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

Project Leader

Henry Mahoo

Organisation

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Sokoine University of Agriculture

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The Project Team

Soil-Water Management Research Group, Sokoine University of Agriculture
Henry F. Mahoo
Mary C. Shetto
Amon Z. Mattee

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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
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

Executive Summary

This study focused on increasing understanding of the relationship between promotion of NRM technologies and its impact on livelihoods using a case study of rainwater harvesting (RWH) research conducted by the Soil Water Management Research Group (SWMRG) of the Sokoine University of Agriculture (SUA) in Tanzania. The study aimed at improving research strategies to assist scaling-up of pro-poor management of natural resources in semi arid areas. The specific objectives of the project were to: (i) Assess the interactions between the livelihood capitals and the institutions and processes of research and communication for RWH systems; (ii) Develop better understanding of the efficacy of communication methods and media products for stakeholders across a range of levels and R & D sectors; (iii) Establish and test best combination of methods for tracking RWH research processes, outputs and outcomes; (iv) Elaborate and promote research and communication process for ensuring RWH and natural resource management (NRM) in a wider context, can lead to positive outcomes and impact with target organisations at national and international levels.

To achieve the research objectives, the study was conducted at village, district, zonal and national level. Two target sites, Maswa district in the Lake Zone and Mwanga and Same districts in the Western Pare Lowlands were selected. At Zonal level, researchers in the two sites where RWH was conducted were involved in the discussions and interviews. At national level, policy makers and research managers were also involved in the discussions. A combination of participatory and non-participatory methods for data collection included literature review, key informant discussions, focus group discussions, community mapping, natural resources mapping and participatory workshops and households surveys.

The study identified different communication methods and media used to disseminate information on rainwater and natural resources management as a whole. They include interactive methods (such as individual contacts with change agents, like research and extension staff), groups methods (like study visits, demonstrations) and mass media and printed materials (such as radio, magazines, booklets and leaflets). Interactive methods through contacts with extension officers and researchers were perceived to be more effective in communicating research findings by different stakeholders. Radio was also used to communicate information, but need to be complemented by interactive methods. Printed form of communication was not common and was mostly linked with training/workshop sessions and these also need to be complemented with other face-to-face discussions for information to be useful. Access to multiple sources of information influenced cognitive ability of farmers to make training on RWH useful. In addition, endowment to resources was found to facilitate use of knowledge to transform livelihood capitals into livelihood outcomes.

Most researchers disseminated research findings using communication methods like workshops/seminars, field days, meetings, exchange visits, agricultural shows and leaflets. Policy briefs, radio and posters were rarely used. Overall, interactive methods were perceived to be more effective. However, since research and communication processes are not strategically included in the NRM research designs this led to inadequate allocation of resources in terms of time and funds. Limited baseline information and impact assessment of technologies promoted by research systems led to failure to attribute changes in the livelihood outcomes and research conducted to address their problems.

In order to improve the impact of research, scaling-up of research findings (through improved communication with key stakeholders beyond farmers) is recommended. NARES should

deliberately institutionalise a culture for promoting research products by improving research designs to include communication strategies to enhance uptake promotion and scaling-up.

1.0 Background

A number of NRM technological innovations have been developed and demonstrated in rural areas in effort to improve productivity and ensure that farmers meet their basic needs for food and income (FAO, 1991; Tenge, 2005). For these technologies to benefit farmers, strategies for promotion of these technologies beyond pilot areas are required (DFID/NRSP, 2000; Grundel *et al*., 2001). One way of sharing knowledge among actors involved in the agricultural knowledge and information transfer systems is through development and distribution of research products using various communication methods and media to key stakeholders. Key stakeholders in the communication processes include farmers, development institutions, private service providers, policy makers, and funding agents. The culture of sharing research findings beyond research-extension-farmer triangle is currently lacking in the agricultural research and development systems in the country.

Limited uptake is caused partly by lack of strategic communication plans to promote research findings to key stakeholders other than farmers (Douthwaite *et al*., 2003). Ashby (2003) urged researchers to recognise that outcomes and impact on NRM research at farmers' level depend on relationships with other stakeholders, who may have more power to visualise and to realize the desired outcomes of interventions than the researchers do. Research and development need to inform policy formulation and update knowledge of the policy makers, planners and other stakeholders to support decision-making that address current issues in the development sector. At district level, use of information from new research findings would enhance development programmes towards promotion of improved technologies. The question is how should the communication of results be managed in order to promote interest of the target groups and supportive actors, who facilitate uptake and utilization of the results? There is a need to assess and understand the current research and communication processes and factors limiting dissemination and uptake of research findings to a wider audience.

Furthermore, due to the nature of NRM, it often takes a long time for impact on livelihoods (e.g. enhanced food security and increased income) and scaling-up (e.g. used widely and policy awareness) to happen. This does not mean that all these projects do not bring about change and impact – the problem is to identify impacts that can be linked or associated to the project objectives. If this is to be addressed, it requires tracking and relating such impacts to the projects, something that is currently lacking in most projects. Moreover the processes that brought this impact are not very well documented. The M&E on impact of NRM programmes mostly focus on assessing project objectives and inputs versus output/outcomes. Thus they fail to capture additional outcomes as a result of research and communication processes carried out. More over, project reports do not indicate explicitly how the processes that led to success/failure of project itself and the effects of this process on outcomes and impact, i.e. tracking. Tracking is more than monitoring, it emphasises on the relationships of activities that lead to output/outcomes. These are essential for uptake promotion and scaling-up.

This study was therefore designed to track and assess the research and communication processes in order to increase the understanding of the relationship between promotion of NRM technologies and its impact on livelihoods. A case study of rainwater harvesting (RWH) research conducted by SWMRG of the Sokoine University of Agriculture was used. In Tanzania, promotion of rainwater harvesting (RWH) techniques is given priority in the implementation of the Agricultural Sector Development Programme (ASDP) of the Ministry of Agriculture, Food Security and Cooperatives (MAFC). The aim is to create and promote continued interaction with key stakeholders including policy makers and development agents

and to inform them on the potential of RWH in improving crop and livestock productivity, and its potential to improve food security and livelihoods of the people in the rural areas.

In the broad sense, RWH is 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 several categories, mostly 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 the 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 characterized by having large catchments. The systems include intermediate components for collecting, transferring and storing the runoff.

In the semi arid areas of Maswa District and Western Pare Lowlands (Same and Mwanga districts), RWH has increased farm yields two fold, raised household incomes and improved food security and the ability to mitigate vulnerability (Hatibu *et al*., 1999; Senkondo *et al*., 1999). Under different RWH systems, maize and paddy yields were reported to have increased up to 3,240 kg/ha and 3,228 kg/ha respectively under RWH in the study areas during the season 2000/2001 (Table 1). Average maize yield without rainwater harvesting was 268 kg/ha. Apart from field crops RWH is also used for production of high value crops like vegetables.

Table 1: Maize and paddy yields (Kg/ha) under different RWH techniques

RWH techniques	**Yields kg/ha**		
	Mwanga[1]	Same[1]	Maswa[2]
Large planting pits (maize)	1,512	2,484	N/A
Ridges and terraces (maize)	1,998	2,862	N/A
Diversion ditches (maize)	1,593	1,620	N/A
Diverting from rangelands (maize)	1,350	3,240	N/A
Diverting from ephemeral streams (maize)	1,350	2,970	N/A
Excavated bunded basins (paddy)	N/A	N/A	3,228

[1] Maize yields [2] Paddy yields. (Source: SWMRG, 2001)

The focus of this study was therefore to track the research and communication processes of the RWH suite of projects carried out by SWMRG in the semi arid areas of Tanzania. It is envisaged that the lessons that will be drawn from this study will be used to contribute towards developing research strategies that will ensure scaling-up.

2.0 Project Purpose

The purpose of the project was to contribute to the body of knowledge on the ways in which the processes of research and communication of natural resources management could be improved so as to strengthen the link between research and development sectors. Improved research strategies would assist scaling-up of research findings on natural resources management and benefit the poor in semi-arid areas. This would improve the understanding, by researchers, research and development planners and service providers, of ways and means to better ensure uptake promotion and scaling-up for impact of research on NRM.

3.0 Outputs

3.1 Research findings

The main outputs of this study were stated as (i) To assess the interactions between the livelihood capitals and the institutions and processes of research and communication for RWH systems; (ii) To develop better understanding of the efficacy of communication methods and media products for stakeholders across a range of levels and R & D sectors; (iii) To identify and test the best combination of methods for tracking RWH research processes, outputs and outcomes; and (iv) To 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 order to achieve the above outputs, five overarching research questions were formulated to guide the research process. These are:-

i. Which communications methods and media used to disseminate 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) addresses output 2 and research questions (iii), (iv) and (v) are addressing output (1). The research processes used by this research is synthesised to propose tracking methods that could be used to improve future research designs to enhance uptake of research findings (Output 3). Output 4 was implemented through design and implementing the communication plans and the results of this processes are also discussed. Research findings are presented following the sequence of research questions. This means that Output 2 is discussed first, followed by research findings for output 1, then outputs 3 and 4.

At farmers level, results are based on the comparison between 'with' (trained) and 'without' (non-trained) farmers to assess the impact of research and communication processes. A total sample of 377 households was interviewed which include 118 trained and 259 non-trained farmers. Trained farmers are those farmers who attended more than one-day training on RWH conducted by SWMRG, District Councils and/or projects. Trained farmers were purposively selected based on the information availed at district and village levels. For non-trained sampling was done at village level (Refer Annex A.2 section 2.2). 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) was considered throughout the analyses. At district level a comparison is made between target

districts (where research by SWMRG was conducted) and non-target districts (other districts found in semi arid areas with potential for utilising RWH research findings). At national level, interaction with policy makers and research managers revealed methods in which they received and use information from research. They went further, discussing factors facilitating and constrain use of information from research as well as problem of researchers in communicating to wider audience. The following sections provide the summary of the findings while more details are discussed in Annex A.2.

3.1.1 Efficacy of communication methods and media products (Output 2)

Efficacy of communication methods and media products used to communicate research findings on RWH to farmers, village extension officers, district officials and policy makers and research managers were assessed. Interactive methods such as training, workshops and seminars that involved direct contact with change agents (extension service providers and researchers) were found to be more effective by all stakeholders. Details of forms of information received by different stakeholders and factors that facilitate and constrain use of information received are discussed in the following sub-sections.

(a) Communication of RWH information at Farmers level

In the research and communication processes at farmers level a combination of methods and media were used to disseminate RWH information as discussed hereunder.

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

Farmers received RWH information mostly through interactive methods like meetings, contacts with extension agents, farmers' group discussions and training (Table 2).

Table 2: Responses (multiple) on methods and media of information dissemination of 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 discussions	61	24	36
Training by SWMRG & Partners	100	-	31
Study visits	46	5	18
Demonstration plots	46	5	18
Media			
Radio	72	44	53
Booklets	24	3	9
Magazine	19	5	9
Leaflets	18	3	7

Source: Household questionnaire survey

Study visits and demonstrations were used to a limited extent. 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 and this prompted those who wanted to contact extension agents

for details to do so. These results show that trained farmers had more contact with extension agents (72%) compared to non-trained farmers, an indication that after gaining more 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. FGDs with trained farmers revealed that printed materials were provided during training sessions, thus making them have more access to more 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 them were not very clear (not reader friendly) 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 disseminated information.

During FGDs with trained farmers, they indicated that the training sessions conducted in all the three districts with durations of one or more days 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, digging pit-holes. Others are rooftop rainwater harvesting and construction of storage tanks, digging small charco-dams, diverting water from rangelands, culverts, gullies and ephemeral rivers; and construction of improved excavated bunds.

(ii) Preference and accessibility of sources of information by farmers

Responses from the questionnaires indicated that large proportion of farmers felt that all media and methods used and information received was perceived useful. However, the concern raised by farmers was that there were problems of accessibility of the preferred methods and media. During focus group discussions, farmers were facilitated to assess the effectiveness of these methods in 12 villages (one FGD per each village). Figure 1 shows the responses on preferences and accessibility of communication methods and media. The most preferred communication methods were interpersonal (face-to-face) contacts with researchers and extension agents and during training workshops. Although during FGDs they ranked these methods high, their effectiveness in delivering information to the end users was felt to be limited due to the fact that few researchers interact with farmers. Likewise, radio, magazines and leaflets were reported to be less accessible in conveying RWH information to farmers, although they were among the highly preferred communication methods. These divergences between preference and accessibility were attributed to limited number of extension agents, poor working gears to extension officers (e.g. lack of transport and poor remuneration) and remoteness of some villages as a result of poor road networks.

Generally mass media like radio was thought by farmers 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. Further analysis indicates, however, that there is limited use of radios by researchers in the dissemination of research findings. This was raised during discussions with researchers and reasons given are that preparation of radio programmes on agricultural message delivered to farmers is the mandate of extension department.

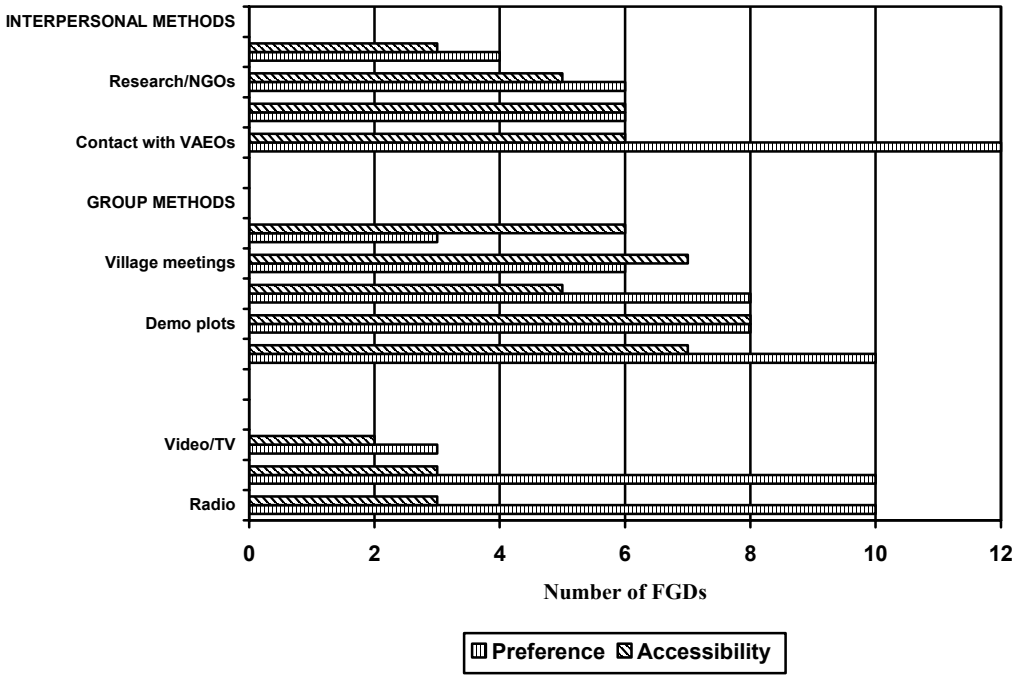

Figure 1: Preference and accessibility of communication methods and media in 12 villages
Source: Focus Group discussions

Although printed materials were also preferred, farmers said they are not easily accessible in the villages. When available they are not user friendly and therefore they were ranked low indicating low preference. 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.

(iii) Factors that facilitate and constrain use of information by farmers

All farmers responded that information received is useful and they used it to improve their indigenous knowledge and hence farming practices. However, there are factors that facilitate and/or constrain use of the information received by farmers. These are discussed in the following sections.

Number of sources of information by farmers

During focus groups discussions, farmers indicated that there are farmers who were more knowledgeable in practicing RWH. Further discussions revealed that such farmers had more exposure to RWH either through training and other sources. A comparison of the number of sources of information between trained and non-trained farmers was made and the results are shown in Table 3. The results show that trained farmers (92%) had more than two sources of information compared to non-trained farmers (13%) who had only one or two sources of information. This may be due to the fact that mostly printed materials were provided during training sessions as notes and printed materials like booklets and leaflets. Discussions with non-trained farmers indicated that those who received training were more knowledgeable on RWH information and those who utilised information provided produce more crops.

Table 3: 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

Information sharing amongst farmers

Results in Table 4 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 facilitate use of information.

Table 4: 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

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 do things differently and neighbouring farmers see the difference they normally become keen and want to learn from the trained farmers. However, during discussions with non-trained farmers, they complained that trained farmers were not always sharing with fellow untrained farmers. A follow up to this with the trained farmers revealed that, mostly they shared information in their farmers' groups. Unfortunately most non-trained farmers were not members of such groups.

Provision of technical support

Farmers who received information through training or other sources in most cases needed technical support from the village agricultural extension officers (VAEOs). This approach normally prompt farmer to seek for more information from extension agents in order to utilise information received. The large proportion of VAEOs interviewed who said that more farmers are seeking support for improved RWH practices confirmed this. For example, technical support was required in measuring of contours; locating and laying out of diversion channels so that they extract water without destroying their fields.

The main constrain was that there are few VAEOs and these cover large areas. For example, during discussions with farmers in Lali village in Maswa district, they complained that they do not get advisory services from the VAEOs. This was confirmed while interviewing the VAEO for Lali village whereby he informed that he is working in two villages (Malampaka and Lali), which are very large. As a result he could not meet all the farmers' demands and therefore farmers had limited access to extension services. The VAEO for Lali village was also not trained on RWH techniques while pursuing his diploma course and did not receive training provided by SWMRG. He therefore admitted that he was 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. They also complained to lack of basic equipment for surveying such as A-frames and line levels for measuring contours.

(b) Communication methods and media at village extension officers level

i) ***Methods and media used to communicate RWH information to VAEOs***

Village Agricultural Extension Officers (VAEOs) in the study districts received information about RWH in different forms and from different sources (Table 5). Information on RWH technologies reached extensionists through seminars, workshops, training of trainers' courses and study visits. Training of trainers' (ToT) course provided by SWMRG was mentioned to be the main source of RWH information delivered to extension officers particularly in districts where research work was conducted.

Table 5: Responses (multiple) on methods of communication for VAEOs

Methods of information	Name of district			Total
	Maswa (n=4)	Mwanga (n=9)	Same (n=4)	(n=17)
	Count	Count	Count	Count
Training of Trainers	-	7	3	10
Seminars	1	4	3	8
Workshops	1	3	1	5
Not trained on RWH	2	-	-	2
Study visits	-	-	1	1

Out of seventeen VAEOs, 10 of them attended ToTs, 7 were from Mwanga district and 3 were from Same District. Extension staff interviewed in Maswa did not attend ToTs conducted in 2000 by SWMRG because they were not residing in these villages at the time the training was conducted. SWMRG partners such as District Councils and other development agencies like MIFIPRO, and GTZ-funded Tanzania Forestry Project (TFP) in WPLL and IFAD/PIDP (Maswa) also conducted seminars and workshops.

Through discussions, some VAEOs also revealed that they were involved in participatory surveys conducted to understand indigenous knowledge (IK) in Maswa, 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 the performance of different RWH systems. The assessment of the different forms of information indicated that ToT courses were most useful and effective because it provided VAEOs with theoretical understanding of the RWH concept as well as practical training in various RWH techniques. Training manuals received during ToT courses and booklets (in Kiswahili) were also good reference materials. From discussion with VAEOs who received practical training on RWH techniques, they confirmed that they were more confident in supporting farmers in the promotion of RWH technologies and hence enhanced uptake of the developed technologies.

ii) Factors that facilitate and constrain use of information by VAEOs

VAEOs indicated that the following factors facilitated and/or constrained use of information on RWH.

Hands-on skills

Those VAEOs who received training with provision of hands-on skills, they indicated that they were empowered and became more competent. In the cases where farmers required demonstrations of techniques to be promoted e.g. laying out of contours and terraces, practical skills were necessary for VAEOs. During discussions, VAEOs who received ToT training felt more competent and confident than those who did not receive training. In addition, trained VAEOs acknowledged that the knowledge they got on RWH systems provided them with more options for improving rainfed agriculture in their areas. In the case of non-trained VAEOs, the use of the information received through printed materials and radio was limited due to lack of practical skills to demonstrate to farmers the improved RWH technologies. The importance of hands-on skills is shown by the respondents in Table 6 where by 6 out of 17 VAEOs interviewed felt that lack of practical training is a constrain to the use of information on RWH. This was explained further during group discussions, that most VAEOS were not trained on RWH during their diploma/certificate courses.

Table 6: 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 choice 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

Lack of transport

Extension staff did not have transport facilities like motorbikes and this was mentioned to limit them from reaching a big cross section of farmers who are spread over large geographical locations. Six VAEOs responded that they are covering more than three villages and these villages are also big, therefore they reach very few farmers especially those who received training and were willing to form groups. There were cases where VAEOs had motorbikes, but did not get support for fuel to enable visit the villages more frequently. For example, VAEOs for Mwembe had a motor bike and is covering the whole wards which had five villages but is rarely getting fuel to make visits to farmers.

Provision of knowledge sharing products

Provision of knowledge sharing products (that are user friendly) from research was felt by VAEOs (5) would help as reference materials when faced by challenges in the field. Production and distribution of knowledge/communication sharing products (KSPs) such as leaflets and booklets for VAEOs and farmers provides support especially in absence of researchers. Some of the VAEOs found that sometimes they felt farmers knew more issues than themselves because farmers were given more opportunities like attending seminars/workshops where technical issues were discussed in their absence. However, some of them thought the KSPs produced would be more meaningful for farmers if village

extension workers were involved so that they are produced in simpler and common language/packages.

Provision of funds

During interviews it was felt by some VAEOs (4) that provision of funds to conduct demonstration plots would assist VAEOs who received training to promote RWH. Most extension projects (which are funded) and in villages with support from NGOs, like Bukangilija under Christian Relief Services (CRS), Lali under World Vision and Kwanyange under MIFIPRO, funds are provided to conduct demonstrations on improved use of rainwater. These helped in the promotion and uptake of RWH technologies. VAEOs acknowledged increased support in the district agricultural development plans (DADPs) for infrastructural development. However, they felt that more support is required for enhancing communication activities in villages to ensure that there is wide promotion of RWH. VAEOs argued that lobbying and advocacy to leaders in the district councils would help to have more allocation of resources for promotion of RWH.

Communication between researchers and VAEOs

Active involvement of extension officers at village level facilitated use of information because they felt that they are part of the programme. There was a general complaint that sometimes researchers do not inform VAEOs when they will visit villages and this led to the tendency for researchers to work with farmers in the absence of the VAEOs. As a result when VAEOs were required to provide support to farmers thereafter, they could not understand some of the issues. VAEOs thought if they knew well in advance research plans in the villages, it would help to programme their activities so that they participate actively to avoid conflicts with other duties. They advised use of mobile phones which most of them have to improve communication.

Provision of technical backstopping to VAEOs

Frequent 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 areas. These enabled VAEOs to continue to use information received and encourage farmers to correct their mistakes.

Involvement of Youths

Some VAEOs felt that most of the time, the selection of farmers for training targeted heads of households (who are normally the old and middle aged) leaving out young farmers. For example, the VAEOs for Kwanyange village (in WPLL) who is also covering more than four villages deliberately involved young farmers in training activities. As a result, he realised that up-take of RWH was high and the young farmers were producing tomatoes using RWH techniques. He associated this with the fact that most young farmers know how to read and write, and when convinced about the new technology they seek more information. They were eager to try and since they are more energetic, they could provide the labour and practice RWH techniques like digging of trenches compared to old farmers. 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.

Support by development agencies

In villages or sites where there were development agencies working or promoting similar technologies to RWH, uptake of RWH technologies was felt to be high because the VAEOs were facilitated with transport and training materials. For example, in WPLL, the area where

MIFIPRO is working, farmers from ten villages covered by this NGO had been trained on RWH. In Maswa and Misungwi districts in the Lake Zone, APROTEC, which is a private company, is promoting 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 construction of rainwater storage facilities. Farmers are using drip irrigation from harvested rainwater to produce high value horticultural crops like onions, water melon and pepper that fetches good price and hence increased their income.

Use of participatory approaches in communication activities

Most VAEOs appreciated that during the RWH research implemented by SWMRG, there was emphasis on the use of participatory approaches. This enabled VAEOs to gain more understanding on different RWH systems 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 claimed 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.

(c) Communication methods and media on RWH information at District level

i) 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 7). Responses from District officials in the target districts (Maswa, Mwanga and Same) and non-target district (Rombo, Moshi, Hai, Handeni districts in the Northern zone and Misungwi, Kwimba and Shinyanga districts in the Lake Zone) show that the interaction with researchers through meetings, seminars and workshops was high (65%). However, in the target districts, direct contact with researchers from SWMRG-SUA was indicated as one of the main source of communication (76%), compared to non-target districts where only 33% of the respondents had contact with researchers. Contact 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 7: 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 7 shows that 67% of the respondents from the non-target districts appreciated more that booklets 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 where available.

Some officials, particularly District Commissioners and Councillors, challenged researchers to use more interactive approaches like demonstrations so that they can learn more by seeing. Furthermore, they indicated that some reports submitted in the district use very technical language that is not reader friendly and hence remain in the shelves. In addition, they urged researchers to produce printed materials that are more reader friendly language so that they could easily grasp information and use it.

ii) 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 of activities about RWH; (iv) lack of feedback from some researchers during and after completion of research projects. These factors are briefly discussed in the following sections.

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 information received by incorporating in their development programmes and seek 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 has been supported by projects like the Participatory

Irrigation Development Project (PIDP) and Rural Water Supply and Sanitation Projects (RWSSP), a World Bank Project. In the non-target districts like Rombo, the district executive director (DED) informed that she 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 support 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.

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 8. Projects and NGOs provided funds to train more farmers and support field activities in the use of RWH techniques.

Table 8: 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

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 to 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 create demand for support from district councils to develop more infrastructure for RWH.

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 demand 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 to end users. This difference could be bridged by the presence of researchers and development agents who had funds to hasten communication processes in the target districts.

Lack of feedback from researchers

District officials had concerns on the tendency of some researchers who usually do not provide feedback on the research progress (during implementation) and findings after completion of the projects. This was particularly mentioned by District Commissioners in Mwanga, Maswa and Bariadi districts. They further complained that some of the researchers do not inform the district officials that they are doing research in their districts. 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 limits 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.

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 because VAEOs are few and not well equipped to advice farmers; it would be more effective for project and development agents to impart skills directly to farmers.

(d) Communication methods and media on RWH information at national level

i) ***Communication methods and media to 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 (a researcher and or policy maker). The most common communication methods used by research managers and policy makers included leaflets and booklets (31%), radio programs (21%), posters (15%) and scientific meetings (9%) as shown in Figure 2. Policy makers also interacted with individual researchers through scientific meetings (9%). Most of them, however, admitted that interaction with researchers is limited. Only 3 percent indicated that they had accessed information through scientific papers.

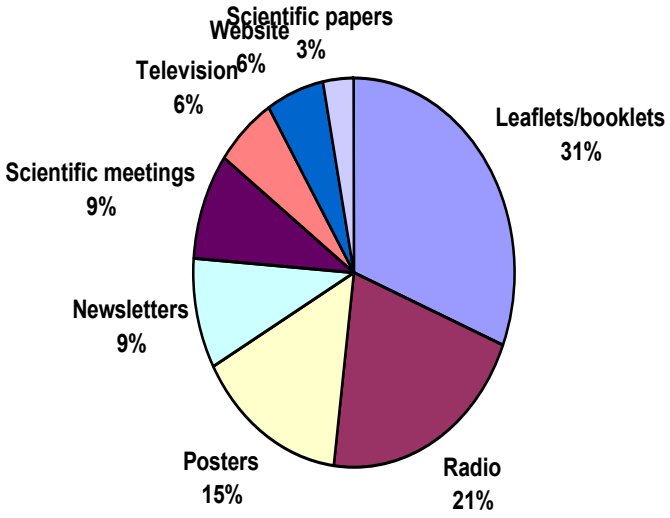

Figure 2: Sources of information received by policy makers (n=21)
Source: Survey data

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

Policy makers at national level indicated that factors that facilitated use of RWH information included interaction with researchers and access to scientific evidence on the potential of RWH. The recent review of the National Water Policy (URT, 2000) is a good evidence of use of information received. 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. Further discussions with policy makers and research discussions looked at the reason for limited communication to key stakeholders by researchers. Results from Table 9 indicate that some of the constraints perceived by national level policy makers and research managers that limit communication by researchers and hence limiting the use of research findings.

Table 9: 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

These include inadequate financing (63%), 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. As a consequence it limited the choice of methods to be used by researchers to communicate with key stakeholders. Some policy makers and research managers thought that 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 they communicate, the language used was very scientific and thus most research reports are not read and are simply left on the shelves. Use of summarised communication documents prepared as policy briefs in simple language is not common currently. There is need therefore of creating awareness to researchers, research managers and policy makers on the need to improve communication for wider adoption of research findings.

(e) **Communication methods and media used by researchers to communicate**

The results of the interviews with researchers on the methods used to communicate research findings are shown in Table 10. 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 constraints in promoting research findings (Annex C7).

i) Methods and media used by researchers to communicate research findings

Results in Table 10 show that methods and media used by researchers to share information included field days and workshops/seminars and on-farm trials, which were sometimes used as demonstration fields.

Table 10: 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

Other methods used included leaflets, meetings, exchange visits, agricultural shows, radio programmes and posters. 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 reach policy makers and

other key stakeholders) were rarely used. 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 interviewed.

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 led to poor targeting and packaging of research findings.

ii) 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.

Limited Communication skills and capability

In general, researchers admitted that they had limited communication skills and capabilities (Table 11). 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 11: 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 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 extension system.

During discussions with researchers at Selian Agricultural Research Institute (SARI), for example, they said that 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.

Inadequate allocation of resources for communication activities

Most researchers admitted that when designing research projects their major focus is to allocate enough resources for field work, 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, they write scientific reports for publication in scientific journals. Few researchers attempted to produce leaflets although these could not be published for wide distribution due to lack of funds. 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 leaders and national level.

Limited awareness and access to national policies and strategies

The results in Table 12 show that a large proportion of researchers (67%) are 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

Table 12: 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

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.

3.1.2 Interaction between research and communication processes and farmers livelihood (Output 1)

An assessment was carried out to in order to understand farmers' perception on the relative importance 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 RWH techniques are 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 (Annex A.2 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 facilitate and/or constrain adoption of improved RWH techniques by farmers and its impact on food security and assets ownership.

(a) 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 are 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 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.

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 13 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 13: 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*' (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 first rain 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 circle 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.

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.

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 14. 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 structure 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 development of such RWH structure is 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 14: 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

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

The location of the field plots in the toposequence is another important factor in practicing RWH because it also influences 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 15 show that most farmers had their fields in the middle or downstream which is associated with high possibility of access to 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 15, 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 flatish.

Table 15: 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 dig 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 lead to low adoption of RWH practices 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 of run-off. A lady farmer in Kwanyange village in WPLL, who received training, had problems to implement what she had leant. 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.

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 believed that their land was receiving enough organic matter and sometimes fertilisers drained from the upstream fields.

iv) Group membership

Normally farmers form groups in order to address felt needs but sometimes also as a result of influence by development agents. During training sessions, farmers were 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 16.

Table 16: 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 16 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 also 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 Maswa District Council to construction 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.

v) Availability of farm tools and implements

Tools and implements are required for land preparation and construction of RWH structures such as contour ditches and diversion channels. In land preparation most farmers use hand hoes, ox-drawn ploughs and tractors (Table 17). The results in Table 17 show that more than

93% of respondents use the hand hoe 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 17: 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 hoe, spades and mattocks.

vi) 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 18). The results in Table 18 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 done did not have own pair of animals for ploughing or a tractor such a person needed money for hiring tractors or animal draught power.

Table 18: 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, but 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.

During feedback workshops, participants analyzed the livelihood capitals that enabled adoption and utilization of RWH technologies (Annex C4, C5 and C6). There was agreement in all the three districts that knowledge on improved technology and labour (human capital) are critical in facilitating adoption of RWH. There was also agreement in Maswa and Mwanga that the second most important factor is natural capital such as access to good land and access to run-off. In Same district, financial capital was ranked second important factor and farmers argued that the natural capitals such as water is a God given resource. Skilled farmers with enough financial resources can convert natural capital into outcomes, and hence were rated as important factors in facilitating 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, there are local arrangement of mobilising resources such as oxen known as *Malika* (in local Sukuma language), where a number of households cultivate large areas within a short time. On the other hand, in Mwanga district, financial capital scored low. The reasons given were that financial capital can not be effectively utilised if farmers are not knowledgeable and well organised (social capital).

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.

(b) 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 19. A large proportion of the trained and

non-trained farmers claimed that the increase contributed in improvement in household food security and income, which contributed in increased asset ownership.

Table 19: 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 grown in semi arid areas like sorghum and millet. 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 3 show the response 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 3 shows, households with trained farmers were more food secure (85%) compared to households from non-trained farmers (62%).

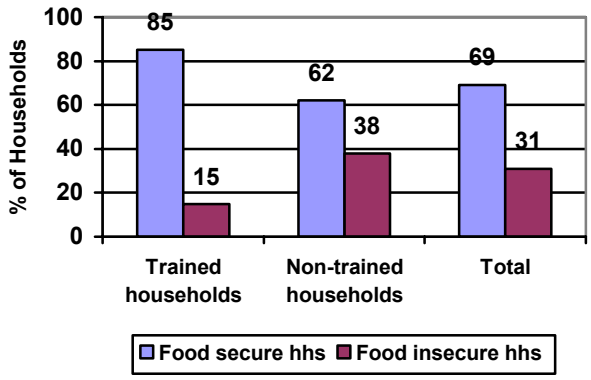

Figure 3: Household food security status as perceived by the community

The results from the community mapping were compared with responses from household interviews. The results (Table 20) show that a large proportion of trained farmers (54%) agreed that they were food secure, while 31% denied that they are not food secure. Similarly, 7% of households that were rated food insecure by the community, responded that they are 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 20: 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 be observed from Table 20 that a large proportion of households that are 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 receive food aid from the government or food relief organisations.

(iii) **Assets ownership**

Improvement in yields of crops under RWH resulted in increase in 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 21 shows the results of the assets owned by farmers. 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.

Table 21: 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

(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 22). For example, the results in Table 22 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 22: 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

3.1.3 Tracking research and communication processes (Output 3)

The tracking of the information pathway from policy-to-research-to-farmers and key stakeholders was carried out as discussed in the preceding sections. Results showed that currently there is limited evaluation of the impact of research on livelihood. Most research project produce reports to satisfy funding agencies on the progress of research, and is thus limited to output level. During discussions with researchers, none of the researchers indicated to have carried out the impact of the disseminated information to farmers. This was so because conventionally, impact assessment is done sometimes after the projects end. It was found out that most projects do not allocate a budget for carrying out baseline survey and impact assessment after the project. In addition, conducting impact assessment is becoming difficult where there is no baseline information that maps out the situation before any intervention let alone documenting the existing indigenous knowledge.

Some researchers were sceptical that baseline surveys are very expensive and sometimes information generated in not used. From this research and experience elsewhere, we have seen that use of participatory approaches such as community/social mapping can be used to map extent of use of similar technologies that exist in the areas before project interventions. Process documentation of the data generated from these processes will form good baseline information. This information could be used to assess changes during project implementation and hence enable researchers attribute and link changes as a result of research interventions. Furthermore, linking research project to policy objectives is another way that would help researchers to assess whether research findings are addressing development objectives and impact thereafter. This would also provide a good picture of the policy-to-research-to-development continuum and hence facilitate the process of impact assessment. Currently, linking research objectives to development objectives and improved communication to policy makers is lacking, hence scaling up and thus wider uptake of research findings by end-users is limited.

3.1.4 Promotion of use of communication strategy in research design (Output 4)

A communication strategy and plan was designed and implemented. The target institutions were researchers, research managers and planners in sector ministry and higher learning institutions. Feedback workshops were carried out at Zonal level that involved researchers and research managers (Annex C7). During the discussions it was realised that the concept of communication strategy was new among researchers. Promotion of this concept to raise awareness and share research findings was sought. Training of trainers' course was conducted to develop a team of champions in training in communication and knowledge management (CKM). The training involved 25 researchers and academic staff from the Ministry of Agriculture Food and Cooperatives (MAFC), Sokoine University of Agriculture (SUA) and Tanzania Meteorology Agency (TMA). The training increased awareness on the existing gap in communication of research findings and trainees forwarded recommendations to their respective institutions in order to ensure that future research designs include communication strategy as a condition for approving research proposals.

Feedback workshops were also conducted at farmers' level to share research findings, which were very interactive and generated more elaboration of the findings.

3.2 Achievements

The project targeted to achieve four outputs, which were adequately achieved.

Output 1:
The understanding of the relationship between livelihood capitals and the institutions and the processes of research and communication for RWH systems was assessed. Critical combinations of the livelihoods capitals were also established. The results created an increased understanding of the factors that facilitate and/or constrain use of information received by key stakeholders in RWH and its relationship in transforming natural resources in livelihoods outcomes.

Output 2:
The most common forms of information received by stakeholders were identified and their effectiveness determined. The most common forms used by researchers to communicate NRM research findings were also identified. Use of interactive methods and reader-friendly written communication methods and media were recommended (Annex A.2). For policy makers use of policy briefs and radio for creating awareness to wider audiences on research findings was recommended.

Output 3:
Tracking research and communication processes on RWH research programme and its impact on livelihoods were assessed as described in the preceding sections. Lessons are drawn from this analysis and shared with other researchers that most research projects are output oriented and little efforts is made to assess impact. Awareness is also created that there is also limited effort to collect baseline data that could be used to assess impact. Use of participatory monitoring and evaluation methods and process documentation were recommended in tracking livelihoods outcomes and impact at farmers' level. To assess the impact of research on livelihood of the policies, the need to track information pathways in the technology development processes from policy development, implementation and reviews processes was emphasised.

Output 4:
The study contributed to an increased awareness of the constraints and barriers of communicating research findings to key stakeholders. Awareness was created through discussions during Training of trainers course conducted for researchers, research managers and planners in the R&D department in the agricultural sectors and academic staff at the at Zonal centres, Ministry's headquarters and Sokoine University of Agriculture. This convinced two research projects, the Smallholder Systems Innovations (SUA) and Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods (PANTIL) to include communication plans in the research proposals for improving uptake of innovations from research findings.

3.3 Things to be done to enhance uptake of research findings

Targeting and packaging of knowledge sharing products: Advocate improvement in targeting and packaging of research findings to address information needs of various key stakeholders than the current approaches of production of research products.

Communication strategy in research designs: Create awareness to researchers to include communication plans in the research designs so that resources are allocated for communication activities.

Communication skills of researchers: Request for more funding to provide training of researchers to improve their communication and knowledge management (CKM) skills using the existing team of champions. Lobby for review of university curriculum to include aspects of communication and knowledge management.

3.4 Research Products

Scientific paper
Lutkamu, M., Shetto, M.C., N. Hatibu and H.F. Mahoo (2005). Scaling-up and uptake promotion of research findings in natural resources management. Paper presented in the East African river Basin Conference held at Sokoine University, Morogoro Tanzania, 7-9 March 2005.

Training of Trainers course notes
Training notes were presented during the Training of Trainers course.

3.5 Promotion of products

The promotion of the project products was done at various levels as part of the implementation of the communication plans designed (Annex C2). These include:

i) A paper was presented at the East Africa River Basin Conference, which was well attended by researchers and research managers both local and international, thus reaching the target audience of this study. (Refer Annex C9)

ii) Training of trainers' course was conducted to 25 researchers from NARS that included researchers, Zonal research coordinators, research planners from the Ministry of Agriculture and Food Security; senior academic staff from the University of agriculture and representative of the Tanzania Meteorological Agency. The ToT used research findings that created awareness to researcher on the challenges of improving promotion activities in their research designs. This is a team of champions on CKM provides an opportunity for scaling-up research findings and the need to improve communication and knowledge management to a wider research community. Proceedings of the workshop are attached as Annex C8.

iii) Feedback workshops were conducted for farmers and extension staff in all three districts, Maswa, Mwanga and Same. This was a response to farmers request to give feedback of the information collected. Farmers expressed dissatisfaction and were tired of people doing research with them and they don't give feedback of the findings from the research done. This necessitated planning for feedback workshops with farmers and extension workers in each district. The workshops generated more information indicating that farmers felt to be part of the research process. Annex C4, Annex C5 and Annex C6.

4.0 Research activities

4.1 Activities 1.1 to 1.4 for Output 1

The research employed a combination of participatory and non-participatory methods for tracking RWH research and communication activities and its relationship to livelihoods outcomes such as improvement on food security, assets accumulation and well-being of the people. The methods included literature review (including grey literature), key informant discussions, focus group discussions, community mapping, natural resources mapping and participatory workshops and households surveys. Through key informant interviews and focus group discussions qualitative data was collected and recorded. Debriefing documents were used to document the processes carried out and the results for easy recording and coding. Data were entered and analysed descriptively using SPSS. Annex C3 give details of the field methods used to collect data.

4.2 Activities 2.1 to 2.3 for Output 2

Assessment of communication methods and media used to disseminate research findings on RWH was done. Ranking methods such as pair-wise ranking were used to determine the perception of farmers on the effectiveness and preference of these methods.

4.3 Activities 3.1 to 3.3 for Output 3

A combination of participatory and livelihood M&E methods were used to assess impact of RWH at household level. Non-participatory methods were also used that included household questionnaire survey. Impact Pathway Analysis was used to track the research and communication processes and the linkage with policy and overall development goals. These methods involved tracking of activities conducted by researchers and their partners and communication intermediaries. Furthermore, tracking of assets and livelihood outcomes at household level were assessed.

4.4 Activities 4.1 to 4.2 for Output 4

A communication plan was designed and implemented. The target institutions were researchers and research managers in NARES and higher learning institutions including research programme implementers and managers. Therefore activities carried out included group discussions with researchers. Preliminary research findings were shared during the East African River Basin Conference. In this conference, a paper was presented and feedback sought. A training of Trainers course was also conducted where 25 researchers from six research zones attended which included Agricultural Research Institutions of MAFS and researchers from the Sokoine University of Agriculture. Feedback workshop for farmers and extension officers at village and district level were also carried out.

5.0 Environmental assessment

5.1 Environmental impact from research activities

The study did not have any specific impacts on natural resources because it was assessing past interventions on improved management of natural resources, with specific reference on use of rainwater in semi arid areas.

5.2 Their effects of dissemination and application of research findings

Better designs of NRM research would in-turn improve contribution of research to natural resources management at policy and field levels

5.3 Evidence during the Project's life and its detection and monitoring
None

5.4 Recommended follow-up action
None

6.0 Contribution of Outputs

6.1 The contribution of outputs to NRSP Purpose
The NRSP purpose aimed at delivering new knowledge that enables poor people who are largely dependent on the natural resource base to improve their livelihoods. Interaction with policy makers and research managers at the MAFC has created awareness on the role of communication strategy to scaling-out and scaling-up of NRM research findings. This resulted in increased budgetary allocation in the 2004/05 and 2005/06 to scaling up of RWH systems to other semi arid areas in the country. The budget statement is stated as "… *Wizara itaendelea kueneza na kutafiti mbinu mbalimbali za uvunaji maji ya mvua ili kuyatumia katika uzalishaji wa mazao, mifugo na matumizi ya nyumbani. Kazi hii itafanyika kwenye vituo vya utafiti vya Ukiriguru na Uyole kwa kushirikiana na Chuo Kikuu cha Sokoine cha Kilimo*" (i.e – The MAFC will support rainwater harvesting research and promotion for crop production and domestic purposes. This work will be done in collaboration with the Sokoine University of Agriculture).

6.2 Attainment of OVIs at Purpose level
OVI 1: By July 2005, NARS managers acknowledge key considerations and ways and means by which to improve the contribution of NRM research to development

The project identified the most common forms used by researchers to communicate NRM research findings. Results also increased understanding of the factors that facilitate and/or constrain use of information received by key stakeholders in RWH and its relationship in transforming natural resources in livelihoods outcomes.

The project created awareness to policy makers and research managers in the MAFC and Sokoine Agriculture University (Directory of Research and Post Graduate Studies) on the constraints and barriers to communication activities by research institutions. The policy makers and research managers acknowledged the need to allocate resources for uptake promotion.

OVI 2: By April 2005, at least 2 target organisations utilise the project's findings on the communication process in their planning for NRM research and/or development programs

Capacity development for researchers was achieved through Training of Trainers in communication and knowledge management strategy (CKMS) development. A team of 25 champions on CKM comprising of researchers and research managers at zonal level from NARES and higher learning institutions (especially SUA) was established (Annex C_8). These participants agreed to include in the designs of NRM research communication and knowledge management strategies.

In addition, the on-going Smallholder Systems Innovations project in Tanzania and South Africa has developed communication strategy for dissemination of research findings. Furthermore, the Programme for Agricultural and Natural Resources Transformation for

Improved Livelihoods (PANTIL) implemented at SUA is developing a communication plan to improve uptake of innovations.

6.3 Uptake promotion

Improvement is recommended on the research design to include communication strategies and plans to enhance uptake promotion amongst research institutions. Efforts were made to create awareness to key stakeholders including the Zonal Research and Development Directors and senior researchers through the ToT course and international workshops. Furthermore, communication with partners who are supporting promotion of technologies from research to support capacity building activities is needed. At the University level lobbying and inclusion of communication aspects in the degree course will be done by the SWMRG.

7.0 Publications and other communication products

7.1 Books and book chapters

None

7.2 Journal articles

7.2.1 Peer reviewed and published

None

7.2.2 Pending publication (in press)

None

7.2.3 Drafted

None

7.3 Institutional reports series

None

7.4 Symposium, conference, workshop papers and posters

Scientific paper

Lutkamu, M., Shetto, M.C., N. Hatibu and H.F. Mahoo (2005). Scaling-up and uptake promotion of research findings in natural resources management. Paper presented in the East African river Basin Conference held at Sokoine University, Morogoro Tanzania, 7-9 March 2005.

7.5 Newsletter articles

None.

7.6 Academic thesis

None

7.7 Extension oriented leaflets, brochures and poster

None

7.8 Manual and guidelines

None

7.9 Media presentations

None

7.10 Reports and data records

7.10.1 Project technical reports

SWMRG, 2004. Tracking changes in natural Resources Management using Sustainable Livelihoods Approaches: Literature review. Project Final Technical Report Annex C1.

SWMRG, 2004. Communication plans for R8088B Project. Project Final Technical Report Annex C2.
SWMRG, 2004. Field manual for data collection. Project Final Technical Report Annex C3.
SWMRG, 2005. Proceedings of Farmers feedback workshop on research for improving strategies to assist scaling-up of research findings to farmers, held in Maswa District. Annex C4.
SWMRG, 2005. Proceedings of Farmers feedback workshop on research for improving strategies to assist scaling-up of research findings to farmers, held in Mwanga District. Annex C5.
SWMRG, 2005. Proceedings of Farmers feedback workshop on research for improving strategies to assist scaling-up of research findings to farmers, held in Same District. Annex C6.
SWMRG, 2005. Proceedings of the researchers workshop on strategies for improving uptake promotion and scaling-up of research findings, held Selian and Ukiriguru Agricultural Research Institute. Annex 7.
SWMRG, 2005. Proceedings of the Professional Development Course and Training of Trainers Course in Managing and Scaling-up of Knowledge in Soil and Water Management. The workshop held at ICE, SUA, 29th August to 2nd September 2005. Annex 8
Lutkamu, M., Shetto, M.C., N. Hatibu and H.F. Mahoo (2005). Scaling-up and uptake promotion of research findings in natural resources management. Paper presented in the East African river Basin Conference held at Sokoine University, Morogoro Tanzania, 7-9 March 2005. Annex 9.

7.10.2 Literature review

SWMRG, 2004. Tracking changes in natural Resources Management using Sustainable Livelihoods Approaches: Literature review. Project Final Technical Report Annex C1.

7.10.3 Scoping studies

None.

7.10.4 Datasets

The following datasets generated included:
Data1_Households questionnaire survey
Data2_FGD Village leaders
Data3_FGD Community mapping
Data4_FGD RWH resource inventory
Data5_FGD with trained farmers
Data6_FGD with non-trained farmers
Data7_Data from household community mapping
Data8_Village Extension officer's data file
Data9_District Leaders data file
Data10_Researchers data file

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9.0 Revised Logframe for R8088B

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Key Assumptions
GOAL = N			
Strategies for improving the livelihoods of poor people living in semi-arid areas, through improved integrated management of natural resources, under varying tenure regimes, developed and promoted	• By 2005, livelihood strategies of poor individuals, households and communities including their dependence on the various components of the NR base, and the relative importance of access to common pool resources, in target areas in at least 2 target countries, understood • By 2005, strategies for improving the livelihoods of poor people, by increasing the productivity of water in rainfed agriculture, through the use of appropriate rainwater harvesting (RWH) and/or soil nutrient management practices, developed and promoted in target areas in at least two target countries • By 2005, strategies that improve access to, and sustained use of, common pool resources by the poor under the most appropriate tenure and management regimes identified, tested and promoted in at least one target area in each of 2 target countries	• Reviews by programme manager • Reports of research team and collaborating /target institutions • Appropriate dissemination products • Local, national and international statistical data • Reviews by programme manager • Reports of research team and collaborating /target institutions	
PURPOSE			
Improved research strategies for assisting the scaling-up of improved management of natural resources, that benefit the poor in semi-arid areas, **developed** and **promoted** through: **Component 1**: ***HELP Office and upgrading of the PT Model***	• By March 2005, at least 3 approved District agricultural Development Plans (DADPs) contain comprehensive plans and activities for integrated management of rainwater	• DADP Documents submitted and approved by the ASDP	• Target beneficiaries adopt and use the developed strategies and/ or approaches • The current

Access to and service provision for the uptake and use of the PARCHED-THIRST model for improving RWH systems by development-related planners and service providers **improved**	• By Dec 2004, SUA senior authorities are sufficiently convinced of demand for PT model to take essential steps to sustain PT Help Office in SUA's system for service provision • By Dec 2004, at least one client builds capacity for use of PT model • By Dec 2003, at least one target district has produced improved RWH development plans assisted by the PT model By Sept 2003, PT model has been adopted by at least one Meteorology Department as an example of a value added product utilising weather data	Minutes of SUA faculty and senate meetings Records of a specified PT client District Agricultural Development Plans (DADP). Processed met data in a form suitable for use in district planning from the Tanzania Meteorology Dept	commitment to increased transfer, uptake and up-scaling of outputs from the NARS, as elaborated in the recently drafted Medium Term Plan (MTP) is maintained to create an enabling environment
Component 2: ***Lessons from past work on the development and promotion of RWH in Tanzania*** Understanding by research and development planners and service providers of ways and means to better ensure of scaling-up and the potential for impact from NRM research improved, using the promotion of improved RWH systems as a case study	• By July 2005, NARS managers acknowledge key considerations and ways and means by which to improve the contribution of NRM research to development • By April 2005, at least 2 target organisations utilise the project's findings on the communication process in their planning for NRM research and/or development programs	Minutes and Reports of Planning Meetings, and of Evaluation of Research or Development Projects – By SUA, DRD, NGOs and Districts	
Narrative Summary	**Objectively Verifiable Indicators**	**Means of Verification**	**Key Assumptions**
Component 2: – *Lessons from past work on the development and promotion of RWH in Tanzania*			
OUTPUTS			
Information services and livelihood development:			

1. Understanding of the interactions between the five livelihood capitals and the institutions and processes of research and communication for RWH systems, **increased**	• By May 2004, plans for Year 3 of the Study prepared • By October 2004, primary stakeholder outcomes and ex-post SWOT of R7888 communication strategy completed • By April 2005, at least three analyses completed of the factors influencing the reach and use of RWH-related information in livelihood strategies • By May 2005, at least 3 assessments of the livelihood changes achieved by primary stakeholders in target districts (Domain V) and the relationship with access to information, including the communication activities of intermediate stakeholders (in Domains W and X) completed. • By Dec 2004, indicators and other key variables for livelihood and PIPS study defined	• Project report for September 2005 • June 2005, Study Report • East African Conference paper – March 2005 • Indicators and variables report (part of inception report – June 2004)	
Ex-post study of SWMRP's communication's work:			
2. Better understanding of the efficacy of communication methods and media products for stakeholders across a range of levels and R & D sectors **developed**	• By June 2005, main findings for intermediate stakeholders robustly linked with the findings for primary stakeholders and utilised for refinement of the main product of Output 3 • By April 2005, main findings for at least 3 types of stakeholders in each of Domains W and X analysed • By Oct 2004, ex-post study of past RWH communication activities with local and national stakeholders designed	Stakeholders Domains W and X tracking study report, (May 2005)	
Using findings of Outputs 1 and 2 to improve NRM research design:			
3. Best combination of methods for tracking RWH research process, outputs and outcomes, **established** and **tested**.	• By June 2005, method reported in at least 2 major R&D meetings in eastern Africa • By Dec 2004, method refined in light of field experience • By July 2004, method field-tested By April 2004, draft method proposed	Project methodology progress reports for 2004 and final version in 2005	
Communication and promotion of findings of O1 & O2, and method of O3:			

4. Research and communication process for ensuring RWH research and, in a wider context, NRM research, that can lead to positive outcomes and impact, **elaborated** and **promoted** with target organisations at national and international levels	• By June 2005, briefing papers distributed to project stakeholders through an interactive process • By May 2005, briefing papers prepared on key findings of the project and implications for the R&D process for key types of project stakeholders developed • In 2005, communication strategy implemented • By August 2004, communication strategy developed and inception meetings (group and one-on-one) with key project stakeholders completed	Project communication strategy Project annual report for 2003-04 NRSP MTR report Briefing papers	
ACTIVITIES for Component 2		**Budget, £**	**Assumptions**
1.1 Undertake a comprehensive literature survey to identify linkages between the livelihood framework, and the process and impact of NRM research 1.2 Establish through theoretical analysis and consultation with stakeholders the relative importance of human, financial, physical, natural and social capitals on uptake, outcomes and impact of RWH research 1.3 Identify and define indicators and other key variables for livelihoods and PIPS in the context of efficient and effective information flows. 1.4 Determine the apparent cause-effect relationship between the five livelihood capitals, communication activities and the adoption and impact of NRM research	By end of specified year & month: **2004 Mar:** The communication activities and research process followed by SWMRP assessed and documented (A2.1). **2004 July:** Literature survey completed and conceptual framework for the process of NRM research developed; tentative communication plan drafted (A1.1). **2004 Sep:** Methodology designed and instruments for data collection developed (part of A1.2 & A2.2). **2004 Dec:** Communication plan developed (A4.1). Data collection begins (part of A1.2 & A2.2). **2004 Oct:** PhD proposal submitted. **2004 Oct-Dec:** Main phase of year 1 fieldwork completed and data and other information collated/organised (part of A1.2 & A2.2). **2005 Mar-Apr:** Emerging findings shared with key NARS stakeholders (part of A4.2). **2005 May:** Major work on data	For Outputs 1-3: Staff, Tnz *15,455 Staff, UK 6,265 Overhead 7,264 Overseas travel 9,515 Field costs 11,607 Total 50,106 * / Some of this budget will be used for Output 4	Stakeholders from earlier RWH projects are traceable and willing to participate in the Study

2.1 Identify stakeholders, communication methods and media products developed in the past RWH research; analyse and document activities and processes used for communication 2.2 Track outcomes and impact as a result of SWMRP's communication activities including the use of its various communication products 2.3 Use findings of 2.2 to define a communication strategy suitable for different categories of NRM stakeholders	analysis completed (part of A1.2 & A2.2). **2004 Dec:** Best combination of methods for tracking and assessing research outcomes and feeding back these findings into the RWH research process developed (part of A3.2). **2005 Mar:** Conceptual Paper presented at the African Symposium on Water Management Reforms (part of A4.2). **2005 Mar:** Further findings shared with key NARS stakeholders (part of A4.2). **2005 Apr:** Findings of the data/information analyses for Outputs 1 and 2 compiled (part of A1.2 and A2.2).		
3.1 Identify methods commonly used to track outcomes of NRM research 3.2 Develop and test different methods with target stakeholders and determine the most relevant for NRM research 3.3 Propose a method that is best suited for use in NRM research	**2005 Apr:** Main insights for Outputs 1 and 2 elaborated and reported (A1.3, A1.4 & A2.3). **2005 May:** Development and testing of tracking method completed, draft product on tracking method shared with key NARS stakeholders (A3.2 & A3.3). **2005 June:** Findings for Outputs 1-3 shared with wider group of relevant stakeholders (A4.2). **2005 July**: Final Technical Report (FTR) submitted to NRSP. ***(Post-NRSP)*** **2005 Dec:** Cause-effect relationship between outcomes/impact and research processes further elaborated. **2006 Mar:** Data analysis and interpretation completed. **2007 April:** PhD thesis submitted.		
4.1 Develop communication plan 4.2 Implement communication plan		Media products 550 Workshop 4,500 Water Conf 90 Total 5,140	

10.0 Keywords

Semi arid, Rainwater harvesting, scaling-up strategies, livelihoods, communication strategy

11.0 Annexes

Annex	Description
Annex C1	SWMRG, 2004. Tracking changes in Natural Resources Management using Sustainable Livelihoods Approaches: Literature review. Project Final Technical Report Annex C1.
Annex C2	SWMRG, 2004. Communication plans for R8088B Project. Project Final Technical Report.
Annex C3	SWMRG, 2004. Field manual for data collection. Project Final Technical Report Annex C3.
Annex C4	SWMRG, 2005. Proceedings of Farmers feedback workshop on research for improving strategies to assist scaling-up of research findings to farmers, held in Maswa District.
Annex C5	SWMRG, 2005. Proceedings of Farmers feedback workshop on research for improving strategies to assist scaling-up of research findings to farmers, held in Mwanga District.
Annex C6	SWMRG, 2005. Proceedings of Farmers feedback workshop on research for improving strategies to assist scaling-up of research findings to farmers, held in Same District.
Annex C7	SWMRG, 2005. Proceedings of the researchers workshop on strategies for improving uptake promotion and scaling-up of research findings, held Selian and Ukiriguru Agricultural Research Institute.
Annex C8	SWMRG, 2005. Proceedings of the Professional Development Course and Training of Trainers Course in Managing and Scaling-up of Knowledge in Soil and Water Management. The workshop held at ICE, SUA, 29th August to 2nd September 2005.
Annex C9	Lutkamu, M., Shetto, M.C., N. Hatibu and H.F. Mahoo (2005). Scaling-up and uptake promotion of research findings in natural resources management. Paper presented in the East African river Basin Conference held at Sokoine University, Morogoro Tanzania, 7-9 March 2005.