NATURAL RESOURCES SYSTEMS PROGRAMME

PROJECT REPORT[1]

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R8390

Report Title

Needs assessment and uptake promotion of RWH research in Nigeria. Scientific report. Annex A of the Final Technical Report of project R8390.

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NRSP Production System

Semi-Arid

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Contents

Previous NRSP funded research has made a significant contribution to pro-poor sustainable development within Tanzania through demonstrating scope for improving crop production by adopting rainwater harvesting. The purpose of this project was to test transferability of research products and processes from Tanzania to Nigeria. The project aimed to raise awareness amongst key stakeholders of the scope for improving rainfed agriculture through better water management whilst gaining an understanding of key factors affecting uptake and promotion of research findings in Nigeria. Work was focussed within Osun State (one of 36 states within Nigeria). Primary stakeholders are poor rural households whose livelihoods are dependent on rainfed agriculture. Other key stakeholders were identified as Osun State Agricultural development Programme (OSADEP) and news media.

On the basis of systems analysis of constraints faced by farmers at the study site, potential for adoption of RWH research findings by the target group was evaluated. Primary data collection in four sample communities using PRA techniques was undertaken to complement these analyses and gain insight into knowledge, attitudes and practices of farmers. Climate related cropping constraints are: distinct dry season during November-March, uncertain start of the cropping season, likelihood of long break in August and frequent dry spells of 5-9 days duration. The study shows that RWH could have an important place in the Nigeria strategy to promote all-season farming. In order to alleviate the August break and extend the cropping season beyond October, systems with storage and supplementary irrigation may be more beneficial than those RWH techniques tested in Tanzania.

An important outcome of the earlier work in Tanzania has been the degree of positive engagement in policy issues. Processes for informing policy discussions on RWH in Nigeria were therefore identified during the stakeholder workshop. A policy paper presenting an overview of the policy environment was delivered as a basis for discussion during a workshop with policy makers, which resulted in a commitment from the state governor to support further RWH demonstration activities.

The project has not been concerned with delivering new research products; rather it has focussed on communicating findings from previous research in Tanzania. The communication plan was therefore a core component of the project. On the basis of stakeholder consultations, radio was selected as the most appropriate medium and a series of broadcasts was designed and delivered in close collaboration with OSADEP. It was found that effective dialogue was constrained by lack of direct knowledge of alternative practices amongst farmers and extension workers.

In Tanzania a twin-track approach was adopted in which advocacy and demonstration were equally important activity strands. An important lesson learned from this project is that the success story from Tanzania was an excellent entry point for transfer, but was not sufficient to bring about adoption. RWH innovations are knowledge intensive and require careful adaptation to local circumstances. Agricultural support services in Nigeria are willing to take on the responsibility for promoting RWH, but lack the capacity to do so effectively. Advocacy alone will not bring about transfer of the success in Tanzania. There is a need for advocacy to be supported by demonstration and training activities.

Chapter 1 Background

1.1 RWH research in Tanzania

Rainwater harvesting research in Tanzania began in 1992 on the basis of collaboration between the University of Newcastle (UNUT) under project R5170 and Sokoine University of Agriculture (SUA) under project R5752. The research was continued and expanded in a second phase 1996-99 under NRSP funding (R6758). UNUT involvement ended in 2000 following hand-over of the PARCHED-THIRST model to SUA under project R7949, while SUA involvement continued under projects R7888, R8088, R8115 and R8118. This concerted effort over more than ten years resulted in demonstrable impact from the level of individual target households to communities, districts and national level.

Pilot sites in two target areas provided opportunities for local level research, demonstration and uptake promotion through direct engagement with poor farmers. At the same time they provided a foundation for a sustained effort that kept stakeholders at all levels well informed of the research and its findings. The philosophy adopted was that the process of promoting uptake is as important as the knowledge or technologies being promoted. An important lesson from project R7888 was that expected users of outputs from research are more likely to use them if they are made aware of how and why they are being produced.

A multitude of terms is used by different practitioners to describe participatory approaches, which aim at ensuring relevance and impact of agricultural research. These include participatory rural appraisal, farmer participatory research and participatory technology development. These approaches have become institutionalised within the research-extension system in many countries in Africa, but they retain the essentially linear transfer of technology paradigm and even when successful, they are likely to result in islands of success. Where the experience in Tanzania differs is that a wider focus was adopted, which encompassed stakeholders at all levels from farmers to policy makers.

1.2 RWH experience in Nigeria

Concerted efforts at agricultural water management in Nigeria can be recognised in two major initiatives since the 1970s, both with a focus on irrigation. In the mid-1970s river basin development agencies (RBDAs) were established for the whole country on the basis of hydrological boundaries. These RBDAs promoted many large dams and formal irrigation projects, which have been widely criticised for their adverse social and environmental impacts (Adams, 1990: p182 et sec) and for their failure to recognise the importance of indigenous floodplain agriculture (Adams, 1990: p168 et sec). During the 1980s another donor-driven initiative led to the creation of Agricultural Development Programmes (ADPs) throughout the country (Davis, 1987). Recognising the success of water lifting to small basins in a system known locally as "fadama" agriculture, they promoted this technique as a way of developing small-scale irrigation (Phillips-Howard, 1996).

Largely through studies of these major development initiatives, indigenous knowledge of agricultural water management techniques has been recognised in relation particularly to swamp rice and flood recession agriculture (Adams, 1990: p168 et sec). However, there are few documented examples of indigenous RWH techniques in Nigeria. In their compilation of indigenous soil and water conservation practices across Africa, Reij et al (1996) present 28 case studies, but include only 3 from Nigeria and one of these is actually the study of fadama irrigation noted above (Phillips-Howard, 1996). This situation is in stark contrast to the extensive literature on RWH techniques elsewhere in West Africa (Mali, Niger, Burkina Faso).

In a rare example of a documented case of RWH in Nigeria, Kolawole and Adewumi (2001) present a study of practices in Borno, Kano and Katsina states. They conclude that RWH "is a profitable agricultural technique in the semi-arid area of Nigeria especially in vegetable production". They note that techniques have been largely neglected by development agencies and are still largely indigenous with little or no attempt having been made to improve their technical efficiency.

1.3 Project purpose

Previous NRSP funded research has made a significant contribution to pro-poor sustainable development within Tanzania through demonstrating scope for improving

crop production by adopting rainwater harvesting. The aim of this project was to test transferability of research products and processes from Tanzania to Nigeria. The project aimed to raise awareness amongst key stakeholders of the scope for improving rainfed agriculture through better water management whilst gaining an understanding of key factors affecting uptake and promotion of research findings in Nigeria. It is anticipated that the ultimate beneficiaries will be poor households whose livelihoods are dependent on rainfed agriculture. Both men and women will benefit from increased availability of knowledge and enhanced capacity of research and extension on water management for agriculture in Nigeria.

Chapter 2 Situation Analysis

2.1 Research setting

The study area is situated within Osun State in South Western Nigeria with particular reference to four agricultural communities: Erin Ijesa and Erin Oke in Oriade Local Government and Obamoro and Mafikuyomi in Olaoluwa Local Government Areas.

Nigeria is a large country which spans several ecological zones and embraces humid tropical to semi-arid climatic zones. There is a clear South to North zonation becoming progressively drier through: rainforest, derived savannah, Guinea savannah and Sudan savannah zones. The sample sites were selected to represent rainforest and derived savannah zones.

2.2 Physical environment

2.2.1 Erin Ijesa and Erin Oke

The soils of the study area generally belong to Alfisol or Ultisols types of USDA classification and Ferric Luvisol or Albic Arenosol of FAO classification. Four major textural classes were encountered in the two communities of Erin Oke and Erin Ijesa. They are sandy loam, loamy sand, sandy clay loam and sandy clay. Table 2.1 below shows the four soil textural classification with their corresponding hydrological characteristics.

Table 2.1 : Soil textural classification

Soil Text. Classification	SHC	BD	WHC	OMC
Sandy Loam	35	1.43	100	1.65
Loamy Sand	30	1.42	105	1.56
Sandy Clay Loam	25	1.40	120	1.61
Sandy Clay	22	1.39	125	1.60

SHC – Saturated Hydraulic Conductivity (cm/hr); BD – Bulk Density(g/cm^3)

WHC – Water Holding Capacity (mm/m): OMC - Organic Matter Content (%)

The area is generally undulating, with slopes varying from 3% to 12% and contains hilly regions at the borders. The area is dissected by a major river having about 8 tributaries. Topography: The topography of these two communities is undulating. It ascends from Akure / Ilesa expressway towards the centre of Erin Oke and then descends gently towards the boundary between Erin Oke and Erin Ijesa. From the boundary, the topography ascends gently to the centre of Erin Ijesa and thereafter is fairly flat.

The two communities are located in the rainforest ecosystem. However because of intensive cultivation, there are considerable fallow lands interspersed with secondary forest. The bush fallow is at various stages of regeneration after previous intense cropping activities. The land is cultivated for swamp crops (swamp rice, vegetables, plantain etc) in the swampy areas and upland crops (cassava, yam, upland rice etc) in the upland areas.

Representative rainfall data for the forest zone obtained from Ibadan is summarised in Table 2.2. Annual rainfall is approximately 1400mm with a rainy season beginning in April and ending in October. Distribution is weakly bimodal with a break in August.

Table 2.2 : Mean monthly rainfall (mm) at Ibadan

Month	Jan	Feb	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rainfall (mm)*	4	18	53	111	170	212	202	168	224	182	30	8

* Mean of 18 years data

The analysis of dry spells (Table 2.3) clearly indicates the significance of the August break in that the probability of dry spells of more than 10 days and more than 15 days can be seen to be much higher than for other months within the rainy season.

Table 2.3: Analysis of dry spells for Ibadan data

Dry spell period	Probability of occurrence (%)											
	Jan	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
> 5 days	100	92	86	68	64	46	69	70	38	64	93	100
>10 days	83	81	38	8	0	0	15	27	9	20	76	78
>15 days	75	48	14	5	0	0	4	10	0	4	55	74

Analysis of the monthly water budget (Figure 2.1) shows moisture deficit for the period mid November to late March and rainfall surplus from April to late October. However, if the balance is computed for effective rainfall instead of total rainfall, then the surplus is seen to be much less and a deficit occurs in the latter part of the rainy season. Clearly management of runoff and infiltration is important.

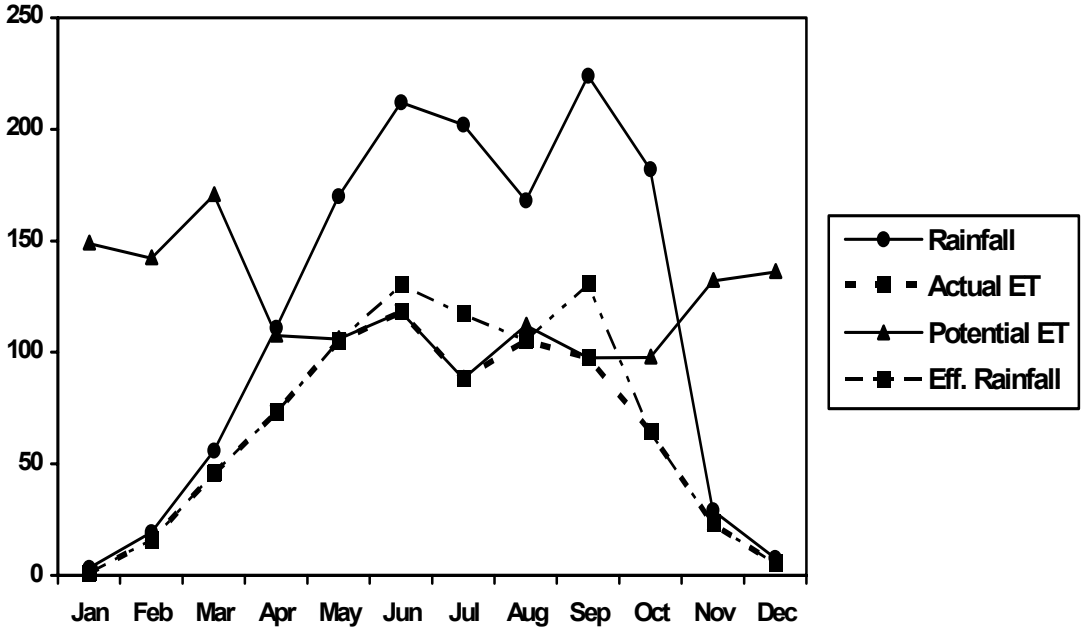


Figure 2.1: Analysis of moisture balance (mm) for Ibadan data

2.2.2 Obamoro and Mafikuyomi

Two major textural classes were encountered in the two communities of Obamoro and Mafikuyomi. They are sandy loam, loamy sand. Table 2.4 shows the soil textural classification of the two different soil types in the area with their corresponding hydrological characteristics.

Table 2.4: Typical Soil Textural Characteristics

Soil Classification	SHC	BD	WHC	OMC
Sandy Loam	22	1.38	105	1.50
Loamy Sand	25	1.40	100	1.40

SHC – Saturated Hydraulic Conductivity(cm/hr); BD – Bulk Density(g/cm^3)

WHC – Water Holding Capacity (mm/m): OMC - Organic Matter Content (%)

The topography of these two communities is fairly flat to gently undulating. However towards the North West boundary of the site, it ascends to "Oba" hill. The two communities are located in the derived savannah ecosystem. A high proportion of the area is under active cultivation or fallow of short period. The land is cultivated for rice,

yam, maize and guinea corn. The land in these two communities is used for upland crop with little or no swampy area.

Representative rainfall data for the derived savannah zone obtained from Ilorin is summarised in Table 2.5. Annual rainfall is approximately 1200mm with a rainy season beginning in March/April and ending in October. Distribution is weakly bimodal with a break in August.

Table 2.5 : Mean monthly rainfall (mm) at Ilorin

Month	Jan	Feb	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rainfall (mm)*	5	12	45	87	160	185	144	135	220	132	6	10

* Mean of 21 years data

The analysis of dry spells (Table 2.6) shows a similar pattern to that for Ibadan data with the significance of the August break again clearly apparent and with overall slightly greater occurrence of dry spells.

Table 2.6: Analysis of dry spells for Ilorin data

Dry spell period	Probability of occurrence (%)											
	Jan	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
>5 days	100	97	91	79	76	54	60	75	21	68	96	100
>10 days	92	82	33	21	10	4	14	33	0	26	92	91
>15 days	81	48	22	6	0	0	6	11	0	10	87	91

Analysis of the water budget (Figure 2.2) shows the same pattern as for Ibadan data. It should be noted that the surplus in September suggests that short term storage offers the prospect of extending the cropping season.

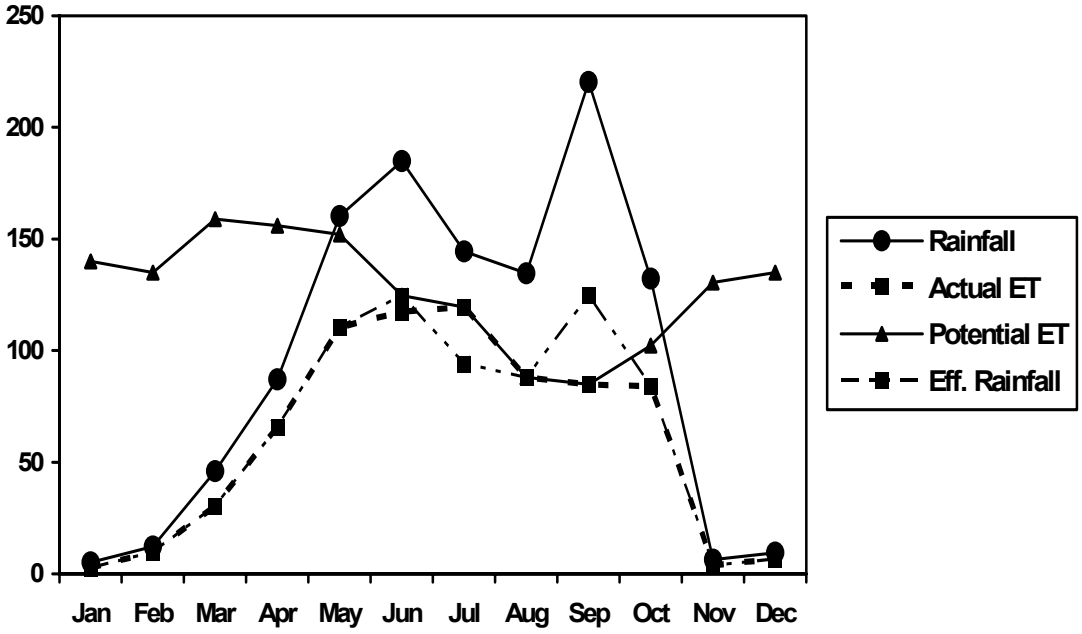


Figure 2.2: Analysis of water balance (mm) for Ilorin data

2.2.3 PARCHED-THIRST simulation study

A tool to aid in the design and understanding of RWH systems - PARCHED-THIRST (Predicting Arable Resource Capture in Hostile Environments During The Harvesting of Incident Rainfall in the Semi-arid Tropics) was developed to provide a user-friendly tool to simulate the most important processes in micro-catchment RWH systems by the University of Newcastle upon Tyne UK in collaboration with Sokoine University of Agriculture in Tanzania.

The model attempts to simulate all the bio-physical processes using parameters that can be measured or estimated to represent crop, soil, site and rainfall; in each of the RWH sub-systems.

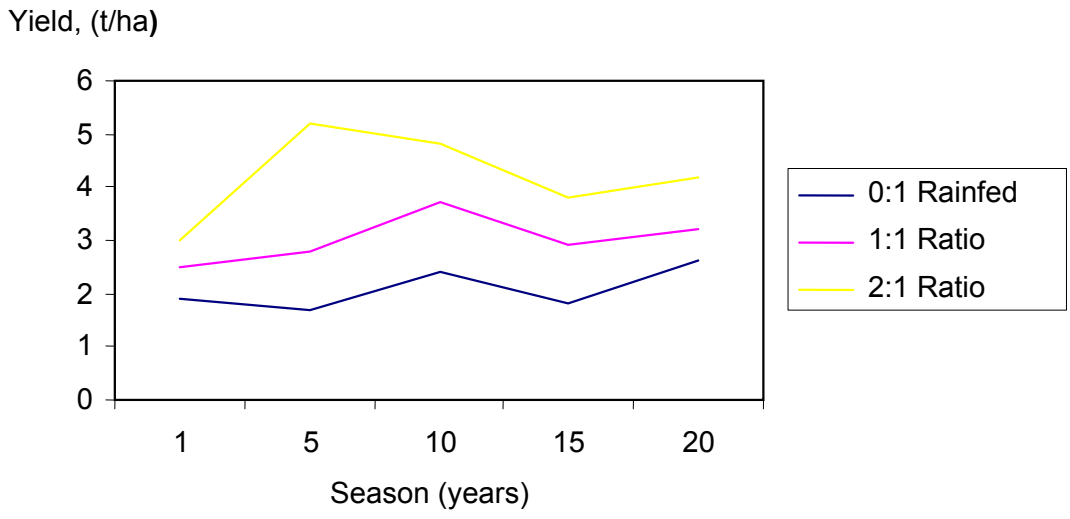
- The catchment sub-system generates runoff, which is harvested and conveyed to the cropped area. The requirement is to simulate runoff response to rainfall
- The cropped area sub-system receives and stores both rainfall and runoff, which contribute to the soil-moisture reservoir.

Rainfall data and representative soil properties for the Obamoro and Mafikuyomi study sites were used for the simulation. Simulations were based on 20 years of available daily data for the experimental site which provides a good range of climatic variability. With a 10-year event, there is a 95 % probability that this will be included within the 20 years simulated therefore a 20 year simulation provides a good indication of RWH systems performance.

Two micro-catchment RWH systems were tested with the data using 2:1 and 1:1 catchment/crop area ratios. A rainfed system (0:1 ratio) was also simulated for comparison. From Figure 2.3, the yield benefits from adopting a RWH system for maize cropping are apparent. However, it should be noted that yields are calculated on the cropped area alone. Recalculating on the basis of the total area suggests that rainfed cropping outperforms the RWH system on the basis of yield per unit area, but only by a small margin. Previous work in Tanzania showed similar results but revealed better performance of RWH when measured in terms of return to labour and other inputs.

Work is continuing to calibrate the model for local maize varieties and to extend the study to sites further into the savannah zone. The use of macro-catchment RWH systems and RWH system with storage also merit investigation.

Figure 2.3: Simulated grain yield for 20 years at Mafikuyomi/Obamoro



2.3 Knowledge, attitudes and practices

2.3.1 Participatory rural appraisal in target communities

Participatory Rural Appraisal[1] was carried out in the four sample communities at an early stage in the project in order to engage directly with primary stakeholders in sample communities which would become the focus for subsequent communication activities. Several tools were used for the survey e.g. semi-structured interviews, focus group discussion, mapping and diagramming, seasonal calendars, charts, transect walks, participant observation, meetings, ranking, and key informant interviews. The semi-structured interviews, focus group discussion and participants' observation were used to collect information on the specific areas of the community life from the people. The mapping, diagramming, charts, seasonal calendars and transects were employed to have visual presentation of the basic facts in terms location of fields, structures, soil type, vegetation, farm activities and rainfall distributions pattern. Some of the tools were used to confirm facts collected during interview e.g. key informant interviews.

It was observed that the people were optimistic about the rainwater harvesting project as an alternative to drought, rain breaks and dry season periods. The soils in these communities are low in fertility and farmers complained of low yield because they cannot afford to buy inorganic fertilizer coupled with lack of appropriate soil conservation and management techniques. Mixed cropping is the major cropping system in the forest zone under bush fallowing system. On the other hand, there is intensive mono-cropping and mixed cropping in the derived savannah zone. In terms of potential for RWH project, derived savannah zone is better in terms of water catchment areas, extensive wet lowlands, large farm size and mechanized farming.

Preliminary conclusions were as follows:

1. The respondents perceived run-off water as useless and destructive with no apparent advantage but numerous disadvantages. The disadvantages include soil nutrient depletion, soil erosion, stunted crop growth, water logging and crop destruction. Insufficient water for crops can be ameliorated by hand wetting in a small plots in fadama areas, but otherwise they have no solution.

[1] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex J. Participatory rural appraisal in target communities.

They claimed that they did nothing to control the run-off on their farms except for making concerted efforts to see that their crops are not destroyed by it. Run-off is regarded as something that destroys the crops in the farm. The community does not see it as anything that is beneficial.

2. While there are no apparent cultural barriers to adoption of RWH, the current perception is that nothing can be done to change things as they have no control over rainfall. On the other hand there is widely expressed belief that climate change has affected the rainfall pattern.
3. There is a need to change the perception and mind-set of the people in terms of run-off benefits, RWH and what it takes to reap results. There is need for the following:
    - Effective communication must be put in place through good communication plan for sensitization/mobilization of people at the community level;
    - Training of extension workers is required through a Training of Trainer workshop;
    - Dissemination of RWH technologies is required through different media e.g. radio jingle, radio drama, radio and television talk, documentary, village film/slide show, and organization of village RWH groups.

2.3.2 KAP and transfer of technology

A follow-up study of farmers' knowledge, attitudes and practices was conducted with the aim of assessing the likelihood of adoption of RWH (Shorrock, 2005). Information was collected on land tenure, crop choice, soil knowledge, constraints to production, land preparation methods, soil and water conservation practices and farmer experimentation. Information was gathered by means of semi-structured interviews with farmers and extension agents, group discussions, diagram drawing, transect walks and joint participant observation.

Farmers readily identified distinct soil types as *amo/ibo* (clay texture), *iledu* (loamy texture), *yarin* (sandy) and *olukuta* (stoney). Some farmers sub-divide these texture based categories on their colour, but make no distinction between sub-categories when it comes to land use. It is noteworthy that these soil types are the same as those recognised by Yoruba farmers in Oyo, Ogun and Ondo states (Osunade, 1992)

although names are transliterated slightly differently. This suggests that farmers will easily be able to determine which soils are appropriate for RWH.

A variety of soil and water conservation practices are apparent. Farmers recognise landscape units (fadama land) with favourable moisture regimes for dry season cropping. Maize, okra, vegetables and tomatoes are the main crops in these areas. There is no evidence of water pumping or irrigation. Rice may also be grown in fadama land (known as swamp rice) but this is not common and is said to be a recent innovation brought by migrants from Benue State. Upland rice is more common.

Adopting the broad definition of an experiment according to Sumberg and Okali (1997) experimentation was widespread amongst farmers in all communities. The most common sources of inspiration appear to be local and informal, although evidence exists of farmers experimenting with introduced ideas. Farmers are able to compare performance with previous yields, often taking account of rainfall, pest attack and other variables. Particularly skilful and innovative farmers can be found and are recognised by other farmers. No previous experience of farmer-participatory experimentation in collaboration with outside "experts" was detected. Contact with extension services has been through top-down initiatives and relations with OSADEP are often poor.

2.4 Preliminary economic appraisal of RWH

The evaluation of the economic and financial potential of rainwater harvesting (RWH) was completed[2] on the basis of an interview schedule in the four target communities. The analysis reported here should be seen as a preliminary appraisal as there has been no opportunity to collect primary data on costs and benefits of RWH within the study area.

The construction of RWH structure (to store 20,000m^3 of water for one hectare) has been estimated to cost ₦120,000. In addition, ₦5000 is proposed for its maintenance every two years, thereby making the economic evaluation of the adoption of RWH an important matter.

[2] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex H. Economic analysis of RWH.

Measures of project worth computed and used are budgetary analysis, payback period (PBP), net present value (NPV), and benefit cost ratio (BCR). For the NPV and BCR the discounting rates used in this evaluation are 10% and 20%, while 10 years was employed for the time horizon.

Net return, which is the difference between gross value of output and the total cost used in the production process, can assist in improving the overall management of the farms and it generally addresses resource productivity in a given period of time.

Pay back period is simply the time taken for expected profits to fully recover the initial outlay or investment; that is, the time taken for cumulative net cash flow to become zero. Pay back has its advantages as an investment criterion. It is a simple cash flow easily understood by farmers. If a business is short of cash, it is essential that investment is changed into cash as soon as possible and this method acknowledges the value of early returns and keeping liquidity. By selecting investment projects with the quickest paybacks, the time value of money is allowed to some extent. Because the method considers only the years in which cost is recovered, estimates are not based over long time periods and so tend to be more accurate than other methods in which the whole life of the asset is considered. Unfortunately, the PBP criterion has several disadvantages that limit its use for appraising long-term investments. The investment analysis (NPV), which allows costs and benefits to spread across the lifetime of the project, is a useful tool to analyze investment in RWH structures that can produce benefit for up to 10 years or more.

This evaluation concentrated on two major crops that are sole cropped: (i) okra, the major crop in Iwo zone and (ii) paddy rice, the major crop in Ife-Ijesa zone. Data obtained on maize output are not adequate and reliable in both zones as it is sold green and in dry form.

The following assumptions were made for the computation of net revenues:

(i) with supplementary water from RWH, there could be at least 30% increase in yield of okra for both seasons while for rice it could at least increase yield of existing cropping season by 30% and allows an additional season for upland rice;

(ii) costs and returns are the same for both early and late seasons for okra;
(iii) farmers will repay both principal and interest in 12 months;
(iv) price per unit is constant in a production year for both enterprises;
(v) operating capital is borrowed from cooperative society at the rate of 12% per annum;
(vi) the money to be invested in RWH reservoir will be obtained from cooperative at the rate of 12% per annum.

Table 2.7 shows results of budgetary analysis for the two crops; paddy rice and okra. The result shows that with RWH farmers will earn more income from the production of both crops. That is, a farmer cultivating okra will earn ₦ 54,120 per hectare as additional income in addition to the existing farm income annually. Similarly, he will earn ₦ 69, 166 per hectare as extra from paddy rice production if he adopts RWH.

The results of investment analysis performed for rice and okra production are presented in Table 2.8. The payback periods show that farmer who adopts RWH technology will fully recover the initial outlay or investment in 2 years and 2 years 7 months when rice and okra are cultivated respectively. The net present values (NPV) for both crops are positive. This indicates that the present value of benefits will exceed the discounted present values of costs. Benefit-cost ratios are all greater than one. These results imply that the adoption of RWH for crop production will be profitable in the long run as farmers will be able to pay for investment and operational costs and yet attain profit.

To test whether the above results will be stable or not (as a result of changes in market prices of inputs and outputs), a sensitivity analysis was undertaken. The results of this are presented in Tables 2.9a and 2.9b.

For okra production, an increase in production costs by 20% will affect the viability of all the measures of project worth (Table 2.9). Contrariwise, a 20% decrease in product prices does not alter the viability of the measures of the project worth. The results also suggest that okra production is more sensitive to changes in input than product prices.

For paddy rice production, an increase in production costs by 20% affects the viability of the project at 20% discount rate though does not alter viability of other measures. Similarly, a 20% decrease in product price does affect the viability of the project at 20% discount rate but does not alter viability of other measures of project worth. These results further suggest that paddy rice production is sensitive to changes in both product and input prices.

The results have demonstrated that net returns for the selected crops (okra and paddy rice) are positive. That is, farmers should be able to cover their costs and remain with a positive balance. RWH is believed to be a viable option to enhance farm income from okra and paddy rice production in the project sites.

With respect to investment analysis, the two crops have favourable measures of project worth (i.e. PBP is less than 3 years, NPV are positive and BCR are greater than one). Sensitivity analysis shows that when prices of inputs used in okra production are changed by 20%, the viability of the project is negatively affected, whereas 20% decrease in product price does not affect the viability of the project. However, 20% change in input and output prices alter the viability of the project in paddy rice production at 20% discount rate. It is also demonstrated that the viability of the project is more sensitive to changes in input prices than product prices.

Table 2.7: Budgetary analysis results

Enterprises	**With RWH (₦ per ha)**	**Without RWH (₦ per ha)**
Okra	219, 746.00	165, 626.00
Paddy	97, 802.00	28, 636.00

Table 2.8: Results of investment analysis

Enterprises	**NPV (10%) (₦ per ha)**	**NPV (20%) (₦ per ha)**	**B:C ratio (10%)**	**PBP**
Okra	185, 460	82, 970	2.38	2 Years, 7 months
Paddy	275, 961	146, 857	3.05	2 Years

Table 2.9a: Results of Sensitivity analysis for Okra

Scenario	Performance indicators			
	NPV (10%)	**NPV (20%)**	**BC ratio**	**PBP**
Basic scenario	185,460.00	82,970	2.38	2 Years 7 months
20% increase in costs	(437.84)	(43,049.38)	0.996	61/4 years
20% decrease in product price	85, 897.44	15,858.61	1.64	33/4 years

Table 2.9b: Results of Sensitivity analysis for paddy rice

Scenario	Performance indicators			
	NPV (10%)	**NPV (20%)**	**B;C ratio (10%)**	**PBP**
Basic scenario	275, 961.00	146, 857.95	3.05	2 Years
20% increase in costs	44,157.65	(19, 626.13)	1.32	7 Years 1 months
20% decrease in product price	56, 244.08	(4374.40)	1.42	4 Years 4 months

2.5 Market Chain Analysis

2.5.1 Methodology

A short study[3] was conducted to investigate the transactions and interactions among different categories of actors in the rice and okra market chains located within the project sites. The study aimed to identify problems encountered by various sets of actors in market chains and then make appropriate recommendations to improve the economic production at the project sites.

[3] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex I. Market chain analysis.

The identified actors were grouped according to the following functions:

(i) Production: Actors selected in this category were known to be performing functions that are directly related to the particular crop production.

(ii) Post harvest and processing: Actors whose functions are directly related to parboiling and milling operations.

(iii) Trading: Actors whose functions are related to the buying and selling of rice.

(iv) Providers of business development services: Individual actors or corporate organizations offering business development services to the market chains.

Rapid market survey methodology was employed for the collection of the primary data in the rice and okra market chains. Various aspects of the different actor groups were examined. These included their profiles, reasons for participating in the chain, relationships with other actors in the chain, perception of government policies, perception on extension, record keeping, etc. Brainstorming sessions were held with all the relevant groups of actors. These sessions were conducted in a way that everyone present was made to air his or her views. In each group, participants were asked to mention the factors limiting their optimal performance of their activities in the market chain. The factors so mentioned were then prioritized, using the method of pair-wise ranking.

2.5.2 Rice market chain

The farmers' group reported more limiting factors than others. This is not surprising since they are the most important partners in the market chain. Prominence was given to two of the factors: rodents' invasion and competition from imported rice. Big rodents commonly referred to as grass cutters often invade farmers' rice fields in the dead of the night. The most effective way of combating/controlling these invading animals is probably to have a fence around the rice fields, but farmers cannot afford to do it. The influx of imported rice was claimed to have been largely responsible for the distortion of their local economy, hence the current mass movement of people out of rice farms.

Access to funds, access to water and improvement in soil fertility were ranked equally by the participating farmers. The issue of funds is a common problem in the Nigerian agricultural system, where many farmers complain of inadequate financial resources.

The changing weather condition has been having its toll on farming activities, to the extent that it is becoming increasingly difficult to reasonably predict climatic events. The sudden cessation of the rain in the middle of the cropping season is becoming too worrisome to the farmers. The non-use of fertilizer and the continuous use of land were probably responsible for the depletion of soil fertility in the two communities. The low ranking accorded birds' invasion was explained by the fact that it is at least controllable, since it happens during the day time.

Four limiting factors were isolated during the brainstorming session for processors. The final ranking of these problems puts access to funds in the first position, followed by drying of rice and competition from imported rice. The common consensus among the processors is that access to cheap loans would allow them to expand the scope of their businesses, as well as solve other problems militating against them.

Table 2.10: Limitations in the Erin Oke /Erin Ijesa Rice Industry

Limitations	**Order of importance for each group of actors**		
	Farmers	**Processor / Traders**	**Rice Millers**
Competition from imported rice	1	3	2
Rodents' (Grasscutters) invasion	1	-	
Access to funds	3	1	1
Access to Water	3	-	
Improvement of soil fertility	3	-	
Improvement of roads	6	4	
Birds' Invasion	7	-	
Access to labour	8	-	
Drying of rice	-	2	
Loan recovery			4
Service / repairs of equipment			5
Low capacity utilization			3

The outcomes of the brainstorming session with millers was that access to financial resources would go a long way to solving their problems, hence the placement of 'access to funds' in the first position. Competition from imported rice was rated second, and this has a direct bearing on the present low capacity utilization of their mills. Only 40 percent of the mills are in operation, due to low patronage. Field observation shows that mills currently in operation are worked effectively for three days in the week.

2.5.3 Okra market chain

Compared to other crops, okra cultivation is preferred by farmers because of the quick stream of income it generates thus helping to overcome farmers' cash flow problems. The consensus of opinions amongst okra farmers was that climate change is having the greatest impact on their farming activities. The second limiting factor was the preservation / storage of okra fruits. This is particularly worrisome to them because of its effects on farm revenue, most especially during the period of glut. Preservation of the fruits through sun drying was not found attractive to the farmers because of its perceived low returns. Access to credit (another common phenomenon in the Nigerian agricultural system) was placed in the third position. The relegation of extension problems to the last position could be a reflection of the poor rating of OSSADEP by okra farmers. It was claimed that little or nothing has been received in form of advice, training or input supplies from the organization in recent past. The little that came their way is usually untimely. They have therefore, been relying on their own initiatives, even in the introduction / adoption of new okra varieties.

The final ranking of the limitations by traders puts access to funds as the most serious problem that should be solved. In the second and third positions were storage problems and poor sales. The issue of poor sales was linked to their desire to look for ways of expanding into new market areas.

Participants in the transportation component also gave the highest priority to 'access to'. It was claimed that they often find it difficult to replace their old and inefficient vehicles which usually gave frequent mechanical problems. They would also want government to effect repairs on poor roads, since these have been adding to their

burden. The issue of low patronage was put in the third place on the prioritized ranking.

Table 2.11: Limitations in the Iwo Okra Market

Limitations	Order of Importance for Each Group of Actors		
	Farmers	Traders	Transporters
Insect pest infestation	5	-	-
Improvement of soil fertility	4	-	-
Access to funds	3	1	1
Access to water	1	-	-
Preservation / Storage difficulties	2	2	-
Poor extension services	6	-	-
Low sales / Low patronage	-	3	3
Transportation problems	-	4	-
Poor roads	-	-	2
Police harassment	-	-	4

2.5.4 Conclusions

(i) There are significant production constraints affecting rice farmers but the dominant factor influencing farmers' participation is the problem of competing with imported rice in the mainly urban market.

(ii) Acceptability in the urban market would be improved by reducing the various sources of foreign particles, such as stones that are usually found in the final product. Small scale mechanical threshers should be developed and promoted for adoption by farmers. Similarly, de-stoning machines should also be introduced to the millers.

(iii) The evolving swamp rice system that is gradually emerging in the Erin Oke / Erin Ijesa rice axis is likely to be more profitable than upland rice. Training programmes should be organised for farmers who currently grow upland rice varieties.

(iv) Okra cultivation is preferred by farmers because of the quick stream of income it generates thus helping to overcome their cash flow problems.

(v) Crop perishability is a major constraint and a study should be conducted to determine consumer acceptability of dried okra.

(vi) There is a clear market orientation and scope for growing other vegetable crops with RWH systems merits consideration.

(vii) Farmers' attitude to OSSADEP is generally negative. It was claimed that little or nothing has been received in form of advice, training or input supplies from the organization in the recent past.

Chapter 3 Policy Environment

3.1 Policy analysis

Nigeria is implementing a National Economic Empowerment and Development Strategy (NEEDS), which encapsulates an objective assessment of her past, present situation and hopes for a better future. The first statement in the strategy document acknowledges Nigeria as an economic miracle that has already begun to unfold and presents NEEDS as a development strategy to consolidate on the gains of the past four years (during which growth in the agricultural sector has averaged 7%), unlock Nigeria's dormant potentials, and provide the base for sustained development of the country. NEEDS signals a break with the past in terms of its underlying philolophy of a government stimulated but private sector–led competitive market economy. NEEDS is anchored on the triple objective of poverty reduction, wealth and employment creation and empowerment of the citizenry, especially the poor and vulnerable. A growth rate of the economy of 7 percent is targeted, and it is to be pro-poor. It is however submitted that it would make a fundamental difference whether growth is led by agriculture, small and medium scale enterprises and manufactures or by the mining and quarrying sector as is presently the case. Thus, under NEEDS, priority is to be given to agriculture, especially improvement in the productivity of peasant farmers, and the continuing investment in water resources is not just to provide water to the people as a social service, but to also provide water for irrigation to further enhance agricultural productivity.

A key objective of the agricultural strategy is the promotion of all-season farming through rain-fed and irrigated farming with emphasis on fadama agriculture as well as implementation of the programme for massive production of tree crop seedlings. Also emphasis will now shift to developing small dams as a more cost effective way of utilizing water resources for irrigation in the country and rain water harvesting for irrigation agriculture was to be promoted where surface and underground water is not readily available. It is significant that RWH is mentioned in this document, even though it would appear in reality that this is essentially cosmetic. Indeed, reference to RWH here says 'where other sources of water are not readily available', indicating the lack of adequate understanding of the essence of the multi-dimensional reasons for harnessing rain water by the authors of the strategy document.

Previous and current government programmes in the water sector have largely been centred on water resources development, while proper management and conservation of the resource was not given adequate attention. Hence, the nation's water sources are under serious threat from inadequate catchments management and widespread pollution, including the indiscriminate disposal of hazardous substances. There is limited groundwater availability in the areas of the country underlain by crystalline rocks. In the more productive sedimentary areas, groundwater exploitation is heavy and uncontrolled. In addition to above challenges, poor watershed management, deteriorating water quality, drought and desertification are inexorably increasing water scarcity. Scarcity threatens urban and rural development with rapidly rising water supply costs, reduced reliability of water supplies, prolonged droughts, flood and erosion and increasing costs of irrigated crop production. Though the Nigerian National Policy on Water Resources has not expressly made any reference to RWH as does the National Agricultural Policy, critical analyses indicate, albeit unconsciously, the embodiment of elements of and basis for RWH in several aspects. The overall indication is a very strong policy support despite the lack of the word "RWH", though faithful implementation is another thing entirely. The implication is that the policy environment can easily be persuaded as to the logic and benefits of an integrated land and water planning approach, which also emphasizes the efficient harnessing of rain as a natural resource.

Further details of the policy analysis appear in FTR-Annex K[4].

3.2 Outcome of policy consultation

A one-day consultation[5] was held with high-level policy makers within Osun State with the following aims:

- Keeping the government of Osun State abreast of progress of the Rain Water Harvesting project of which they had earlier been made aware during stakeholder workshops.

[4] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex K. Overview of policy environment.

[5] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex L. Proceedings of policy workshop.

- Creation of informed awareness, at the policy level, of the critical issues involved in employing RWH technologies to improve rainfed agriculture.
- Extraction of commitment to support the project from the government.

Members of the project research team served as resource persons, with support from Prof. Hatibu from Tanzania. Documents made available to the participants included:

- A policy briefing paper which reviewed the current state of land and agricultural water use in Nigeria. This reviewed the state of Nigerian agriculture, land and water use policies.
- Review of the RWH experiences in Tanzania, backed up with SWMNet Strategy paper and ASARECA NRM strategy document.

Responses and the overall discussion indicated considerable awareness of the project through the various activities so far undertaken. These include the radio programmes, TV documentaries, stakeholder workshops etc.

Specific policy recommendations were agreed by participants as follows:

- Invest adequately on integrating land, water and livelihoods
- Pay increased attention to upgrading "rainfed" agriculture while removing the artificial distinction between rainfed and irrigated systems
- Focus on efficient systems of rainwater capturing, soil health management and supplementary irrigation
- Integrate RWH with infrastructure as well as groundwater and water supply projects

Osun State Government pledged to work with the Research Group to develop an integrated land and water use policy for Osun State. Furthermore a commitment was given by Osun State Governor to support the establishment of pilot demonstration farms in the three agricultural zones of the State.

Chapter 4 Knowledge Transfer

4.1 Stakeholder analysis

The first step towards developing the communication plan for effective transfer of RWH research from Tanzania to Nigeria was a stakeholder workshop[6]. The objectives were to:

- Describe and outline the values of rainwater, run-off/erosion to agriculture and human existence.
- Identify the RWH research success from Tanzania.
- Identify and analyse the stakeholders relevant to the transfer of RWH research successes from Tanzania to Nigeria.
- Identify and analyse the problems, knowledge gap and needs of target beneficiaries in relation to RWH technologies and strategies.
- Identify and state the elements within the communication plan. i.e.
    - Who communicates what?
    - To whom, and through what media?
- State the outcome/ output/ effect of communication on the receivers.

A stakeholder was defined as any person, group or institution with an interest in a project outcome. This definition includes intended beneficiaries and intermediaries, winners and losers, and those involved or excluded from decision-making. Stakeholder analysis distinguishes between primary stakeholders (ie. intended beneficiaries) and secondary/institutional stakeholders (ie. others who can significantly influence the outcome of the project).

Stakeholder analysis aims to:

- Identify and define the characteristics of primary stakeholders;
- Identify and define the level of influence of primary stakeholders;
- Assess the manner in which they might affect or be affected by the project;
- Understand the relationship between stakeholders, including an assessment of the real or potential conflicts of interest between stakeholders.

[6] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex D. Proceedings of stakeholder workshop.

The following stakeholders were identified:

- Target beneficiaries (farmers)
- Extension agency: Osun State Agricultural Development Programme (OSSADEP)
- Policy formulation and implementation agency: Ministry of Agriculture and Natural Resources (MARD).
- Non – Governmental Organizations e.g. New Nigeria Foundation (NNF) and the United Nations Development Programme (UNDP).
- The News Media
- Agricultural related Institutions. e.g. Credit, land, and inputs
- Commodity and Community Associations/Unions/Organizations
- Researchers.

Representatives of these stakeholder groups who were present in the workshop participated in developing a problem tree (Figure 4.1). Each of the causes identified in this way was further developed by considering contributory factors which was then arranged in cause-effect chains. It was then possible to identify the "knowledge gaps" in relation to RWH and review the activities defined in the project logical framework.

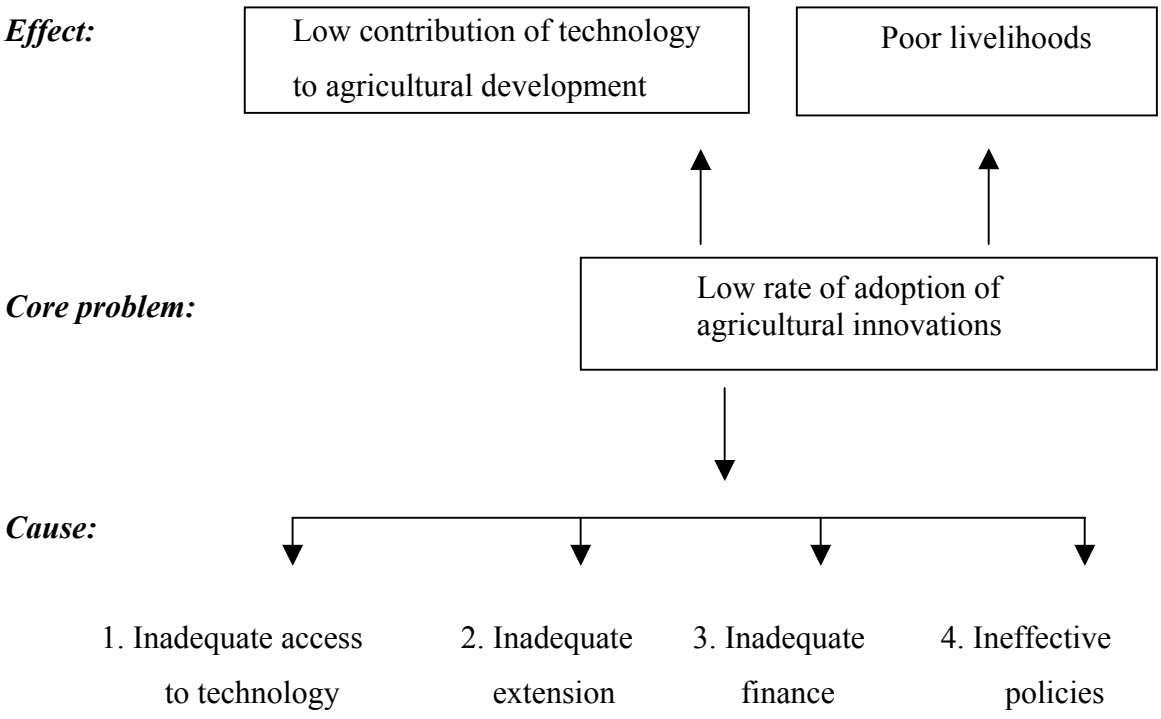


Figure 4.1: Problem tree developed by stakeholders

It was agreed that there are peculiar circumstances of RWH interventions, which tend to differ from other agro-technology packages (seed/fertilizer/pesticides) because they are (a) knowledge intensive and (b) easily divisible. It is not simply a matter of communicating a standard package of inputs, but requires more careful problem analysis by the individual farmer to decide what to do. There is no single recognizable "improved practice". The farmer may decide to adapt current practice and move part of the way towards the improved RWH practice. The problem analysis, then provided the basis for developing an outline communication plan, as follows:

Table 4.1: Development of an outline Communication Plan

Communicator	Receiver	Message	Through what channel?	Expected output
Research scientists	Extension delivery agency (OSSADEP)	*Rain water and its values *Problems and needs on ground. *Rain water harvesting and associated opportunities *RWH technologies and recommendations *Resources on ground. *Teaching methods / channels of communication *Communication plan	*Stakeholders' workshop. *Collaborative and participatory research. *RWH technology training workshops. *Fortnightly training sessions. * Demonstrations: SPAT and OFAR *Documentary on RWH using radio and television. *Newsletters and photographs *RWH software and power point show.	*Bridging gap on KAP of RWH among the extension agents. *Package the RWH technologies into useful and adoptable recommendations. *Willing to disseminate the RWH technologies to farmers. *Selecting relevant and appropriate communication methods. * Critique of communication plan * Participatory Research on RWH pilot project. *Training and visits to farmers on RWH
Research scientists	Target beneficiaries	* Rainwater runoff value * Problems and needs on the	* Group contacts (eg. farmer forum,	* Awareness creation * Participatory RWH research

		ground * RWH opportunities * RWH technology options	demonstrations) * Mass media (eg TV, radio) * Farm visits * Participatory learning	* Legitimization * Skills development
Research scientists	Policy formulation and implementation agency (MANR)	*Rain water and its values *Problems and needs on ground. *Rain water harvesting and associated opportunities *RWH technologies and recommendations *Resources on ground. *Teaching methods / channels of communication	*Stakeholders' workshop. *Round-Table meetings *Video show / clips *Newsletters and photographs *RWH software and power point show. *Documentary on RWH using radio and television.	*Positive advice to Government on legitimization of RWH research and funding. *Awareness creation and publicity of RWH technologies in Osun state. *Policy formulation and implementation on RWH in Osun State.
Research scientists	Policy makers	*Rain water and its values *Problems and needs on ground. *Rain water harvesting and associated opportunities *RWH technologies and	*Round –Table meeting in Government offices *Video clips and Power point with RWH software shows.	* Creation of RWH awareness through Government publicity. *Investments in RWH *Formulation and implementation of RWH policy.

		recommendations	*Documentary on RWH using radio and television	*Sponsoring RWH bill into law in the State House of Assembly.
Research scientists	NGOs	*Rain water and its values *Problems and needs on ground. *Rain water harvesting and associated opportunities *RWH technologies and recommendations *Resources on ground.	*Stakeholders' workshop. *Collaborative and participatory research (PRA). *RWH technology training workshops. *Video clips and Power point with RWH software shows. *Documentary on RWH using radio and television.	* Creation of RWH awareness at the grassroots level. * Give fund, logistic, and policy supports to farmers on RWH. *Investments in RWH.
Extension delivery agency	Target beneficiaries	*Rain water and its values *Problems and needs on ground. *Rain water harvesting and associated opportunities *RWH technologies and recommendations *Resources on ground.	*Interpersonal contact methods such as farm and home visits. *Group contact methods such as group meetings and discussions, demonstrations, field day and farmers' forum. *Mass media contact methods	*Participatory research work on RWH project. *Understanding and adoption of RWH technologies at household and community levels. *Investment in RWH Project at individual farmers and group levels.

			such as campaign, newsletters, radio and television. *PRA for situation analysis and Participatory learning .	* Farmers that have been convinced about the benefits of RWH technologies.

4.2 Communication plan

It was anticipated that different stakeholder groups would want to do different things in response to the communication process:

- Research partners will achieve a shared vision and develop capacity to use research findings in other projects;
- Participating farmers will interpret and validate research findings and assert ownership of any deemed to be relevant to their circumstances;
- Local government will be aware of the impact of their policies and actions on land management / resource use and examine scope for improvement;
- Service delivery agencies will participate in the research, be aware of responses of primary stakeholders and adapt findings to their own needs.

The Communication Plan (Table 4.2) was designed to meet these different objectives.

The decision on communication materials to be used (eg. face-to-face briefing, workshops, pamphlets, video, radio, street drama) was influenced by understanding developed during the design/investigation phase on

- Who the research product is for and their preferred means of communication;
- The communication objective of the specific stakeholder group (or subgroup);
- The best means of communication for the specific product.

Preliminary activities including project inception workshop, initial field visits to sample communities, visit to RWH research sites in Tanzania, stakeholder workshop and PRA in sample communities all informed the development of the plan.

The communication plan was focussed on the creation of awareness on RWH in Nigeria amongst:

- Primary stakeholders : local leaders, opinion leaders, women groups, youths, farmers groups.

- Secondary stakeholders : Extension delivery agents / agencies, ministries of Agriculture and Natural Resources, Policy Implementation Agencies, NGOs, Research Institutions, Media Organizations, Scientists
- Policy makers : Governors, Local Government Chairmen of local councils, Secretary to the State Government (SSG), Speakers of House of assembly & Legislators, Permanent Secretary for Agriculture and Commissioner for Agriculture and adviser to the Governor on Agriculture and Rural development

The specific objectives were:

- To create awareness on the values of runoff, RWH and existing potential for RWH in Nigeria.
- To arouse the interest of the stakeholders in RWH
- To sensitize the stakeholders to invest in RWH Research / Project

The communication plan was implemented jointly by the RWH research team from OAU and the communication officer of the extension delivery agency (OSADEP) using radio as the main medium of dissemination. In addition a Training of Trainers Workshop was held for extension workers from OSADEP. Details of radio broadcasts are given in an appendix to FTR Annex E[7].

[7] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex E. Communications Plan.

Table 4.2: Communication Plan

Communication Channels/Media	Target Audience	Message	Time	Time Schedule	Frequency of Use/day
Radio Jingle	Primary Stakeholders Secondary Stakeholders Policy Makers and Public	Awareness cration on run-off RWH: Values to food security and domestic uses	1 min.	6 weeks	2 slots/day
Television Jingle	Secondary stakeholders Policy makers and general public	Awreness on run-off and RWH values to Agriculture, food security and domestic uses	1 min.	6 weeks	1 slot / day
Radio Talk e.g. straight talk – interview – panel discussions	Policy makers Public Secondary stakeholders and community people	Values of RWH, role of stakeholders, ways of collaboration Techniques of RWH	15 mins	13 weeks	2 slots/week
Video Documentary Television (English)	Policy makers Secondary Stakeholders Researchers in related disciplines	• History of RWH Research • RWH, Research success • RWH benefits • RWH techniques • RWH stakeholders and the roles	1 hour	13 weeks	One transmission per week

Eroya: Yoruba audience participatory programme. Radio phone-in	Primary stakeholders: Men/Women/Youth farmers, Community leaders. Secondary stakeholders: Extension personnel - NGOs - Policy makers	• Background to RWH Research • RWH success in other countries • RWH research in Tanzania • Benefits to Nigerians • RWH techniques • Resources on ground • Roles of Stakeholders • Other influencing factors	2 hours	12 months	One programme/quarter (13 weeks)
Leaflet/guide (Technical guide)	• Extension Agents • NGOs • Researchers • Publics • Students • Farmer groups • Research Institutes	• Objectives of RWH techniques • Site and topographical requirements • Site preparation • Field preparation • Construction of Channels • Diversification of water, • Duration of diversion • Management of structures	Throughout the life span of the RWH Research and beyond	Beyond project life span (1000 copies – initial print)	Daily/weekly/monthly depending on request or target audience

Village RWH groups	Local community groups eg. Women, youth and farmer group RWH village groups	• Needs assessment • Radio messages: timing and discussion • Site selection • Site construction • Chanelization • RWH techniques • Management of RWH technologies • Reviews of field activities	1 –2 hours	13 weeks	One village visit / month or as situation demands

It became apparent at an early stage in the project that advocacy alone would not bring about transfer of the success in Tanzania. Rather, there is a need for advocacy to be supported by demonstration and training activities. Hence it was decided that a demonstration plot should be established for one season in Mafikuyomi Village. The main objectives were to:

(i) provide a platform for engagement with farmers and extension workers;

(ii) create an avenue for stakeholders to evaluate the desirability of RWH.

Based on the Tanzanian experience, the demonstration consisted of two separate plots; one for micro-catchment and the other for macro-catchment. Unfortunately the season was exceptionally dry with a six-week dry spell in June/July and it was impossible to carry out all the intended stakeholder evaluation and training activities.

4.3 Evaluation of Communication Plan

An evaluation[8] of the media used in the process of implementing the Communication Plan was conducted, which focused on radio jingle, radio talk and Eroya phone-in radio programme

The main objective was to determine the effectiveness, appropriateness and adequacy of these communication activities. The specific objectives are to:

(i) know the extent of awareness creation and number of people reached;

(ii know the frequency of hearing the programme by target audience; and

(iii) determine the appropriateness and adequacy of the messages, time of relay and duration of relay of messages to the target audience.

Three sets of subjects were picked in the following ratio: Men (180); Youth (60); Women (60). The population used was the Cassava Growers Association (CGA) in Osun State. There are 20 farmers per Local Government Area from where 6 men and 2 women were selected for interview. Also, 2 youths between the ages of 12 and 24 years were selected from each of the 30 Local Government Areas in Osun State, which covers the three agro-ecological zones namely Iwo zone (derived savannah)where Mafikuyomi is situated, Osogbo zone (Sudan Savannah) and Ife/Ijesa zone (forest area) where Erin Ijesa and Erin Oke are based.

The majority of respondents (87%) were found to be aware of the radio programmes. The major source (67%) of information/awareness about these programme is the radio itself. About 23% heard about it from friend or from a scientist from OAU. A small number (3.0%) knew about the radio programmes from journalists, while fellow farmers created the awareness for others (17%).

While the large majority of the respondents did not listen to radio jingles and Eroya audience phone-in programme at all (82% and 63% respectively), a considerable number of respondents (38%) claimed to have listened to radio talks between 1 and 5 times, 12% to have listened between 6 and 10 times and 17% of the respondents listened 10 to 15 times. The time when radio jingle and Eroya programme was

[8] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex N. Evaluation of communication activities.

relayed on radio might be responsible for the large number of respondent not to have listened to these programmes.

Detailed analysis showed that 45% of respondents discussed the RWH themes with other people; 21% asked further questions about RWH; while 25% report having read more about RWH. About 32% of the respondents wanted the RWH techniques demonstrated for them to see it working, while just 4% have tried to visit OAU research group and Osun State Agricultural Development (OSADEP) for further enquiries, while 17%) did not report any effort to follow up.

A little below 50% of the respondents saw the RWH Technology being transferred to Osun State as a welcome development. About 34% saw it as an effort that is capable of solving the water scarcity problems in Osun State; 45% perceived RWH as an innovation that would allow farming throughout the year and that it would increase food production in the state. While 20% of the respondents perceived RWH as a means of improving their livelihood, 4% indicated that it cannot work; and a few respondents (14%) wanted to participate in the project. A few respondents (4%) cannot say anything about RWH now, perhaps because of its newness. Some (22%) wanted to learn about RWH and said that the radio programmes should continue to give them more insight into the RWH project.

On the time of relaying the radio talk programmes to the public, about 33% believed that the timing is appropriate; 10% believed that the timing is not appropriate and must be changed; 13%) wanted the time and day of relaying the programme to be changed and the majority (55%) wanted the duration be increased from 15 minutes to 30 minutes.

The average number of people estimated to have listened to the radio programmes was 1.5 million people. It is concluded that the communication plan has been successful in reaching a large target audience and in creating awareness of RWH technology. It has sensitized and mobilized the stakeholders towards accepting the RWH project as an alternative to water scarcity in Osun State.

Chapter 5 Discussion and Conclusion

5.1 Communicating the RWH message

The project was not concerned with generating new research products, but was focussed on testing transferability of findings from previous research in Tanzania. The communication plan was therefore at the core of the project. The decision on communication materials and methods to be used was influenced by understanding developed through stakeholder consultations and was informed by interactions with the RWH research team in Tanzania.

Key stakeholders were identified as Osun State Agricultural Development Programme (OSADEP) and news media. It was recognised that RWH innovations differ from agro-technology packages (seed/fertiliser/pesticides) in that they are (a) knowledge intensive and (b) easily divisible. It is not simply a matter of communicating a standard message, but requires more careful adaptation to the circumstances of a particular farm.

Communication activities aimed to generate awareness of possibilities for improvement to cropping systems in Osun State (and more widely in Nigeria) through improved soil-water management. Radio was selected as the most appropriate medium and a series of broadcasts was designed and delivered in close collaboration with OSADEP. Short radio jingles were first used to generate interest. A series of weekly technical talks followed, which adopted a variety of formats. One programme in a regular series of audience phone-in shows was also devoted to RWH.

The effectiveness and impact of these activities was monitored throughout by regular meetings with farmer groups established by the project in four sample communities. They were found to be very effective in stimulating interest and the entry-point of reporting a success story elsewhere in Africa undoubtedly contributed to this result. Letters and calls received for the phone-in programme were comparable to the number for other broadcasts on road safety and on malaria that were broadcast in the same slot. An objective measure of reach was obtained though a survey across Osun State, which indicated that more than 70% of respondents had listened to the radio

talks with 30% having listened more than 5 times. It was also found that 37% has listened to the phone-in programme.

A study of agricultural information dissemination in Kano State (Adekunle et al, 2004) supports the conclusion that radio is the preferred medium of communication. It was found to be the preferred means of receiving information amongst all age groups and equally between women and men. They reported also that radio listening groups were popular. Some differences were noted in the preferred broadcast time which indicates a need for careful scheduling to target a particular audience.

5.2 Investigating constraints to adoption

On the basis of an analysis of constraints faced by farmers at selected case study sites, an attempt was made to evaluate the potential for adoption of RWH research findings by the target group. Clearly it could be argued that a situation analysis of this nature should be completed before launching communication activities to promote adoption of RWH. In reality, the short-term nature of the project required that these activities had to take place simultaneously. This proved to be a problem only in so far as the need for a demonstration site quickly became apparent.

Available data on soils and rainfall were analysed to establish the frequency and severity of dry spells. The rainy season extends from April to October and outside this season cropping tends to be restricted to riparian zones and wetlands (known locally as fadama lands). Dry spells of 5-9 days duration occur throughout the wet season and represent an increasing constraint towards the north of Osun State and further north into the savannah zone. The rainy season is effectively split by a period of low rainfall in August when dry spells longer than 15 days are common.

There is a perception amongst farmers that climatic variation has added to the risk of rain-fed cropping. This is supported by evidence from Fakorede & Akinyemiju (2003) who analysed climatic data for OAU research farm for the period 1975 to 2000. They showed that the rainy season has shown an increasing tendency to false starts and concluded that there has been a delay in the onset of the rainy season by about a month.

A simulation study using PARCHED-THIRST software provided an initial assessment of the likely success of RWH for maize cropping. The study shows RWH benefits for micro-catchment systems and supports the assessment of the importance of dry spells as a constraint to rain-fed cropping. Macro-catchment systems were not simulated, but are expected to be beneficial especially where they can be combined with short-term storage and supplementary irrigation. These would deliver the benefits most desired by farmers of alleviating the August break and extending the cropping season beyond October. The simulation study was conducted by staff from OAU, one of whom is continuing and extending the study. This will permit calibration of the maize model for a recommended local variety and will allow for assessment of RWH performance under drier conditions further north into the savannah zone. The model was not used within the project as a training tool for other stakeholder groups.

Economic and socio-cultural constraints to adoption of RWH were addressed largely through participatory appraisal in four sample communities. The full market chain was examined, taking account of processing, storage and marketing constraints. Issues of resource access and use rights were explored with a view to mobilising community participation. A variety of existing soil and water conservation practices are apparent and evidence suggests that farmers will easily be able to determine which soils are appropriate for RWH. Evidence of farmer experimentation is widespread and particularly innovative farmers can be found. Marketing constraints exist but farmers regard input supply and poor support from extension services as a greater challenge.

The attempt to establish a short term RWH demonstration[9] in Mafikuyomi Village failed due to unfavourable weather conditions. It was therefore impossible to carry out the intended stakeholder evaluation and training activities, which would have provided further insight into farmers' attitudes to adoption of RWH.

Nevertheless, it is clear that farmers were very receptive to the message of success in Tanzania and there are no apparent cultural barriers to adoption of RWH. Evidence supports the previous conclusion in Tanzania that runoff is generally perceived as useless and destructive rather than as a valuable resource. Poorly distributed rainfall is

[9] Obafemi Awolowo University (2005) Needs assessment and uptake promotion of rainwater harvesting research in Nigeria. Final Technical Report, Annex O. Evaluation of pilot RWH trials.

known to be a problem but is accepted as an inevitable part of life and is not presented as a manageable production constraint. When RWH is advocated as an alternative then it is received very positively. Indeed expectations may be unrealistically high and there is a risk of over-selling RWH. The weakness of OSADEP as the vehicle for promoting RWH innovations must therefore be a matter of concern. Only limited training-of-trainers activity was completed within the project and there is insufficient capacity to effectively support knowledge-intensive RWH innovations.

5.3 Promoting RWH at policy level

An important outcome of the earlier work in Tanzania has been the degree of positive engagement in policy issues. This has contributed to the impact of RWH research there through a process of taking messages upwards then outwards. In attempting to transfer this success to Nigeria we must ask: are there systematic ways of influencing policy or was the work in Tanzania simply opportunistic?

Processes for informing policy discussions on RWH in Nigeria were therefore identified during the stakeholder workshop which was held at an early stage of the project. Subsequent project activities were conducted in close liaison with OSADEP as the key stakeholder with Osun State. A policy review was completed as the basis for engagement with state-level decision makers in a policy oriented workshop held towards the conclusion of the project.

The broad development policy context is expressed in the National Economic Empowerment and Development Strategy (NEEDS) which recognises that in order to achieve the target of 7% growth within a pro-poor agenda it will be necessary to refocus attention on the agriculture sector. It could therefore be argued that the ideal opportunity exists to roll-out a productivity enhancing innovation such as RWH. Such a policy would not be inconsistent with Nigeria's agriculture and water policies.

Within the current agriculture policy a key objective is identified as the promotion of so-called all-season farming. Emphasis is given to extending the current focus on fadama agriculture and it is a small step to extend the focus to encompass RWH innovations. Within the current water policy there is evidence of a shift away from the previous emphasis on large-scale water resource development and recognition of an

important role for small dams. It is again a small step to extend the focus to embrace the concept of RWH as an approach to resource conservation and management.

Participants at the policy workshop were receptive to these ideas and recognised the need for an integrated approach to land and water management if the sustainable development agenda under NEEDS is to be realised. A commitment was given by Osun State Governor to funding further RWH demonstration activities and this is seen as a strong indication that further engagement will result in impact at the policy level.

5.4 Conclusion

This relatively short-term investigation in Nigeria aimed to contribute to the NRSP goal of *developing and promoting strategies for improving the livelihoods of poor people living in semi-arid areas through improved integrated management of natural resources under varying tenure regimes*. In particular, it aimed to promote rainwater harvesting in a new target area on the basis of previous success in Tanzania.

In Tanzania, initial fieldwork was done in an area where water scarcity was known to be a constraint to dryland cropping. A second focus was later added at a site identified as having pre-existing RWH practices developed by farmers with no external assistance. Thus far in Nigeria work has been focussed within Osun State at sites which were selected for their convenience rather than to meet the above criteria. A shift of focus to a site further into the Guinea savannah zone (close to Ilorin) would be more likely to achieve short-term success. In addition, there would be much to be gained by investigating pre-existing RWH practices in order to build upon indigenous knowledge. The level of interest generated by the project indicates that support for a follow-on project along these lines would be justified.

In Tanzania a twin-track approach was adopted in which advocacy and demonstration were equally important activity strands. An important lesson learned from this project is that the success story from Tanzania was an excellent entry point for transfer, but was not sufficient to bring about adoption. RWH innovations are knowledge intensive and require careful adaptation to local circumstances. Agricultural support services in Nigeria are willing to take on the responsibility for promoting RWH, but lack the capacity to do so effectively. Advocacy alone will not bring about transfer of the

success in Tanzania. There is a need for advocacy to be supported by demonstration and training activities. The short duration of this project has mitigated against successful demonstration but the level of interest generated indicates that support for future demonstration and training activities would be justified.

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