NATURAL RESOURCES SYSTEMS PROGRAMME

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1.0Introduction

Agricultural research and development (R&D) in developing countries has a primary objective of improving the welfare of the rural families through enhanced agricultural productivity. To-date R&D is faced with challenges to meet the demand for food (Biggs, 1997; Barrett *et al*., 2002). There are about 290 million people in SSA who still live in poverty, and nearly 40% of them live in arid and semi arid areas, of which almost half are in Eastern and Southern Africa (Hazzell and Haddad, 2001; Kydd *et al.*, 2004). The majority of this population largely depends on rainfed agriculture or the exploitation of natural resources for their livelihood and consequently most of them are haunted by famine and food insecurity. To meet the food demand, agriculture in semi arid areas require effective utilisation of scarce resources such as rainwater to increase its productivity, supported by sound technological innovations from R&D and sound policies (Hatibu *et al*., 2002; Shapiro and Sanders, 2002).

Many research and development programmes and projects on natural resources management (NRM) have been conducted in Tanzania and other countries to address problems of declining natural resource productivity. Due to the nature of interventions in natural resource management, it often takes a long time for significant and appreciable change and impacts on livelihoods and scaling-up to happen. Evaluation of these project interventions has often failed to demonstrate impact (Mosse, 1998). This does not mean that all the projects do not bring about changes and impacts – the problem is to identify impact that can be linked to or associated with the project objectives. The current approaches used to evaluate outcomes and impact of NRM programmes and projects include: (i) identification of what would have happened without the intervention; (ii) clear identification of control groups; (iii) identification, and quantification or estimation of variables (including those that are outside the control of the project) which can influence outcomes and impact of the project; and (iv) optimal combination of quantitative and qualitative methods for monitoring changes and impact (Weiss, 1990; Guijt, 1998).

However, these approaches are not explicit on how processes of the projects themselves can be tracked and the effects of these processes on the outcomes and impact. Thus the approaches fail to capture additional outcomes as a result of research and communication processes. Tracking is about documenting carefully the meaningful events in research and communication processes in order to discern more accurately what is happening, how it is happening, and why it is happening rather than just what has happened (Ashley and Malecka, 2002). Tracking is more than monitoring; but it is lacking in most NRM research projects (ILEIA, 1999; Bond and Mukherjee, 2002). Understanding and documentation of research and communication processes is important if interventions are to be replicated on a large scale for wider impact. This means that targeting for impact requires scaling-up and tracking, to relate such impacts to the projects.

On the other hand, past and current R&D in NRM has not always been effective in communicating findings it generated. Most of the information generated from NR research could not inform policy formulation and decision making to support farmers' efforts (Mosse, 1998; Hatibu *et al*., 2002). As a result, in many cases farmers could not utilise information provided due to lack of an enabling environment in relation to policy, institutions and processes that were necessary ingredients for adoption of new technologies. The problem is partly caused by the way research projects are designed. Review of the project formulation

guidelines shows that although there has been dissemination of research findings, most research projects do not contain a communication plan of how the research products will be communicated to end users to ultimately contribute to impact on their livelihoods (Tarimo *et al*., 2004). Because of this shortfall there is often a gap between impacts and the contribution of research, thus making assessment of the impacts of research projects difficult (Douthwaite *et al.,* 2003).

The review of literature was carried out to increase understanding of the concepts use in R&D for NRM development. Issues covered included: the sustainable livelihood framework; methods for tracking change and scaling-up as a input in developing the conceptual framework and methods for data collection.

2.0Overview on Agricultural Research and Development

Literature reveals that development is a process that involves evolution, with changes occurring in the social, economic and political spheres (Crewe and Harrison, 1990, Eichers and Staatz, 1990). Modernisation theories, despite their shortcomings in explaining social heterogeneity, still inform agencies in the development arena (Eichers and Staatz, 1990; Crewe and Harrison, 1990; Mango, 2002). Different models developed under this theory have guided agricultural development to-date, amongst which include the diffusion model, induced innovation model, and communication model (Ruttan and Hayami, 1990; Rogers, 1995). These theories were implemented through various approaches to technology transfer, from conventional approaches to the Training and Visit (T&V) system (van den Ban and Hawkins, 1988); farming systems approaches (Kaimowitz, 1990) and, currently, participatory approaches (Chamber *et al*., 1989).

Review of these approaches revealed that development of innovations is a complex process to which many actors in different roles contribute (Biggs and Farrington, 1990, Cornwall, 2003). Biggs and Farrington (1990) emphasised that agricultural research and technology promotion activities are always integrated with political, economic and institutional events. Likewise, Long and van der Ploeg (1988) argued that *'agricultural development is many sided, complex and often contradictory in nature. It involves different sets of social forces originating from international, national and local arenas. The interplay of these forces generates specific norms, directions and rhythms of agricultural change'*. Debates around improvement of the poor are essential in search for the best ways to address this complex situation.

3.0Policies guiding research and communication processes in NRM

The study showed that there are policies that guide NRM in all relevant sectors such as agriculture and livestock, forestry, land and water. Policy and strategy documents reviewed included the National Science and Technology Policy of 1995; Agriculture and Livestock Policy, 1997; National Forestry Policy, 1998; National Water Policy, 2002; Poverty Reduction Strategy Paper, 2002; Agricultural Sector Development Strategy (ASDS, 2001); Agricultural Sector Development Programme (ASDP) of 2003; National Forestry Research Master Plan 2000-2009 of 1999; National Agricultural Research Fund, 2002; and Tanzania Soil Fertility Initiative – Concept paper and Guidelines for Zonal Agricultural Research

Funds, 1999. Some of the policy and strategy documents mentioned contain some aspects of soil and water management (or NRM). However, some of the documents acknowledged lack of communication of research findings particularly on soil and water management to end-users.

The Water Policy (URT, 2002), for example, states categorically that there is very limited research done in water resource management and the research findings are not adequately disseminated to end-users. It is however acknowledged in the Water policy that in order to attain equitable, efficient and sustainable water resource management and based on the experience gained in the country and internationally, understanding water resource management will be based among other things on improved communication. Improvement in the dissemination and utilisation of research findings in the sector will be achieved through strengthening of the information, education and communications system; and monitoring and evaluation involving many stakeholders.

Both the Agricultural Sector Development Strategy (URT, 2001) and the Agricultural Sector Development Programme (URT, 2003) and the recent Medium Term Plan (MTP) for R&D programme of MAFS identified poor communication of research results as one of the major problems in the uptake and utilization of research results (MAFS, 2003). These documents recognised the importance of informing and up-dating relevant information for all stakeholders such as input suppliers, equipment/implement manufacturers in a market economy. The ASDP emphasises that the current focus in research processes will be on data collection, analysis and dissemination for planning purposes at the national level by sector ministries. It is at this interface that research should play a role in informing stakeholders on the scientific evidence of performance of various technologies so as to influence planning and resources allocation for uptake of improved technologies on a wider scale. However, traditional research still uses the conventional communication methods for dissemination of research findings.

4.0 The Role of Rainwater Harvesting in Livelihood development

4.1. Rainwater harvesting research and promotion

Development in semi arid area is influenced by a number of factors that facilitate of constrain farmers in addressing the challenges the face in improving livelihoods. One of the most limiting factors in semi arid areas is water. Agriculture in semi arid areas is largely rainfed, and rainfall is erratic. Therefore capturing rainwater and utilising it effectively has been a challenge in R&D. This is discussed briefly hereunder.

The semi arid areas which covers about two thirds of land in Sub Saharan Africa are generally characterised by poor resources, low and unreliable rainfall and sparse vegetation (Steiner and Rockstrom 2003). Agriculture in these areas is typically risk-prone and difficult. Crop yields may vary from year to year, crop failures can occur as a result of drought and household food security is often precarious. Although water is only one of the many inputs in agricultural production it is perhaps the most critical. Water is a central ingredient of the multifunctional characters in agriculture and land. When water is scarce, the need for water management skills and its efficient use rises. Rainwater harvesting for crop and livestock production is a promising way of upgrading rain-fed agriculture in semi-arid areas (Barklund, 2000).

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). The term RWH describes a wide range of techniques, which collect rainfall runoff for different uses by linking a runoff-producing area with a separate runoff-receiving area (Young et. al., 2002). RWH systems are classified in several ways, 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 (Mahoo, et al 1999). The system is accompanied with cultural practices to ensure that crops make the most effective use of the scarce water. It is sometimes called water conservation and is basically a prevention of net runoff from a given cropped area by holding rainwater and prolonging the time for infiltration. It is basically all the conventional approaches to soil and water conservation, designed to enhance infiltration of rainwater into the soil.

Another 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). This system is used mainly for growing medium water demanding crops such as maize, sorghum, groundnuts and millet. 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 main problem has been that in most projects in the past there has been bias towards promoting soil conservation rather than soil water conservation with production. This contributed to the problem faced by farmers of not realising the benefits of the soil conservation systems (SWMRG, 1999).

The third category is macro-catchment RWH characterized by having large catchments. Catchments for these systems are located outside the cropped area, where individual farmers have little or no control over them. The systems include intermediate components for collecting, transferring and storing the runoff. According to Gowing et al. (1999), the system is difficult to differentiate from conventional irrigation systems, but it is referred as RWH as long as the water for harvesting is not available beyond the rainy season. The three categories show that, RWH for crop production is a continuum ranging from conventional soil and water conservation at one end and supplementary irrigation. Thus RWH should be regarded as a continuum of techniques that link in-situ soil-water conservation at one extreme to conventional irrigation at he other (Gowing *et al*., 1999)

4.2. Role of RWH in Livelihoods

It is widely accepted that utilisation of good water management through various RWH techniques enables farmers to improve their local natural resource base as a viable and effective strategy for alleviating food insecurity (Agarwal and Narain, 1999; Prinz, 2001; Smet and Moriarty, 2001; Ngigi, 2002; Steiner and Rockstrom 2003). Use of rainwater harvesting techniques has been found to significantly improve production and the productivity of labour (Table 1) and other inputs in an area of very low rainfall of less than 300 mm per season (Senkondo, et al, 1999).

Table 1: Estimated 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

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 is reported to increase up to 3,240 kg/ha and 3,228 kg/ha respectively under RWH in the study areas during the season 2000/2001. Average maize yield without rainwater harvesting was 268 kg/ha compared to 1,019 kg/ha obtained with RWH during the Vuli of 2000/2001 in Same District which was generally a bad season. Apart from field crops RWH is also used for production of vegetables, fruits, as well as tree crops.

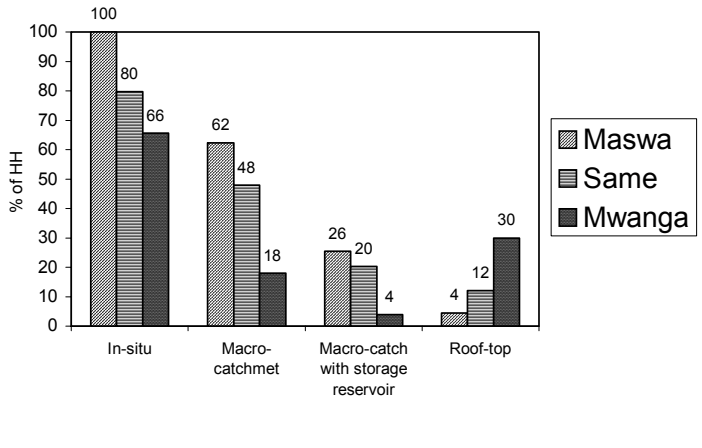
Table 2: Gross margin analysis for maize with and without RWH in Makanya catchment

Field location along the catchment	**Maize with RWH**		**Maize without RWH**	
	Gross margin (Tshs/ha)	**Return to labour (Tshs/man-day)**	**Gross margin (Tshs/ha)**	**Return to labour (Tshs/man-day)**
Head	2,086	3,996	NA	NA
Middle	3,645	4,139	NA	NA
Tail-end	1,726	2,555	NA	NA
Overall	68,162	2,39	-53,197	-25

Source: Senkondo et al., 1999.

Use of RWH practices for the semi-arid areas could substantially improve crop production, alleviate food shortages and increase farm incomes. Research shows that farmers practicing gully flow diversion in Makambako obtained maize yield of 2.31 t/ha, while those practicing tied-ridging systems produced 1.63 t/ha. The minimum yield is 144% obtained from the common farmers practice in the area. After harvesting maize farmers used remaining harvested water to produce tomatoes. Gross margins analysis for off-season tomato production indicate that farmers earned Tshs 1,091,333/-

Fig. 1: Adoption of RWH in WPLL and Maswa



Use of RWH techniques increasing production as a result of improving management of water from the moment it falls and ensuring that most of it is

used productively before it is returned to the atmosphere by evaporation and runoff. RWH techniques ranges from in-situ methods where rainwater is captured and retained where it falls to improve crop production to macro catchment techniques of diverting and storing runoff from ephemeral streams and gullies with storage (Hatibu et al, 2002). Through research and communications processes farmers in Western Pare lowlands and Lake zone areas have acquired knowledge of RWH and have often put it into practice (Fig 1). Mostly in-situ RWH techniques are commonly practiced, followed by diverting runoff from ephemeral rivers. Wider adoption of RWH in similar environments would help in improving livelihoods by ensuring increase in food security and income (Barkland, 2000).

4.3. The livelihood concepts

In understanding the impact of research and development in poverty reduction various arguments are put forward. Understanding of the relationship of livelihoods capital as it influences adoption of improved NRM including RWH and its impact on livelihoods outcomes is discussed.

The recent livelihood framework and analytical approaches built on earlier development theory helps to better capture the nature and dimensions of poverty and the role of different interventions in reducing poverty (Ellis, 2000). Livelihood is defined by Chambers and Conway (1992) to 'comprise the capabilities, assets (store, resources, claims, and access) and activities required for a means of living'. While this definition captures the essentials of livelihood ideas, it is criticised for including access as an asset (Ellis, 2000). Ellis (2000) defines a livelihood to 'comprise the assets (natural, physical, human, financial and social capital), the activities and access to these as mediated by policies, institutions and social relations that together determine the living gained by the individual or household'.

This definition separates capital assets that people have at their disposal and how different people acquire access to assets and opportunities. Ellis (2000) simplified the framework into five components. The first component is on assets farmers have that essentially describe the economic relationship between livelihood assets a household have or can access. Assets are described into five major categories as follows: (i) Natural assets that include the natural resource stocks from which resources flows useful for livelihoods are derived for example, land, water, biodiversity, wildlife and other environmental resources; (ii) Physical assets comprising of the basic infrastructure (transport, shelter, communications and energy) and production equipment that enable people to pursue livelihoods; (iii) Human assets which include skills, knowledge, labour or ability to command labour, good health important to the ability to pursue different livelihood strategies; (iv) Social assets which are the social resources such as networks, membership to groups, relationships of trust, access to wider institutions of society upon which people draw in pursuit of livelihoods; and (v) Financial capitals comprising assets like savings, credits, remittances or pensions and those that provide them with different livelihood options. Uptake of technologies by end users requires financial capital outlay such as credit; social mobilisation of labour and utilisation of these assets is knowledge-dependent.

The second component comprises of activities in which individuals or families are engaged using their assets to earn a living. Activities that farmers are engaged in may include farm activities such as cultivation, livestock keeping and non-farm activities like brick making, weaving and thatching. The third component is on livelihood outcomes that are the result of the people's success or failure in transforming, through a variety of strategies, the assets available to them into food, income and other basic needs. Livelihood outcomes may not

affect household members the same way due to differences in power relations (Morris et al., 2000). Hence, understanding of the internal and external household dynamics is important. The fourth component is the economic relationships that are embedded in social and political relations as implied by the policy and institutional context. Different households are affected in different ways by a range of structures and processes or policy, institutions and processes in the way they access assets (Satgé, 2002).

There is also vulnerability context of the people's livelihoods viewed in terms of shocks, seasonality and trends. Vulnerability refers to exposure to contingencies and stress and difficulty in coping with them (Ellis, 2000). In semi arid areas frequent occurrence of drought or floods may influence the way households develop livelihood strategies to cope with such events. Availability of new information in utilisation and management of assets such as rainwater may reduce risks that could lead to improved food security and increased income. This would enable farm families convert assets they have like knowledge, labour and finances into new assets such as constructed charcodams or water tank for rainwater storage. These processes of converting assets caused changes in the external environment that affect individual households either positively or negatively and can draw down assets and reduce or increase consumption.

The study will use the livelihood framework to track activities, assets, vulnerability and outcomes at farmers' level to establish contribution of RWH in improving livelihoods of the people. The study will also strive to understand the relationships between research processes and livelihood capitals that facilitate or constrain use of RWH information. In addition, the study will increase understanding of the impact of RWH on livelihoods as a result of communication processes to promote uptake of RWH technologies.

5.0Communication of research findings

Communication is defined as a process of sharing or conveying information, while dissemination is an act of distributing information to various audiences in forms appropriate to their needs (DFID/NRSP, 2002). Communication and dissemination of research findings aims at increasing wider awareness of research products and, in turn, enhances the speed of use of the research products. Review of the past and current research projects shows that dissemination of research findings has always been through technical reports and papers mainly aimed for other scientists, and delivery of extension messages is left to the extension systems (Obinne and Ozawa, 1997; Garforth, 1998). This resulted in slow uptake of innovations because the extension system is ill equipped to make effective communication happen. Furthermore, it is realised that uptake of research products need more players other than research, extension and farmers as suggested in the knowledge triangle of the Agricultural and Knowledge Information Systems (FAO/World Bank, 2000). Ashby (2003) urged researchers to recognise that outcomes and impact on NRM research 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.

A recent review of the implementation of agricultural research programme in Tanzania recognised that there was a great weakness in communicating research findings to the target

stakeholders, thus limiting the impacts of research on rural livelihoods and possibilities of extending research findings to a wider area (MAFS, 2003). Dissemination of research findings has been through writing of technical papers mainly aimed for other scientists. In addition, a large proportion of resources in the research system is utilised in generating technical innovations rather than in ensuring that those innovations reach the end users. However, the review failed to articulate clearly the communication barriers to effective up-take promotion. Where research on NRM has succeeded to reach various stakeholders, including policy makers, it took a long time and the processes that led to these successes are not well documented. For example: for the past 12 years RWH research has been carried out in Tanzania, but it is only now that it is receiving policy attention. RWH aspects have been incorporated in the Water Policy revised in 2004, Medium Term Plan of the National Agricultural Research System (MAFS, 2003); and RWH interventions are funded under the District Agricultural Development Plans (DADPs) in Same, Mwanga and Maswa Districts (SWMRG, 2002). However, the difficulty is to link these outcomes to the RWH research project objectives. Understanding of the processes that led to these outcomes and impact of such research will assist in scaling-up current and future research programmes in NRM.

6.0Scaling-up of Research Findings

In traditional practices the research system generates technologies while the extension service promotes these technologies to farmers. Many studies in 1980s expressed dissatisfaction with the approach and this dialogue led to evolvement of Farming Systems Research (Merrill-Sands, 1986). Further development was made following the debate about the role of farmers in creation of agricultural technologies, which led to increased participatory approaches to research (Chambers and Ghildyal, 1985, Fernandez and Salvatierra, 1991). However, often these approaches focus more on reaching farmers rather than addressing the system in a holistic manner, thus fail to reach other important levels such as policies, programmes and watersheds that are required to jointly make decisions for a meaningful impact. Challenge remains in finding ways to spread or scale up these innovations to wider audiences.

Scaling-up of technical innovations or research findings is defined as a way of providing more quality research benefits to more people over a wider geographical area more quickly, more equitably and more lastingly to bring about impact (Gundel, 2001; Snapp and Heong, 2003). Where geographical spread of innovations to more people and communities within the same sector or stakeholders group happen it is referred to as scaling out or horizontal scaling-up. There vertical scaling-up is institutional in nature and involves expansion to other sectors/stakeholder groups, from grass roots organisations to policy makers, donors, development institutions and international partners (Gundel et al., 2001).

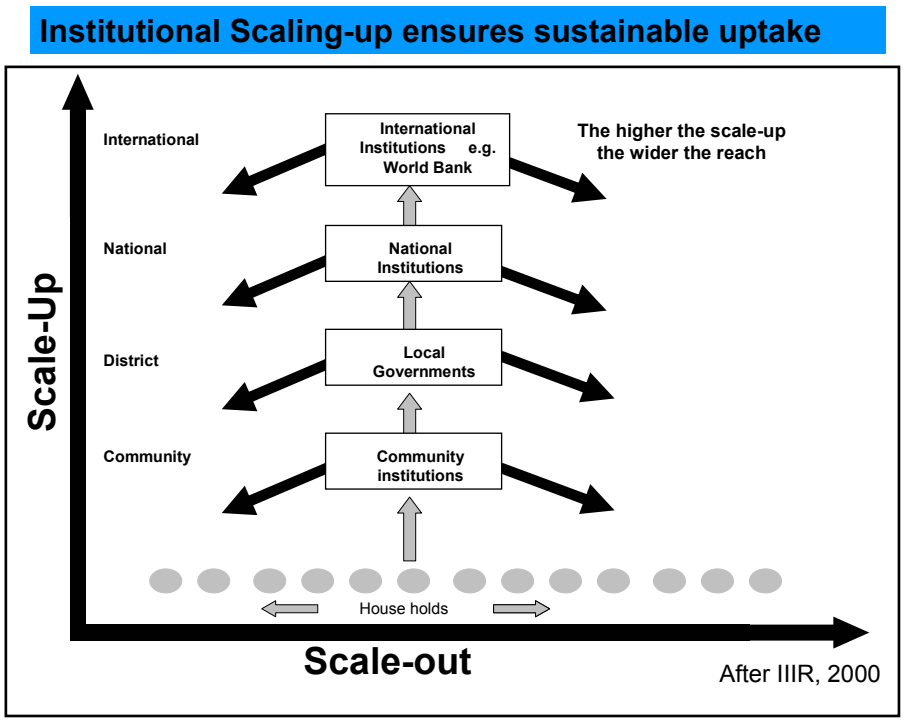


Figure 2: Scaling up and scaling out of research findings

The end users of knowledge and information generated may be farmers who would adopt and adapt the technologies. However, creating awareness to policy makers, manufacturers and financial agencies that provide credit to farmers may lead to faster utilisation of information as they assist in providing support to ingredients required by farmer to use such information.

7.0Tracking Change and Process Documentation

For research to realise impact there has to be a systems to monitor changes during the implementation of research project. Currently several methods are used to monitor progress of research. However as discussed earlier, these methods have limitations. The current methods assessed the relationship between input and outputs (Guijt, 1998). The approaches used to evaluate outcomes and impact of NRM programmes and projects contain the following features: (i) identification of what would have happened without the intervention, (ii) clear identification of control groups; (iii) identification and quantification or estimation of variables (including those that are outside the control of the project) which can influence outcomes and impact of the project; and (iv) optimal combination of quantitative and qualitative methods for monitoring changes and impact (Weiss, 1995; Guijt, 1998). One of the limitations is that they lack documentation of processes led to success or failure (Mosse, 1998). The approaches failed to realise that technology development is social process and is people oriented (Douthwaite et al., 2003).

Tracking for change require a systematic procedure of conducting investigation, which emphasise on the interrelationship of activities in the research process that leads to outputs and finally outcomes (ILEIA, 1998). Process documentation on the other hand involves capturing information about activities and strategies, participants, interactions, issues and contextual factors which are essential in promoting uptake and scaling-up. Process documentation in R&D is not for evaluation, but could reflect on the factual processes and learn from insights that emerge (Shah, 1997; Mosse, 1998). It also involves organising the

information gathered in ways that provide an opportunity for stakeholders to reflect and learn throughout the process, analysing information by looking for common themes and trends and placing findings in context. Currently, the problem is that researchers generate a lot of information but most of the information that led to success or failure of the project remains in researcher's field notes. This information in most cases consists of the process that one needs to understand to be able to repeat some or improve the process in similar environment. This is a gap that needs to be addressed.

7.1. Current methods used in tracking impact

The current methods used to tracking impact include the following:

i. Conventional monitoring and evaluation (IFAD, 2001)
ii. Participatory monitoring and evaluation (Guijt, et al., 2001)
iii. Livelihood monitoring and evaluation (Turton, 2001)
iv. GTZ Impact Evaluation Model ((Douthwaite et al., 2003)
v. Impact Pathway Analysis (Briones, et al., 2004)
vi. Program Theory Matrix approach (Douthwaite and Schulz, 2001)
vii. Livelihoods asset status tracking (Bond and Mukherjee, 2002)

Merits and demerits of these methods are summarised in Table 1. The criticism on the conventional M&E is that it is mostly externally driven and is done by outsiders and sometimes is perceived as a process of 'policing' to verify use of inputs/resources rather than decision making tool that allows better planning (Guijt, et al. 2001). Participatory M&E and other related methods are more people oriented that improves usefulness of the information generated during M&E. However, most of these methods for tracking impact are criticised for not being explicit on how processes of the projects themselves can be traced and the effects of these processes on the outcomes and impact (Mosse, 1998). These approaches failed to capture additional outcomes as a result of research and communication processes. Process documentation enables researchers to track the processes that led to success or failure during implementation of research projects. On the other hand, impact assessment which in theory is supposed to be conducted after the project ends to make final assessment of a change on livelihood. It was observed that most research project ends without conducting impact assessment. This led to problems of associating changes to research interventions carried out in this study.

Table 1: Merits and demerits of the current tracking methods

Current methods	**Merits**	**Demerits**
Conventional monitoring and evaluation	– Assess the performance of technologies based on outputs	– Emphasis on input-output relationship and it is linear process – Knowledge generation and dissemination do not recognise the role of socio-economic, cultural and agro-ecological conditions. – Consider end users as passive recipient – Do not consider innovation is a social process – Role of key stakeholders not apparent
Participatory monitoring and evaluation	– Emphasis on co-learning and on farmer empowerment to adaptive knowledge – Change agent is a facilitator – Knowledge generation is a social process that considers socioeconomic aspects	– Researcher lack skills for carrying out PM&E – Can not cover wide areas in short time – Too much focus on farmers leave out key stakeholders in the process
Livelihood Monitoring and evaluation	– Enable tracking of activities, assets, vulnerability and outcomes as they influence livelihood status – More attention to linking micro and macro interventions	– Emphasis on people may sideline environmental issues – Power not adequately addressed – More sectoral focus
GTZ Impact Evaluation Model	– Recognise that knowledge generation and dissemination are social processes – Considers end users are partners – Addresses the attribution gap through self evaluation – Emphasise establishment of ex-ante baseline information to facilitate post-ante assessment. – Considers M&E as a learning process	– Too much focus on farmers leave out key stakeholders in the process
Impact Pathway analysis	– Assess the research processes and its linkage with policy	– Rely on conventional methods of M&E that use expert judgement
Program Theory Matrix approach	– Bridges project output and project intermediate and long term impact – Link with log-frame approach linking clearly goals and outputs – Many people can adopt because it uses existing log-frame approach	– Inadequate linkage with policy environment – Much emphasis on farmers leaving out other key stakeholders in the process
Livelihoods asset status tracking	– Use qualitative assessment that are converted into qualitative scores	– Require use of participatory skills which are lacking to most researchers

With this understanding, a combination of participatory and livelihood M&E methods will be used to assess impact of RWH at household level. Impact Pathway Analysis was used to track the research and communication processes because of its provision to link with policy issues. The details of methods for field data collection are in Annex C3.

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