number of improved housing.

(iv) Livestock ownership

Livestock are important assets for farmers in the study areas. Most farmers indicated that when they harvest enough crops they sell the surplus crops and the cash obtained is used to buy livestock such as cattle, goats, sheep, donkeys and chicken. Livestock is considered as a savings that can be disposed off only when it is absolutely necessary. Generally, trained farmers had larger herds and flocks (Table 35). For example, the results in Table 34 show that 36% of trained farmers owned cattle in the range of 1-10 compared to 24% of their counterparts. Owning large herds or flocks was also found to facilitate adoption of macro-RWH systems among livestock keepers in order to meet the water supply needs of their herd and also for domestic use.

Table 35: Responses (multiple) on livestock owned by trained and non-trained households

Do you own the following livestock? (Yes)	Trained farmers (n=118)	Non-trained farmers (n=259)	Total (n=377)
	(%)	(%)	(%)
Cattle			
No cattle	41	62	55
1 to 10 cattle	36	24	28
11 to 20 cattle	15	10	11
More than 20	8	5	6
Goats			
No goats	41	62	55
1 to 10 goats	36	27	30
11 to 20	14	8	10
More than 20 goats	9	3	5
Other livestock			
Sheep	45	26	32
Chicken	91	82	85
Donkey	5	3	4

Source: Household questionnaire survey

3.4 Tracking research and communication processes

Following the observations in the preceding chapters, analysis of the research and communication processes in relation to the research link with institutional policy and policy-to-research-to-farmers are summarised in this section. Research and Development in NRM in Tanzania is carried out by the National Agricultural Research System (NARS) of the MAFS; and institutions of higher learning (Sokoine University of Agriculture).. Policies and research guidelines of these institutions are expected to guide research development by linking policies to research project objectives so that impact of its interventions contributes to organisational goals. The following section briefly discusses the two systems.

(a) Research and communication processes in NARS

The agenda in research is guided by policies developed at the national level (Figure 7). In the MAFS, discussions with policy makers and research managers indicated that they are responsible in providing the overall guidance and policy guidelines to ensure that new improved technologies are developed and disseminated using appropriate dissemination pathways. Policy makers emphasised that research findings should also be adaptive and demand driven as indicated in the agricultural sector development strategy (URT, 2003).

Although they admitted that there is no systematic way of assessing research impact, regular monitoring and evaluation is usually done by the Zonal and national level research managers to establish whether research project achieved its objectives/purpose and outputs based on the log-frame. Production of annual research reports was one of the means of verifying whether researchers had performed their activities.

Further analysis of guidelines for research proposal development does not demand for researchers to produce knowledge sharing products. This was confirmed during discussions with researchers when claimed that dissemination is not the mandate of the research system. In addition, concerns were raised (during review of the R&D performance and preparation of Medium Term Plans (MTP) of MAFC) that communication of research findings was poor.

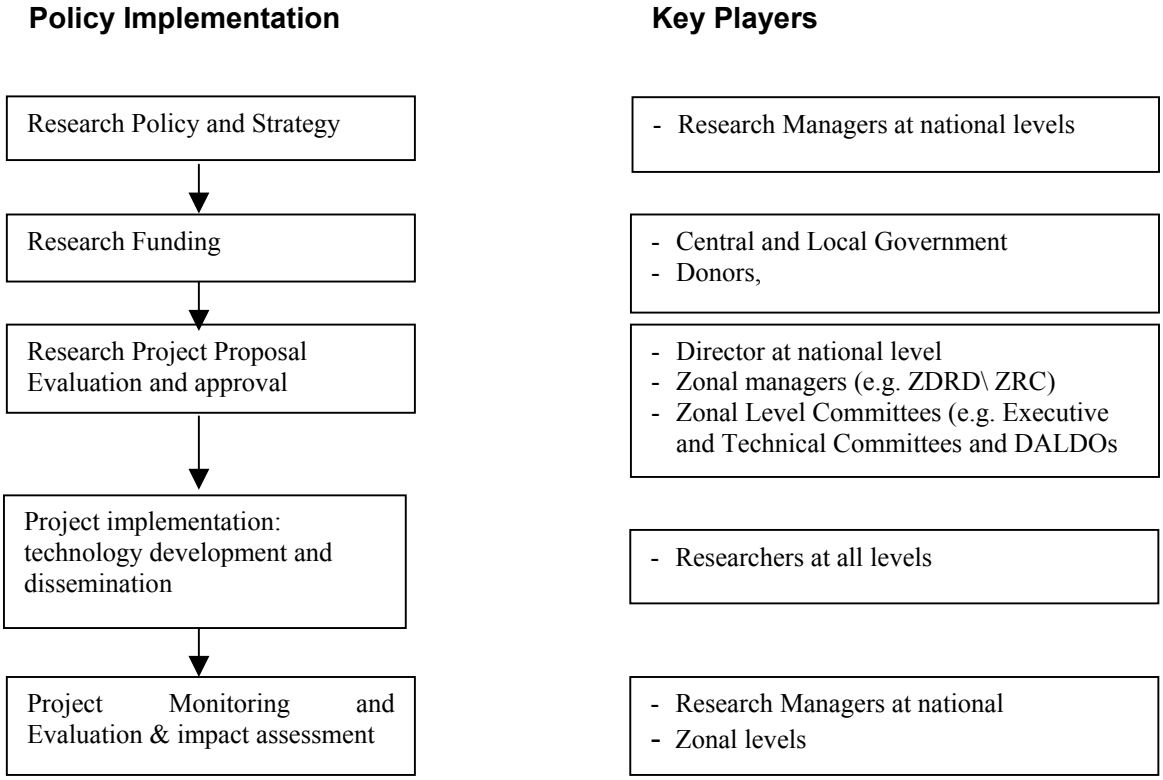

Figure 7: The research development process and pathway of the NARS

This may be attributed to the way research has been perceived to be the source of new knowledge and its role is to generate knowledge while extension is required to disseminate to end users. However, currently the extension system is not well equipped to translate the research findings and disseminate to end users. When discussing with district level extension staff, it was felt that researchers may be in a better position to communicate with key stakeholders such as district official, because they operate at a higher level compared to extension workers. This call for a change of mind-set by researchers to develop a culture of disseminating research findings to fill the gap. Change of mindset of researchers to take responsibility of promoting the products from research will inevitably involve capacity development. Implementation of the proposed changes should be guided and research design should ensure resource allocation for promotional activities.

(b) **Research and communication processes at the Sokoine University of Agriculture**
Similar observations were made when the research and communication process for SUA was reviewed. The results are shown in Figure 8.

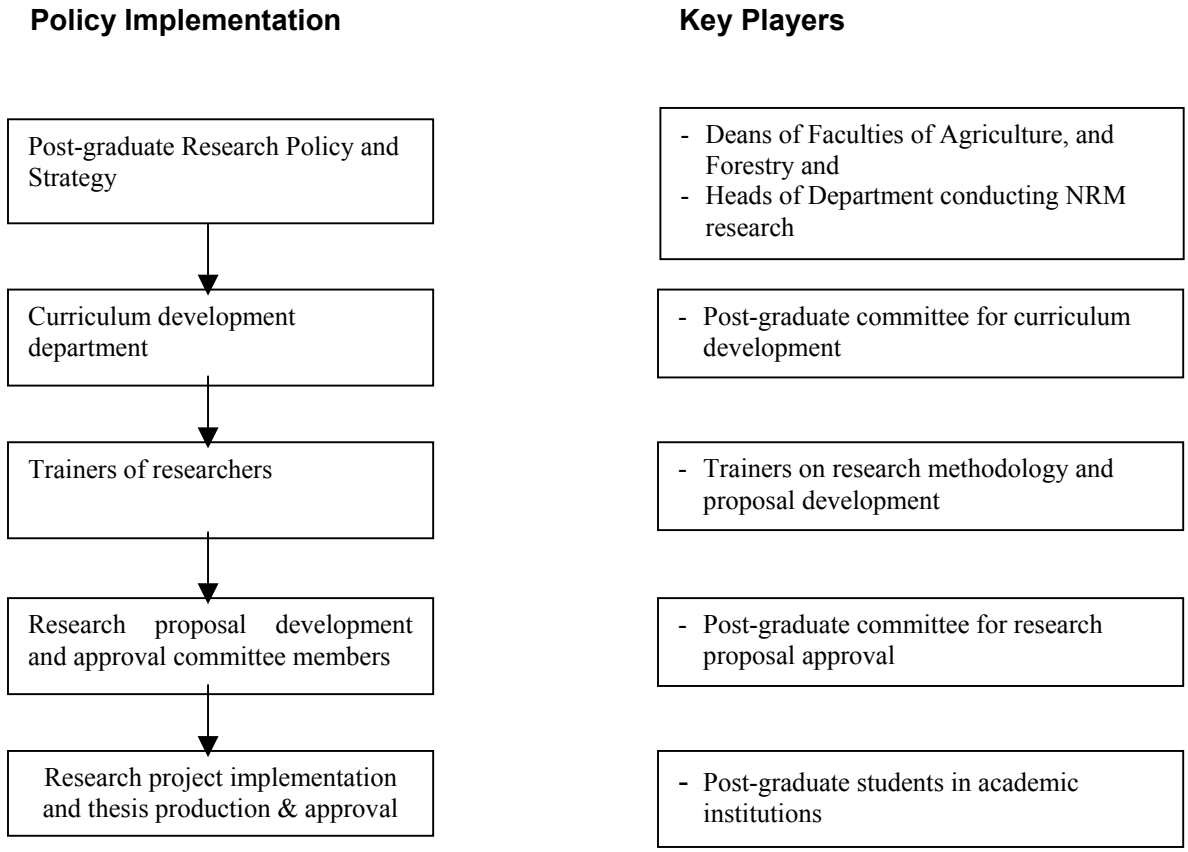

Figure 8: The research development process and pathway at SUA

At the university level, analysis showed that most of the research carried out was for achieving academic qualifications. Researchers are assessed for successful submission of theses and the results are summarised in forms of abridgement targeted to peer researchers. Farmers and other key stakeholders meant to benefit from these results seldom receive feedback of the research findings. Although recently there have been initiatives to carry out adaptive research that increased farmers participation, much remain to be done to in disseminating research findings to a wider audience. Dissemination done during agricultural shows and production of printed materials reached few farmers and key stakeholders around towns and cities. To increase impact of research carried out by these academic institutions research designs need to target wider audiences in addition to increased involvement of farmers and village level extension workers.

The tracking of research and communication processes in the two cases showed that there limited assessment of impact of research processes. Out of the total respondents at policy and research management level, only 22% of the policy makers and research managers indicated that they carried out regular follow-up of adoption of technologies produced by research. Furthermore, it was found that researchers (70%) did not carry out evaluation of the KSPs produced and promoted. Few adoption studies have been carried out in the NARS and SUA.

Inadequate monitoring and evaluation by researchers and extension makes it difficult to assess the contribution of the research in overall development goal of improving livelihoods and reducing poverty.

Generally, it was observed that no thorough stakeholders' analysis was carried out to identify information needs of different categories of farmers and other key stakeholders. During workshops with researchers, it was revealed that almost all the researchers never carried out stakeholders' analysis to identify information needs of the end users. Most of the research was targeted to farmers, leaving out other key stakeholders who could have provided enabling environment for uptake of new research findings. Out of 50 knowledge sharing products produced by the three ARIs in the last 5 years, 27 were targeted to smallholder farmers, 5 to large scale farmers and 9 to extension staff. Only 9 KSPs were targeted to policy makers and other stakeholders. Therefore targeting is a major shortfall that needs to be addressed in uptake promotion for scaling-up and wider impact to happen.

(c) Implication for improving scaling-up strategies and impact of research

For research and communication processes to be meaningful and have impact on livelihoods of the people improvements are required to ensure that research project are objectively designed to be result oriented. This would necessitate the need for researchers to do research business differently and engage in promoting the products instead of waiting for extension people who might not even be informed of the existing products. Influencing changes in the policies and institutions in order to support uptake of technologies would enhance uptake by end-users with the aim of increasing productivity.

In improving tracking changes in research and communication this study proposes inclusion of the following steps in research designs

Step 1: Create baseline information for tracking change –

- Identify key stakeholders
- Decide on indicators to be monitored and processes to be used
- Assess current information available to different stakeholders about the technology

Step 2: Design communication plan for sharing information generated in the research and communication processes

Step 3: Process documentation:

- Decide who in the research team will be responsible for process documentation and field notes recording. Use of debriefing documents is very useful in recording the processes.
- Decide when and how it will be presented and shared (experiences with other stakeholders and fellow researchers).

Step 4: Assess changes occurring during the project implementation as a result of research and communication processes.

Including these steps in the research design would bring researchers to a stage of indicating stakeholders, indicators for envisaged change, that is, how information will be used and the processes that will ensure that information will be disseminated. The following example summarised the framework.

Stakeholders	Indicators for change (how will information be used)	Processes to be used
District Executive Director	District leaders are sufficiently convinced to promote X technologies and is included in the district plans	Consultation, brokering of information
Policy makers	Policy/programme documents supports promotion of X technologies	Lobbying, workshops, presentation
Input suppliers	Include rippers in the list of products to be stocked in the input shops for distribution in Y districts	Linked with profit that they would make if decide to stock the products
Farmers	No. of farmers practicing technology X; Change in production of enterprises targeted	Community mapping; natural resource mapping monitoring production; assess vulnerability without technology X.

Documentation of the research and communication processes would also be enhanced through use of field method guides that would use summaries of the processes in the format like the debriefing documents. The documentation of processes facilitates tracking of activities that could be replicated in another area

3.5 Promotion of research findings

The main target institutions for this research project (R8088B) were the researchers and research managers in the NARS and higher learning institutions. In order to implement output 4, a communication plan was designed (Annex C3). The communication plan was implemented through conducting training and consultation with key stakeholders to give feedback of the research findings on improving strategies for scaling-up. Training of trainers' course was conducted as a way to share results and get feedback from research. The ToT was also conducted as a way to promote and build capacity of researchers on designing communication strategies. Workshops with researchers and feedback workshops for farmers and extension staff were also conducted

A total of 25 researchers from the Zonal research centres and SUA attended the ToTs course. Researchers assessed past research using four case studies during the training. The case studies used were past and on-going research project documents from the Ministry of Agriculture and SUA. In all the four case studies, it was found that they did not have communication plans to guide dissemination of research findings. This resulted in development of KSPs that were not well targeted and packaging that did not take into consideration information needs of the stakeholders. Researchers realised that there was inadequate stakeholders' analysis during the research design stage. As a result knowledge sharing products developed by research projects did not address information needs of the targeted user. For example, some of the leaflets produced by projects used technical language that could not be easily understood by farmers. Stakeholders' analysis would enable researchers to identify key stakeholders who are crucial in influence uptake of promoted technologies. Participants recommended that there should be deliberate efforts to institutionalise promotion and scaling-up of research findings by including communication strategy.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Based on the findings of the study on the research and communication processes the following conclusion can be drawn.

4.1.1 Communication methods and media

(i) Interactive communication methods such as training, workshops, consultations between researchers and key stakeholders are more effective in delivering research findings and provide opportunity for feedback and clarity of the messages delivered.

(ii) Radio, as a media is good in creating awareness about technologies but it is less effective in facilitating adoption compared to other media such as magazine, booklets and leaflets. There is, however, limited use of radio as a media by researchers.

(iii) Provision of practical training to VAEOs and farmers would enhance uptake of information delivered and adoption of improved RWH techniques.

(iv) There is limited funding of communication activities at district, researchers and national levels. Districts are not allocating resources to support extension officer to carry out activities for promotion of improved technologies from research. Researchers are not allocating adequate resources in the research project due to lack of communication plans. At national level, funds are provided for technology development with little or no emphasis on promotion of research findings.

(v) Communication language used by researchers in writing reports that are meant to share research findings with stakeholders are too technical and thus not clearly understood by the users in the target institutions. This limit use of information from research findings.

(vi) Stakeholders' analyses at the research design facilitate choice of methods and media to be used as well as packaging and targeting of the communication activities.

(vii) Access to multiple sources of information increases exposure to more information to stakeholders and hence influences the cognitive ability of farmers and increased use of information.

(viii) Research guidelines for development of research proposals do not demand for promotion of research findings, hence no framework for development of communication plans.

4.1.2 Promotion of RWH research and its impact on livelihoods

(ix) Endowment to resources facilitates use of information and adoption of improved technologies. Access to land, run-off and labour are critical in facilitating adoption of RWH techniques. Where communities have strong social cohesion it facilitate mobilisation of labour, which otherwise require financial capital to access.

(x) Practicing RWH in semi arid areas resulted in increased production that ensured food security to large proportion of households and increased income, hence improvement in assets ownership and well being.

(xi) Lack of baseline data before interventions and limited impact assessment of technologies promoted through NRM research thrust leads to failure to attribute changes in the livelihood outcomes and policy environment.

(xii) Process documentation of the research and communication interventions facilitate scaling-up of research findings as well as the how of doing it.

4.2 Recommendations

4.2.1 Communication methods and media for dissemination of research findings

(i) Researchers should take advantages of many radio stations owned by private service providers to broadcast research findings for creating awareness to wider audience. However, radio messages should be complemented by other methods that are more interactive.

(ii) Researchers should be innovative in the choice of communication products to reach target users with complementing sources of information. Using policy briefs, TV news slots and other media to promote research findings in order to reach wider audience particularly the policy makers is recommended.

(iii) Research projects should be designed to include communication strategy that would allow stakeholders analysis at the design stage. This will guide proper targeting and packaging of research findings to more stakeholders and facilitate dissemination to suit different categories/domains of stakeholders.

(iv) Lobbying and advocacy to district councils and national level policy makers is required to ensure allocation of more resources for promotion of NRM, using more interactive methods such as demonstrations.

(v) Research projects that work with farmers directly through use of participatory technology development create a danger of raising expectation amongst farmers whom they work with. Link with development agencies can help to satisfy expectations of continued support and ensure that messages are appropriately extended to more users.

(vi) Translation and use of simple language that could be easily understood by farmers and key stakeholders who can provide enabling environment for uptake of research findings by farmers is recommended.

(vii) Strategies for improving communication of research findings should involve development of necessary capacities of researchers to meet the needs and demands of information requirement for multi-stakeholders involvement. In addition, strengthen capacities for production of research products into user friendly forms.

(viii) Development of communication strategy for the promotion and dissemination of improved technologies from research is essential component of research itself. The cost of producing knowledge sharing products is high, but justifiable. Therefore, research designs should at least allocate about 10% of its budget for promotional activities to increase the impact of research and development.

(ix) There is need for reviewing communication policies and mandate of research systems to build a new system that would give more mandates to promote products from research for its wide use.

(x) Utilisation of communication strategy concept can be generally applied to wide natural resources management for improved impact of research and development. Guidelines for improving communication developed by NRSP can be adapted to suit different context and therefore recommended for wider use by R&D.

4.2.2 Promotion of RWH research and its impact on livelihoods

(xi) Research intervention should include aspect of farmer empowerment through promotion of farmer networking in areas where social cohesion is declining. This would revise traditional systems of assisting each other in accessing information and mobilisation of resources like labour and hence facilitate uptake of innovations by farmers.

(xii) For effective tracking of the contribution of research in development goals, use of participatory approaches to establish baseline information is recommended. In addition, processes documentation should be carried out to facilitate scaling-up.

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6.0 APPENDICES

Appendix 1: Checklist for Focus Group Discussion - Community Mapping

i. How many households are in your sub-villages?

ii. What is your local perception on food security?

iii. What is the current food security situation in the village?

iv. What are the characteristics/indicators of a household that is food secure or insecure?

v. Which months are of greatest difficulty in term of food availability in the village?

vi. What are the coping strategies in times of food shortage? How effective is the strategy?

vii. Which groups are considered to be most vulnerable? And why?

viii. Have you received any food aid in the last two seasons? If yes, who received the aid?

Appendix 2: Checklist for Focus Group Discussion -RWH Resource Inventory Mapping

i. What are the important natural and physical resources mentioned by farmers? Where are they located? Are they currently used for RWH? Farmer will be facilitated to reflect on the capital assets that they have access to.
ii. Who have more access to runoff (downstream users or upstream users or all farmers)?
iii. What factors constrains or facilitates promotion or use of RWH in the village?
iv. Which of these factors that constrain use of RWH can be resolved within the village and which ones needs outside interventions?

Resources available for RWH in the villages observed during field visit

Areas visited	**Features observed**	**Status of use**	**Explain on the status of use**
Example: 1. Mforo catchment	a. Ephemeral river where farmers harvest runoff		
	b. Culverts		
	c.		
	d.		
	e.		
2. ……			

Appendix 3: Checklist for Focus Group Discussion on Communication aspects with trained farmers

i. What RWH information have you received? Was this information (contents) useful?

ii. Which sources/media of information have farmers found most/least useful?

iii. What other sources of information could have been used to promote RWH (e.g. church groups, kinship – social groups) and how does this influence information exchange)?

iv. What formal institutions convey information to farmers and how are beneficiaries of this information selected?

v. Who do farmers share information with (spouse, children, other farmers)?

vi. After the training what factors facilitated utilisation of information received? (link this with the five capitals assets)

vii. Are farmers more organised into groups to utilise the resources now than before receiving RWH knowledge? Explain.

viii. What are the benefits/shortcomings of using RWH?

Appendix 4: Checklist for Focus group discussion on RWH technology with farmers who did not received training

The following questions will be asked to generate information during focus group discussion.

i. What do you know about RWH and how is this reflected in your practices?
ii. What happens when it rain or when there is a runoff from upstream?
iii. How much was captured (all the water that flows, half of it, very little or none)?
iv. What are the resources needed to capture runoff? (Link it to capital assets and role of information and technology in utilisation of resources).
v. Who uses runoff?
vi. Why some are able to use runoff? (Research Team should lead the discussion to get information about right of use of resources available i.e. tenure issues and power relations on the use of runoff to understand the diversity of situation).
vii. What are the benefits of using runoff?
viii. Are there conflicts in use of RWH? What kind of conflicts?
ix. What are do you do as a community to resolve or minimise conflicts to enable you utilise assets available for improving your livelihood?
x. Has social cohesion reduced as a result of these conflicts? Use arrow diagram tool to assess social cohesion whether it is negative or positive as a result of use of water resources.

Information should be recorded on a flipchart sheet for all to share. (Tools to quantify some of this information will be sought).

The five capitals and indicators of importance to RWH

Assets	**Indicators**
Natural:	• Ownership of land; • Access to land (enquire about access to land/agricultural fields by various groups such as women?) • Ownership and access to water/runoff sources (gullies, streams); • Extent and nature of this access and its effect on their decision to invest in RWH related activities? • Soil type and its fertility (as perceived by farmers)
Human	• Knowledge and skills about RWH • Labour: access and control of labour
Financial	• Access to savings including livestock keeping in assisting farmers to get money for investing in RWH; • Presence of rural financial institutions and they role in supporting agriculture
Social	• Membership in farmer groups and • Other social networks that enable to access assets that are limiting such as labour in kind, finances and information
Physical	• Markets availability for the produce encourages utilisation of RWH techniques (discuss how is this true with farmers in their respective villages?) • Road infrastructure situation in the village.

Appendix 5: Questionnaire for Household interviews

District:	
Village:	
Sub-village	
Interviewee No:	
Name of interviewer	
Time spent	Start time ……. End time ……

A: General Information

Name of the head of household	
Gender of the head of household	
Person responding to the interview	Head of HH ❒ Spouse ❒ Other specify ❒
Education level	Non formal ❒ Primary ❒ Secondary ❒ Tertiary ❒
Number of members of the household	Adults: …….. Children: ……

B: Questions related to adoption and access

1. Land ownership:

How many farm plots do you have?

Plot No.	1	2	3	4
Location	Upstream ❒ Middle ❒ Downstream ❒	Upstream ❒ Middle ❒ Downstream ❒	Upstream ❒ Middle ❒ Downstream ❒	Upstream ❒ Middle ❒ Downstream ❒
How was it acquired	Inherited ❒ Bought ❒ Rented/borrowed❒	Inherited ❒ Bought ❒ Rented/borrowed❒	Inherited ❒ Bought ❒ Rented/borrowed❒	Inherited ❒ Bought ❒ Rented/borrowed❒
If rented or borrowed from who?	Father ❒ Spouse ❒ Neighbour ❒ Village govt ❒	Father ❒ Spouse ❒ Neighbour ❒ Village govt ❒	Father ❒ Spouse ❒ Neighbour ❒ Village govt ❒	Father ❒ Spouse ❒ Neighbour ❒ Village govt ❒
Est Acreage for each plot				
Under RWH?	Yes ❒ No ❒	Yes ❒ No ❒	Yes ❒ No ❒	Yes ❒ No ❒
Acreage under RWH?				
Have you received training in RWH? Yes ❒ No ❒				
Are practicing improved RWH?				

2. What type of RWH system do you practice? (If is a non-adopter go to questions 19)

In-situ RWH system	
Deep tillage	Yes ❒ No ❒
Ridging, contouring and terracing	Yes ❒ No ❒

Sunken seed bed (maboda)	Yes ❒ No ❒
Pit holes	Yes ❒ No ❒
Micro RWH systems	
Roof top RWH without storage tanks	Yes ❒ No ❒
Roof top RWH with storage tanks	Yes ❒ No ❒
Diversion from ephemeral stream or gullies	Yes ❒ No ❒
Diversion of run off from rangelands	Yes ❒ No ❒
Diversion of runoff from culverts	Yes ❒ No ❒
Digging furrow around the farms	Yes ❒ No ❒
Macro RWH systems	
Excavated bunds	Yes ❒ No ❒
Charco dams	Yes ❒ No ❒
Sand dams	Yes ❒ No ❒

3. Labour availability

Is labour availability for farming a problem?	Yes ❒ No ❒
What is the principle source of labour for farming?	Household members ❒ Hired labour ❒ Reciprocal labour ❒
If RWH is adopted what was the principle source of labour?	Household members ❒ Hired labour ❒ Reciprocal labour ❒ Not applicable ❒
What implements do you use in farming and RWH activities?	Hand hoe ❒ Animal drawn implements ❒ Tractor ❒

4. Finances

Which RWH activities require financial input?	…… ……
Is lack of finance a barrier for you to adopt RWH?	Yes ❒ No ❒
How did you overcome this constraint?	Used income from: Small business ❒ Pension ❒ Loan ❒ Savings ❒ Sale of assets ❒ Remittances ❒ No I did not ❒

5. Social networks

Which village group or associations are you a member of?	None ❒ Women Group ❒ Farmers' group ❒ Youth Group ❒ Religious groups ❒
Has your involvement in social groups or association helped you to adopt RWH?	Yes ❒ No ❒ NA❒

In what way has it helped in adopting RWH?	Mobilise labour ❒ Access information ❒ Access training ❒ NA ❒

C: Questions related to Information about RWH technologies

6. Information on RWH

For how long have you known about RWH?	Very recently ❒ Less than five years ❒ Five to ten years ❒ More than ten years ❒ Not before today ❒
From whom did you get this information?	Parents ❒ Fellow farmers ❒ Village extension officer ❒ Researchers ❒ None ❒

7. What is the source of RWH information?

Source/Media	Response	Is it useful	How frequent are you accessing it?
Training	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Extension agent	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Radio	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Magazines	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Posters	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Booklets	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Leaflets	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Farmers groups	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Village meeting	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Exchange visits	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Field days	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently ❒
Nyinginezo	Yes ❒ No ❒	Yes ❒ No ❒	Not available ❒ Less frequent ❒ Very Frequently

			❒

8. If received training?

What type of training?	Seminar/workshops ……❒ Exchange visits ……❒ Others (mention) ……..❒
Where was the training conducted?	Theoretically ❒ Practically ❒ Both theory and practicing ❒
Who provided training?	Village Extension agent ❒ District staff ❒ Researchers ❒ Combination of the above ❒
How long was it?	One day ❒ 2 days ❒ More than 2 days ❒
How useful was the training?	Very useful ❒ Useful ❒ Not useful ❒

D: Questions related to impact of RWH on Livelihoods

9. Production Activities:

Has adoption of RWH led to increased productivity?	Yes ❒ No ❒
If yes in which crops?	Maize ❒ Paddy ❒ Vegetables ❒ Beans/lablab ❒ Cotton ❒ NA ❒

9.1 Are engaged in the following activities?

Activity	
Small business	Yes ❒ No ❒
Brick making	Yes ❒ No ❒
Short terms employment (labourers)	Yes ❒ No ❒
Charcoal making	Yes ❒ No ❒
Quarrying	Yes ❒ No ❒
Lumbering	Yes ❒ No ❒
Bee keeping	Yes ❒ No ❒
Sand mining	Yes ❒ No ❒
Local brewing	Yes ❒ No ❒
Labourer	Yes ❒ No ❒
Others (specify): ……	Yes ❒ No ❒

9.2 Has RWH led to investing into any of the following livelihood strategies?

Activity	
Small business	Yes ❒ No ❒
Brick making	Yes ❒ No ❒
Short terms employment (labourers)	Yes ❒ No ❒
Charcoal making	Yes ❒ No ❒
Quarrying	Yes ❒ No ❒

Lumbering	Yes ❒ No ❒
Bee keeping	Yes ❒ No ❒
Sand mining	Yes ❒ No ❒
Local brewing	Yes ❒ No ❒
Others (specify): ……	Yes ❒ No ❒

10. Intra-household control and decision making

Who made the decision to adopt RWH technologies?	Husband ❒ Wife ❒ Both ❒ Widow (er)/divorced ❒ Single ❒ NA ❒
Who within household controls increased income as a result of practicing RWH?	Husband ❒ Wife ❒ Both ❒ Widow (er)/divorced ❒ Single ❒ NA ❒

11. Assets

11.1 Livestock ownership

Types	
Cattle	Less than 10 ❒ 10 to 20 ❒ More than 20 ❒ None ❒
Goats	Yes ❒ No ❒
Sheep	Yes ❒ No ❒
Chicken	Yes ❒ No ❒
Donkeys	Yes ❒ No ❒

11.2 **Other assets**:

Plough/ridger	Yes ❒ No ❒	Radio	Yes ❒ No ❒
Ox-cart	Yes ❒ No ❒	Bicycle	Yes ❒ No ❒
Water storage facility	Yes ❒ No ❒	House roofed with corrugated iron sheets	Yes ❒ No ❒
Bed	Yes ❒ No ❒	Mattress	Yes ❒ No ❒

12. Food Security Status

Is food produced in your farm enough for household consumption last year?	Yes ❒ No ❒
If not, how did you make up the shortfall?	Bought with other income ❒ Borrowed ❒ Food aid ❒ Sold assets to buy ❒ Didn't ❒

Thank you.

Appendix 6: **Checklist for semi structured interviews with Extension staff**

Extension staff in the villages will be interviewed individually using a semi-structured questionnaire provided in the debriefing document. The following questions will be asked:

i. Have you received training about Rainwater harvesting? When? Where? Who organised? How many times? How was it delivered?

ii. If yes, which of these RWH techniques were you trained on? (If not, go to questions vi).

iii. How practical was the training?

iv. Did the training on RWH help you in your extension work? If yes, how? If no, why?

v. Was there any support provided after the training to enable you communicate this information to farmers?
   - If yes, what kind of support was provided? (to be coded later)
   - If not, what could be the reason?

vi. How does RWH fit in your everyday extension work?

vii. Are farmer coming to you to seek for assistance/information on RWH? Yes ❒ No ❒ If yes, how do you assist them? If no, why do you think they are not coming to seek for information?

viii. What communication media/methods do you normally use in communicating RWH information with farmers?

ix. What communication media would you prefer most in communicating RWH information? Why?

x. What practical constraints do you face in promoting RWH technologies to farmers?

xi. What constraints do you face in communicating RWH information with farmers?

xii. What can you say about communication approaches used by researchers and other extension service providers to:
   - Extension staff?
   - Farmers

xiii. What would you suggest to improve future designs in communications?

xiv. What do they think are the most important factors that influence farmers to adopt or not adopt RWH technologies?

xv. What are the benefits/shortcomings that farmers get by adopting RWH technologies?

Appendix 7: Checklist for District officials

Improved Research Strategy to Assist Scaling-up of Pro-poor Management of Natural Resources in Semi Arid Areas (NRSP R8088B)

Dodoso kwa ajili ya Wakuu wa Wilaya ; Wakurugenzi wa Halmashauri ya Wilaya; Afisa Mipango wa Halmashauri ya Wilaya; Wakuu wa Idara wa Halmashauri ya Wilaya; na Waheshimiwa Madiwani (Checklist for District leaders imcluding District Commissioners; DED; Heads of departments; and Councillors).

Taarifa binafsi (Personal information):

Halmashauri/Kata	:	
Jina la anayehojiwa:		
Jinsia:	Me: ❒ Ke: ❒	
Wadhifa/Cheo		
Muda katika wadhifa	Miezi: Miaka: ……	
Jina la anayehoji		Tarehe:

Je unaelewa nini kuhusu Uvunaji Maji ya Mvua (UMM) {Understanding of the RWH concept}
……
……
……

Chanzo cha taarifa juu ya UMM (Source of Information)
……..
……..
……..
……..

Je, taarifa hizi za UMM zina umuhimu wowote katika shughuli za kilimo katika eneo lako? (Is RWH information useful in your district/ward?)

Muhimu sana	Muhimu	Muhimu kiasi	Sio muhimu
❒	❒	❒	❒

Kama ni muhimu, umezitumiaje taarifa hizi za UMM katika mipango ya maendeleo ya kilimo katika eneo lako? (How did you use this information?)
……
……
……
……

Aina gani ya teknolojia za UMM walengwa wanazitumia katika eneo lako? (Which RWH techniques are commonly used in your area?)
……..
……..

Kwa kipindi cha miaka mitatu iliyopita ni kiasi gani cha fedha kimetengwa na kutumika kuendeleza shughuli za UMM katika wilaya yako? (In the last three years what proportion of development funds were allocated in promoting?)

Mwaka	Kiasi kilichotengwa	Asilimia (%)	Kiasi kilichotumika	Asilimia %
2005/06				
2004/05				
2003/04				

Umetumia mbinu gani kuwahamasisha walengwa katika eneo lako juu ya UMM na mbinu hizi umefanikiwa kiasi gani kusambaza teknolojia hizi? (What strategies have you used to promote RWH in your area?)

Mbinu		**Zimefanikiwa sana**	**Zimefanikiwa kiasi**	**Hazikufanikiwa**
Mikutano na wakulima vijijini	N ❒ H ❒	❒	❒	❒
Kuziweka katika mipango ya wilaya/kata	N ❒ H ❒	❒	❒	❒
Kutoa mafunzo kwa wakulima	N ❒ H ❒	❒	❒	❒
Kuwa na mashamba ya mifano vijijini	N ❒ H ❒	❒	❒	❒
Kuwawezesha wataalam wa vijijini kwa mafunzo	N ❒ H ❒	❒	❒	❒
Kuwawezesha wataalam wa vijijini kwa vitendea kazi	N ❒ H ❒	❒	❒	❒
Kutenga fungu la fedha kwa ajili ya kujenga miundo mbinu	N ❒ H ❒	❒	❒	❒
Kuweka kanuni na sheria ndogo ndogo	N ❒ H ❒	❒	❒	❒

N=Ndio; H=Hapana

Ni wadau gani wengine wanashughulika katika kuendeleza shughuli za UMM katika eneo lako? (mfano: NGOs, miradi)

……..
……..
……..

Ni mabadiliko gani yametokea kwa wakulima katika kipindi cha miaka mitano iliyopita katika wilaya yako baada ya kutumia mbinu ya UMM? (What is the extent of change have occurred at farmers' level on the following as a result of adopting RWH?):

Uzalishaji wa mazao	**Makubwa sana**	**Makubwa kiasi**	**Kidogo sana**	**Hakuna mabadiliko**
Uhakika wa chakula katika kaya				
Kipato cha wakulima				
Kuongezeka kwa uzalishaji wa mifugo				
Kuongezeka ubora wa malisho				
Kupeleka watoto shule				

Ujenzi wa nyumba bora				
Kujiunga na vikundi				

Mambo gani yamewezesha kuenea kwa matumizi ya teknolojia za UMM katika eneo lako? (What facilitates the use of information on RWH for different stakeholders?)

Mambo yaliyowezesha kuenea kwa teknolojia ya UMM	**Ndiyo/Hapana**
Kushirikishwa wakulima katika shughuli za utafiti	N ❒ H ❒
Watafiti kuhusisha teknolojia za asili km: kilimo cha majaluba	N ❒ H ❒
Kuwapa mafunzo wakulima katika kuboresha mbinu za asili za UMM	N ❒ H ❒
Kuwashirikisha viongozi wa ngazi ya wilaya/kata kupokea matokeo ya utafiti	N ❒ H ❒
Utayari wa wilaya kuwekeza katika miundo mbinu ya UMM km. banio, lambo	N ❒ H ❒
Ukame wa mara kwa mara katika maeneo yao	N ❒ H ❒
Nyingine (zitaje):	

Vikwazo gani vimezuia kufanikisha matumizi ya teknolojia za UMM katika eneo lako? (What constrains the use of information on RWH for different stakeholders?)

Vikwazo katika kueneza teknolojia ya UMM	**Ndiyo/ Hapana**
Wakulima wengi kutopata elimu ya mbinu bora za UMM	N ❒ H ❒
Wakulima kutokuwa tayari kutumia teknolojia ya UMM	N ❒ H ❒
Wakulima wana njia mbadala; (zitaje):	N ❒ H ❒
Kutokuwa na hati za umiliki ardhi zinazuia wakulima kuwekeza katika UMM	N ❒ H ❒
Kutokuwepo kwa miundo mbinu ya UMM	N ❒ H ❒
Kutokuwepo kwa sera zinazowezesha matumizi ya mbinu za UMM	N ❒ H ❒
Kutokuwepo kwa kanuni zinazovutia uwekezaji katika UMM	N ❒ H ❒
Nyingine (zitaje):	N ❒ H ❒

ASANTE KWA USHIRIKIANO WAKO

Appendix 8: Questionnaire for Researchers

Improved Research Strategy to Assist Scaling-up of Pro-poor Management of Natural Resources in Semi Arid Areas (NRSP R8088B)

Organisation		Location:
Name of the respondent:		
Position of respondent		
Sex:	M: ❒ F: ❒	
Name of Interviewer		Date

1. Are you aware of any policy and strategy documents? Yes ❒ No ❒
   If yes, list them:
   i. …….
   ii. …….
   iii. …….
   iv. …….

If no to Q1, give reasons: …….
……
……

2. Do you have access to documents listed above? Yes ❒ No ❒

If yes to Q2 rank the level of accessibility:

Policy/Strategy documents awareness	Accessibility
	High ❒Medium ❒ Low ❒
	High ❒Medium ❒ Low ❒
	High ❒Medium ❒ Low ❒
	High ❒Medium ❒ Low ❒
	High ❒Medium ❒ Low ❒
	High ❒Medium ❒ Low ❒

In the ranking if there is low access to policy/strategy/programme documents, what are the reasons?

……

If no, give reasons:

……

3. In the past five years (2000–2005) list the policy/strategy/programme documents that were produced and have a bearing on soil and water management (SWM)
   i. ……..
   ii. ……..
4. What SWM information do these documents contain?
   i. …….
   ii. …….
5. What was the source of SWM information they contained?
   i. …….
   ii. …….
6. Which of these policy and strategy provide guidance in developing research proposal on SWM?
   i. ……
   ii. ……

7. Do these policy/strategy documents contain any directives to ensure dissemination of research findings? Yes ❒ No ❒
   If yes, mention: ……..
   ….……..
8. Give your opinion on improvement of policy documents that is necessary to facilitate dissemination of research findings and uptake of technologies
   ……..……..……..
   ……..
9. How many research policy briefs have you produced in the past five years? List them.
   i. ……
   ii. ……
10. Who were the target users (e.g. policy makers, research managers) of this information and what specific advice were given?

Target user	Specific advice
Policy makers:	
Research managers: Zonal level	
Research managers: national level	
Others (specify)	

11. Rank the extent to which these advices have been used by target user:

Target user	Extent of use
Policy makers	High ❒ Medium ❒ Low ❒
Research managers: Zonal level	High ❒ Medium ❒ Low ❒
Research managers: national level	High ❒ Medium ❒ Low ❒
Others (specify	High ❒ Medium ❒ Low ❒

12. For each target group give reasons if the extent of use is ranked low

Target user	Reasons
Policy makers:	
Research managers: Zonal level	
Research managers: national level	
Others (specify)	

13. Are there examples of the integration of research findings regarding SWM into policy documents? Yes ❒ No ❒
    If yes to Q 13, mention the policy documents…….
    ……..
14. What knowledge sharing products (KSP)[4] have you produced in the past five years?

Knowledge Sharing Products (KSP)	Intended stakeholders

15. For each of the KSP what were the stakeholders' needs?

KSP	Stakeholders needs

[4] KSP are transferable technologies or findings of research from which end users choose.

16. To what extent did the stakeholders participate to prepare these KSP?

Knowledge Sharing Products (KSP)	Stakeholders participation
	High ❒ Medium ❒ Low ❒ No ❒
	High ❒ Medium ❒ Low ❒ No ❒
	High ❒ Medium ❒ Low ❒ No ❒

17. At which stage did they participate?

Knowledge Sharing Products (KSP)	Stage of participation

1= Problem identification; 2= Technology development; 3= Evaluation stage; 4= Dissemination stage

18. Which communication methods did you use to disseminate your research findings? Are they effectiveness and adequate to ensure adoption?

(a) Methods	Effectiveness of the method			Adequacy on adoption	
	Very effective	Effective	Not effective	Adequate	Inadequate

If not effective/inadequate, give reasons:

Method	Reason for lack of effectiveness/inadequacy

19. Which communication media did you use to disseminate your research findings? Are they effectiveness and adequate to ensure adoption

(b) Media	Effectiveness of the media			Adequacy of the media	
	Very effective	Effective	Not effective	Adequate	Inadequate

If not effective/inadequate, give reasons:

Media	Reason for lack of effectiveness/inadequacy

20. Do you evaluate the adoption of these research findings (KSPs) you produced and promoted? Yes ❒ No ❒

If no, give reason: …….

If yes, what is the proportion of adoption by the target groups?

Technology (KSP)	**Extent of Adoption**
	High ❒ Medium ❒ Low ❒ No ❒
	High ❒ Medium ❒ Low ❒ No ❒
	High ❒ Medium ❒ Low ❒ No ❒
	High ❒ Medium ❒ Low ❒ No ❒

21. Which pathway was used to disseminate research findings? How effective it was the pathway in influencing adoption?

(b) Pathways	**Used?**	Effectiveness of the pathways		
		Very effective	Effective	**Not effective**
Village extension worker	Yes ❒ No ❒	❒	❒	❒
Village leaders	Yes ❒ No ❒	❒	❒	❒
Progressive farmers	Yes ❒ No ❒	❒	❒	❒
Farmers groups	Yes ❒ No ❒	❒	❒	❒
Input stockists	Yes ❒ No ❒	❒	❒	❒
Produce buyers	Yes ❒ No ❒	❒	❒	❒
District Leaders	Yes ❒ No ❒	❒	❒	❒
Councillors	Yes ❒ No ❒	❒	❒	❒
Printed materials (specify)	Yes ❒ No ❒	❒	❒	❒
Media production (specify)	Yes ❒ No ❒	❒	❒	❒
Others (specify)	Yes ❒ No ❒	❒	❒	❒

Give reasons for not using some of the pathways mentioned (specify):
…….
…….

22. Have you been trained in communication skills? Yes ❒ No ❒
If yes, how do you assess yourself in terms of capability to communicate and promote your research findings to the following target users?

Stakeholders	**Level of Capability**		
	High	Medium	Low
Farmers	❒	❒	❒
Village Extension officers	❒	❒	❒
District extension officers	❒	❒	❒
Fellow researchers	❒	❒	❒
Research managers	❒	❒	❒
Policy makers	❒	❒	❒
District leaders	❒	❒	❒
Input stockists and traders	❒	❒	❒

If not trained do you think is necessary? Give your opinion:……
……

23. What barriers are there in communicating and promoting research findings?
   i. To farmers: ……..
   …….
   ii. To research managers: …….
   ……..
   iii. To Policy makers: ……
   ……..

iv. To District leaders: ……..
……
v. To input stockists/produce traders: …….
……

24. What are the barriers for effective utilisation of research findings?
(a) Farmers: ……..
……..
(b) To research managers:……..
……..
(c) To Policy makers: ……
……..
(d) To politicians: ……..
……..
(e) Input stockists and traders: …….
……

25. Suggest interventions for overcoming the identified barriers:
i. To farmers: ……..
ii. To research managers: …….
……..
iii. To Policy makers: ……
……..
iv. To District leaders: ……...
……..
v. To Input stockists and traders: …….
……..…….

Any other remarks:
……
……

THANK YOU FOR YOUR COOPERATION

Appendix 9: **Questionnaire for Policy makers and research managers at national level**

[*Directors of Planning, Research & Development, Extension, Livestock Research and Training, Director for Post Graduate Studies & Deans of Faculties*]

Ministry/Institution:	Location:
Name of respondent:	
Position of respondent:	
Sex: Male ❒ Female ❒	
Name of interviewer:	Date

General questions:
How long have you been in this post? Months _____/Years _____

A. Promotion of research results on NRM with specific focus on soil and water management

1. What are the main research areas on SWM does your Ministry/Institution promote
   i) …….
   ii) …….
   iii) …….
2. What research results have you produced in this Ministry/Institute with regard to S&WM?
   i) ……..
   ii) …….....
   iii) ……
3. How do you receive information on research findings from researchers?
   i) ……
   ii) ……
   iii) ……
4. Do you promote research results in this Ministry/Institution? Yes ❒ No ❒
5. How do you promote research results in this Ministry/Institution?
   i) ……
   ii) ……
6. What media do you use in promoting these research results?
   (Posters, radio, leaflets, etc)
   i) ……..
   ii) …….
   iii) ……
7. Which of the listed media is most effective in reaching the target end-users?
   i) …….
   ii) …….
   iii) …….
8. What is the role of the NAR system in ensuring that there is effective promotion of research results?
   i) ……
   ii) ……
9. What constraints do you encounter in promoting the research results?
   i) …….
   ii) …….

B. Uptake of research results on soil and water management by end users.

10. What is the role of the research system in ensuring an effective up-take of research results?
    i) ……
    ii) ……
11. Do you have any pathways through which your research results in soil and water management are delivered to end-users? Yes ❒ No ❒

12. Which pathways do you use in ensuring that research results in S&WM reach end users?
    i) …….
    ii) …….
13. Which of the pathways mentioned are most effective in ensuring that the research results reach the end users?
    i) ……..
    ii) ……..
14. What reactions if any have you received from the end users?
    i) ……..
    ii) ……..
15. What constraints are you encountering/do you encounter in using any of the pathways you have mentioned?
    i) ……..
    ii) ……..

C. Utilization of research results with specific focus on soil and water management

16. What is the role of the research system to ensure effective utilization of research results with specific focus on S&WM?
    i) ……..
    ii) ……..
17. How wide are your research results utilized?
    i) ……..
    ii) ……..
18. What methods do you use to ensure that research results in S&WM are effectively utilized?
    i) ……..
    ii) ……..
19. What approaches do you use to ensure that the results have effectively been utilized? (M & E, Impact studies etc)
    i) ……..
    ii) ……..
20. What do you do with the feedback that you receive from end users?
    i) ……..
    ii) ……..
21. What constraints are you facing/have you faced in ensuring that the end products are utilized?
    i) ……..
    ii) ……..
22. Do you reward researchers for the impact made on R&D? Yes ❒ No ❒ If yes give details? ……

Appendix 10: Questions for Directors of Post Graduate Studies & Deans of Faculties

1. Does your Institution have any policy/guidelines on communication and up-take of research results? Yes ❒ No ❒. If YES, give details.

…….
…….

2. Does the policy contain issues on NRM/S&WM? Yes ❒ No ❒.
   If YES, give details.

…….
…….

3. Does your Institution have strategies on communication up-take of research results? Yes ❒ No ❒. If YES, give details.

…….
…….

4. Do the strategies contain issues on NRM/S&WM? Yes ❒ No ❒.
   If YES, give details.

…….
…….

5. Which Departments/Institutes have a curriculum addressing issues on soil and water management?

…….
…….

6. Does the curriculum contain communication plans for disseminating soil and water management results to end-users? Yes ❒ No ❒. If Yes, what knowledge sharing products do you produce and promote to end-users?

…….
…….

7. What communication methods/media do you use to promote these products?

…….
…….

8. How do you ensure that the end users sustain the promoted products?

…….
…….

9. What constraints do you encounter in promoting the products?

…….
…….

10. Do you conduct any short courses on communication skills? Yes ❒ No ❒

    If YES, does the content of the course include issues on communication in NRM research? Yes ❒ No ❒

    If YES, give details of the contents.

…….
…….

11. How often do you conduct the short courses? ❒ Once ❒ twice per year ❒ Others

12. What is the average number of participants per intake? _____

THANK YOU FOR YOUR COOPERATION