

**A STUDY OF RESEARCH-EXTENSION-FARMER LINKAGE IN
THE CENTRAL ZONE, TANZANIA**

BY

ELINA DUNSTAN



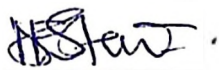
**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN
AGRICULTURAL EDUCATION AND EXTENSION OF SOKOINE
UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.**

ABSTRACT

In the past agricultural research institutes have been working almost in isolation without involving other stakeholders in agricultural development. The government has restructured the ZARDIs funds in the effort to strengthen research-extension-farmer linkages. In this respect, the present study investigated the research-extension-farmer linkage based on current institutional arrangement particularly in the central zone. Three Districts namely Mpwapwa, Chamwino and Dodoma Municipality in Dodoma Region were selected for this study. The study population consisted of research staff in the zone, extension staff and farmers from the three Districts. Structured questionnaires were used in data collection. The current arrangement has created several opportunities to strengthen linkage. These are agricultural technologies developed on farmers' fields and availability of ZARDEF and DADPs which enable stakeholders to undertake participatory activities. Reading materials, agricultural shows and on farm experiments were found to be highly effective in linking stakeholders in the dissemination of agricultural technologies. The zone has adequate number of qualified staff at all levels. Presence of ZRELO facilitates easy flow of agricultural information although the ZIELU is not so effective. The zone has conducted 40% of their experiments on farmers' fields and a block farm of about 300 acres of grape vine has been established on farmers' fields. The zone is still facing challenges in linkage activities. Lack of adequate and timely funding for research and extension was found to be a major problem that impairs effective planning for joint activities. The ZIELU was found to be ineffective as there were no permanent office. Cost sharing for research activities was still a problem as the Districts do not yet contribute funds for research activities. The study recommends the following: early disbursement and increasing research and extension funds, improving ZIELU and cost sharing in research and extension activities so as to strengthen the linkage.

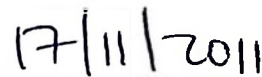
DECLARATION

I, Elina Dunstan, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my original work and that it has neither been submitted nor being concurrently submitted in any other institution.




Elina Dunstan

(MSc. Candidate)



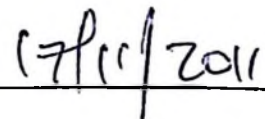
Date

The above declaration is confirmed by:



Professor A.Z. Mathee

(Supervisor)



Date

COPYRIGHT

No part of this dissertation may be reproduced, stored in any retrieval system, or transmitted in any form or by any means without prior written permission of the author or Sokoine University of Agriculture in that behalf.

ACKNOWLEDGEMENTS

This study would not have been possible without the financial assistance of the Belgium Technical Cooperation (BTC). I am greatly indebted to them for the support, without which it would not have been possible for me to undertake the study.

My sincere gratitude is also due to my supervisor, Prof. A. Z. Mattee, for his devotion, guidance and patience. Let me take this opportunity again to express my appreciation to all members of the academic staff of the Department of Agricultural Education and Extension and other staff from different Departments for their useful comments during the development of the research proposal.

I would like to express many thanks to all staff of the research institutions in the central zone namely Mpwapwa, Makutupora and Hombolo for their contribution and tireless efforts throughout the study; and the Chamwino, Mpwapwa and Dodoma Urban District extension staff for their contribution and for allowing me to conduct research in their areas. Special thanks are extended to farmers in the mentioned three Districts for the cooperation they gave me during the field work.

I am also indebted to my family, particularly my husband Wilson Deonatus Malosha, our beloved daughters Beatrice and Judith and our son Martin for their prayers, love, patience, understanding and encouragement during the entire period of this study. May God bless them all.

DEDICATION

This work is dedicated to my dearest father Dunstan Kiangio Baluah, my mother Stella Clement Kihyo and my late brother John Kiangio Baluah who made a lot of effort in laying down the foundation for my education.

TABLE OF CONTENTS

| | |
|--|-----|
| ABSTRACT | ii |
| DECLARATION | iii |
| COPYRIGHT | iv |
| ACKNOWLEDGEMENTS | v |
| DEDICATION | vi |
| TABLE OF CONTENTS | vii |
| LIST OF TABLES | xii |
| LIST OF APPENDICES | xiv |
| LIST OF ABBREVIATIONS | xv |
| | |
| CHAPTER ONE | 1 |
| 1.0 INTRODUCTION | 1 |
| 1.1 Background Information..... | 1 |
| 1.2 Problem Statement..... | 2 |
| 1.3 Justification of the Study | 3 |
| 1.4 Objectives of the Study..... | 5 |
| 1.4.1 Overall objective..... | 5 |
| 1.4.2 Specific objectives | 5 |
| 1.5 Research Questions | 5 |
| | |
| CHAPTER TWO | 6 |
| 2.0 LITERATURE REVIEW | 6 |
| 2.1 The Concept of Research – Extension - Farmer Linkage..... | 6 |
| 2.2 Factors Influencing Linkage Between Research, Extension and Farmers..... | 7 |

| | | |
|----------------------------|---|-----------|
| 2.3 | Achievements and Benefits for Creating the Link Between Research, Extension and Farmers..... | 8 |
| 2.4 | Strengthening Research-Extension-Farmer Linkage..... | 9 |
| 2.4.1 | How can strong productive linkages and partnerships be developed?..... | 9 |
| 2.4.2 | Involvement of various agricultural stakeholders in the link | 10 |
| 2.5 | Opportunities for Creating a Strong Link Between Research, Extension and Farmers | 11 |
| 2.5.1 | Information and communication mechanisms..... | 11 |
| 2.5.2 | Decentralization of services..... | 12 |
| 2.5.3 | Organizational and institutional arrangements | 13 |
| 2.5.4 | Financial support..... | 14 |
| 2.5.5 | Human capacity | 14 |
| 2.6 | Challenges and Problems Affecting the Effective Research, Extension Farmer Linkage | 15 |
| 2.6.1 | Communication barriers..... | 15 |
| 2.6.2 | Personal differences | 16 |
| CHAPTER THREE | | 18 |
| 3.0 | METHODOLOGY | 18 |
| 3.1 | Description of the Study Area..... | 18 |
| 3.2 | Study Design | 18 |
| 3.3 | Study Population | 18 |
| 3.4 | Sampling Procedure and Sample Size | 19 |
| 3.5 | Data Collection Methods | 19 |
| 3.5.1 | Primary data..... | 19 |
| 3.5.2 | Secondary data..... | 19 |

| | | |
|--|---|-----------|
| 3.6 | Data Analysis | 20 |
| | | |
| CHAPTER FOUR | | 21 |
| 4.0 RESULTS AND DISCUSSION | | 21 |
| 4.1 Basic Characteristics of Respondents | | 21 |
| 4.1.1 | Age of respondents..... | 21 |
| 4.1.2 | Sex of respondents | 22 |
| 4.1.3 | Marital status of respondents | 22 |
| 4.1.4 | Education level of respondents | 23 |
| 4.2 Linking Research, Extension and Farmers | | 24 |
| 4.2.1 | Linking researchers and extension staff | 24 |
| 4.2.2 | Linking researchers and farmers..... | 26 |
| 4.2.3 | Farmers' views about contact with researchers | 28 |
| 4.2.4 | Participation of extension staff and farmers in research activities | 29 |
| 4.2.5 | Participation of research staff and farmers in extension activities | 31 |
| 4.2.5.1 | Participation of research staff in extension activities | 31 |
| 4.2.5.2 | Participation of farmers in extension activities | 32 |
| 4.3 Opportunities Created to Strengthen Linkage Between Research, Extension and Farmers | | 33 |
| 4.3.1 | Linking research, extension, farmers and private sector | 34 |
| 4.3.2 | Presence of research technologies and projects..... | 35 |
| 4.3.3 | Involvement of various stakeholders in research and extension activities... | 36 |
| 4.3.4 | Information and communication mechanisms for linking research, extension and farmers in dissemination of agricultural information | 37 |

| | | |
|---------|---|----|
| 4.3.4.1 | Views of researchers about methods created to link with extension and farmers | 38 |
| 4.3.4.2 | Views of extension staff about methods created to link with research and farmers | 43 |
| 4.3.5 | Human resources..... | 47 |
| 4.3.6 | Financial resources..... | 48 |
| 4.4 | Achievements that Have Been Registered so far in Research, Extension and Farmer Linkage | 49 |
| 4.4.1 | Achievements that have been registered by research institutions..... | 50 |
| 4.4.2 | Achievements that have been registered by extension offices | 51 |
| 4.4.3 | Achievements that have been registered by farmers..... | 52 |
| 4.5 | Challenges and Constraints that are Still Being Faced in Linking Research, Extension and Farmers..... | 52 |
| 4.5.1 | Challenges facing research institutions | 54 |
| 4.5.2 | Challenges facing extension staff | 55 |
| 4.5.3 | Challenges facing farmers | 57 |
| 4.6 | Ways that can be used to Strengthen Linkage Between Research, Extension and Farmers..... | 58 |
| 4.6.1 | Researchers' opinions on strengthening linkage between research, extension and farmers..... | 58 |
| 4.6.2 | Extension staff's opinions on strengthening linkage between research, extension and farmers..... | 60 |
| 4.6.3 | Farmers' opinions on strengthening linkage between research, extension and farmers..... | 61 |

| | |
|---|-----------|
| CHAPTER FIVE..... | 63 |
| 5.0 CONCLUSIONS AND RECOMMENDATIONS..... | 63 |
| 5.1 Conclusions..... | 63 |
| 5.2 Recommendations | 65 |
| | |
| REFERENCES..... | 67 |
| APPENDICES | 73 |

LIST OF TABLES

| | | |
|-----------|--|----|
| Table 1: | Basic characteristics of respondents | 22 |
| Table 2: | Field of specialization of respondents..... | 24 |
| Table 3: | Views of extension staff about visits of researchers to their work stations | 25 |
| Table 4: | Views of extension staff on visits to research institutions | 26 |
| Table 5: | Distribution of researchers according to ways used to link with farmers | 27 |
| Table 6: | Views of farmers on researchers' visits to their villages | 28 |
| Table 7: | Views of farmers on their visits to research institutions | 29 |
| Table 8: | Views of researchers about participation of extension staff in research..... | 30 |
| Table 9: | Views of researchers about participation of farmers in research activities | 31 |
| Table 10: | Views of extension staff on participation of researchers in extension activities | 32 |
| Table 11: | Views of extension staff on participation of farmers in extension activities | 33 |
| Table 12: | Views of research staff about collaboration/involvement of different stakeholders other than extension staff ad farmers in research activities | 35 |
| Table 13: | Distribution of researchers according to methods created to link with extension and farmers | 38 |
| Table 14: | Distribution of respondents (extension staff) according to methods used to link with research institutions and farmers | 43 |
| Table 15: | Views of respondents about achievements registered on linking research, .. | 51 |

| | | |
|-----------|---|----|
| Table 16: | Distributions of respondents by challenges that still facing linkage activities..... | 53 |
| Table 17: | Distribution of respondents according to their opinions on what can be done to strengthen linkage | 60 |

LIST OF APPENDICES

| | |
|---|----|
| Appendix 1: A Study of Research-Extension-Farmer Linkage in the Central Zone, Tanzania..... | 73 |
| Appendix 2: Extension Staff Questionnaire | 80 |
| Appendix 3: Questionnaire for Farmers | 88 |
| Appendix 4: Checklist for the Zonal Agricultural Research Development Institutes (ZARDIs) Directors/Liaison Officers of Research Institution ... | 92 |
| Appendix 5: Checklist for the DALDOs/Liaison Officers of Extension office | 94 |

LIST OF ABBREVIATIONS

| | |
|------------|---|
| AKIS | Agricultural Knowledge and Information System |
| ASDP | Agricultural Sector Development Programme |
| CORMA | Client Oriented Research Management Approach |
| CRDB | Co-operative and Rural Development Bank |
| DADPs | District Agricultural Development Plans |
| DALDO | District Agricultural and Livestock Development Officer |
| FAO | Food and Agricultural Organization |
| FEPU | Farmers Education and Publicity Unity |
| FFS | Farmer Field School |
| FSA | Farming Systems Approach |
| IITA | International Institute for Tropical Agriculture |
| ILO | Information Liaison Officer |
| INADES | Institute for Social and Economic Development |
| IPR | Internal Programme Review |
| MAFC | Ministry of Agriculture Food Security and Cooperatives |
| NARIs | National Agricultural Research Institutes |
| NAROs | National Agricultural Research Organizations |
| NARS | National Agricultural Research System |
| NGOs | Non Governmental Organizations |
| PELUM | Participatory Ecological Land Use Management |
| PRA | Participatory Rural Appraisal |
| PROLINNOVA | Promoting Local Innovation |
| R&D | Research and Development |
| R4D | Research for Development |

| | |
|--------|--|
| RLDC | Rural Livelihood Development Company |
| SNAL | Sokoine National Agricultural Library |
| SPSS | Statistical Package for the Social Sciences |
| TSZ | Tanzania Shorthorn Zebu |
| URT | United Republic of Tanzania |
| ZARDEF | Zonal Agricultural Research and Development Fund |
| ZARDIs | Zonal Agricultural Research and Development Institutes |
| ZARFs | Zonal Agricultural Research Funds |
| ZCCs | Zonal Communication Centres |
| ZEC | Zonal Executive Committee |
| ZIELU | Zonal Information and Extension Liaison Unit |
| ZILO | Zonal Information Liaison Officer |
| ZRELO | Zonal Research Extension Liaison Officer |
| ZTC | Zonal Technical Committee |

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The links between agricultural research and technology transfer agents in developing countries are often a major bottleneck in agricultural technology systems and have received little attention in the past (Kirway *et al.*, 2003). Much has been said and written about the weak link between research, extension and farmers, which renders the dissemination of research results to farmers ineffective. Various attempts have been made over the years to improve those linkages (Mattee and Isinika, 2002). Some of the attempts are the decentralization of extension services and deconcentration of National Agricultural Research Systems. Decentralization in most countries including Tanzania makes local governments and other local stakeholders key actors in the demand for agricultural services provision.

In the last ten years the public funded National Agricultural Research Organizations (NAROs) and/or Institutes (NARIs) have become increasingly autonomous in order to meet these challenges. Many NAROs were decentralized through the establishment of local level, often agro-ecological based- research institutes (such as the Zonal Institutes in Tanzania). The main reason for decentralization and de-concentration of National Agricultural Research Systems (NARS) were the requirement for greater involvement by stakeholders to help focus research on client needs, to enhance scientific rigour and to promote a sense of stakeholder ownership in the research institution and its work (Kirway *et al.*, 2003).

The on-going decentralization process encourages research stations and extension organization to be more autonomous at zonal and district level respectively. However, in

the past research has been working almost in isolation without involving other stakeholders in agricultural development. The current institutional policies and arrangement aim at breaking such communication barriers which existed in the past. In this respect, Zonal Agricultural Research and Development Institutes (ZARDIs) have established Information and Liaison Offices whose objective is to improve communication and collaboration with other agricultural development stakeholders at the zonal, national and international levels (MAFC, 2003). The Information Liaison Officer (I.L.O) is a researcher and assumes responsibility by maintaining contacts with all stakeholders and clients with all the Districts of the Zone. For each Region within the Zone, a team of liaison officers has been identified. These teams are composed of one scientist (regional coordinator) and two field officers who act as District Information and Liaison Officers (MAFC, 2003).

Tanzania is divided into seven mandate Zones for agricultural research. The Zones cover vast areas with a diversity of farming systems. Dodoma Region falls under the Central Zone which is among the seven Zones for agricultural research.

1.2 Problem Statement

Studies in agricultural knowledge have shown that the constraints that hamper the development of agriculture in developing countries including Tanzania are often aggravated by a serious lack of access to reliable and timely agricultural research information and knowledge. This is not only to the farmers, but also extension workers, researchers, policy makers and other stakeholders (Lwoga, 2006). In the past research has been working almost in isolation without involving other stakeholders in agricultural development and extension services in Tanzania have been offered through what has been termed as supply driven and manipulative approaches (Rutatora and Mattee, 2001a).

According to FAO (1997), some of the shortcomings pertaining to research and extension include: research problems being investigated were generally not in accordance with the priority needs of agricultural producers, and knowledge generated at research stations has not been effectively transferred to producers. These issues arise because of weaknesses in the links between research and extension institutions. Technology development and transfer functions are treated in isolation of each other.

The government has restructured the ZARDIs in the effort to strengthen research-extension-farmer linkages, and so improve the effectiveness of both research and extension. But the extent to which this restructuring has addressed the linkage weaknesses on the current institutional arrangements is not well known. Having realized the importance of the research-extension-farmer linkages in agricultural development, it is therefore important to study how effective the research-extension-farmer linkage is, based on current institutional arrangement of research and extension in Dodoma Region using Central Zone Research Institutes as a case study.

1.3 Justification of the Study

The Ministry of Agriculture Food Security and Cooperatives (MAFC) and the Ministry of Livestock and Fisheries Development are among the Agricultural Sector Lead Ministries. These two Ministries have set up Zonal Agricultural and Livestock Development Funds (ZARDEFs) that will foster agricultural and livestock development in the zones by addressing priority areas of research that were identified by stakeholders in respective zones (Blackie *et al.*, 2003). On the other hand, the Ministry of Agriculture, Food Security and Cooperatives has created the offices of the Zonal Research and Extension Liaison Officer and the Zonal Information Liaison Officer at every zonal research headquarters.

The aim is to improve the linkage among research, extension and farmers in improving agricultural production through the use of improved technologies (URT, 2003a).

In research and extension linkages and coordination, there is a set of linkages and coordination fora which involve various stakeholders in agricultural development. These include Annual Donors' Conference, Annual Stakeholders' Conference, Annual Commodity Meetings, National and Zonal Agricultural Shows and the Annual Agricultural Conferences. At the zonal level the following fora have been instituted, these are Zonal Technical Committee and Zonal Executive Committee (ASDP, 2003). The current sources of agricultural information and communication channels also help in the dissemination of agricultural information between researchers, extension and farmers. These include technology reference materials, internet, radio, TV programmes, on-farm and on-station trials, agricultural shows, leaflets, posters brochures etc (MAFC, 2003).

The on-going decentralization process encourages research stations and extension organizations to be more autonomous at zonal and district level respectively. However, in the past research has been working almost in isolation without involving other stakeholders in agricultural development. The current institutional policies and arrangement aim at breaking such communication barrier which existed in the past (MAFC, 2003). The findings of this study will form the basis for the government and other sectors in formulating concrete strategies which will deal with challenges constraining linkage between research and extension and use opportunities identified to improve the linkage in agricultural development.

1.4 Objectives of the Study

1.4.1 Overall objective

To assess the factors influencing the research-extension-farmer linkage based on current institutional arrangement in the central zone.

1.4.2 Specific objectives

- i) To identify opportunities created to strengthen linkage between research, extension and farmers in the current institutional arrangement
- ii) To determine the achievements that have been registered so far in research, extension and farmer linkage
- iii) To identify the challenges and constraints that are still being faced in linking research, extension and farmers
- iv) To determine ways that can be used to strengthen research-extension-farmer linkage.

1.5 Research Questions

- i) What opportunities have been created to strengthen linkage between research, extension and farmers in the restructured ZARDIs?
- ii) What achievements have been registered so far in research-extension-farmer linkage?
- iii) What challenges and constraints are still being faced in linking research, extension and farmers?
- iv) What means can be used to further strengthen research-extension-farmer linkage?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Concept of Research – Extension - Farmer Linkage

In line with various policy reforms, different providers have engaged themselves in extension delivery (Rutatora and Mattee, 2001b). The concept of linkage implies the communication and working relationship established between two or more organizations pursuing commonly shared objectives in order to have regular contact and improved productivity (Agbamu, 2000). If the barriers between two systems are permeable enough for messages and responses to flow out of each to the other, then a link has been created between the two. From this viewpoint, agricultural research and extension services are two systems which are linked by information flow and feedback.

Linkage has been conceptualized as an operational relationship established when two or more organizations pursue commonly shared objectives, e.g., agricultural research and extension (R&E) in increasing production (Woods, 1985). Linkage between agricultural research and extension therefore, would mean the evolution of a clearly defined institutional arrangement, which provides for regular contact among research scientists and extension professionals to solve problems faced by farmers and to develop a package of recommendations that will enhance agricultural production. The effective communication links between researchers and extension staff are vital in the modification of technological recommendations and in initiating further research; such links enable new technologies and management practices to be suited to local ecological conditions (Agbamu, 2000). The participation of extension workers in adaptive research trials allows them to become familiar with the technologies they are expected to promote and also helps to ensure that the sociological dimensions of farming are not neglected.

According to MAFC (2003), the traditional view of agricultural research and extension being mainly a government responsibility is changing rapidly. The on-going decentralization process in Tanzania encourages research stations and extension organizations to be more autonomous at zonal and district level respectively. In this respect Zonal Agricultural Research and Development Institutes (ZARDIs) have established Information and Liaison Offices whose objective is to improve communication and collaboration with other agricultural development stakeholders in the zone, national and international levels. The networking includes strengthening good relationship with all kinds of stakeholders in agricultural development in the zone.

2.2 Factors Influencing Linkage between Research, Extension and Farmers

The linkage is influenced through integration of functions, creation of linkage units, integration through regular joint activities and integration through ad hoc activities. Also technology availability and relevance, responsiveness and sustainability influence linkages (FAO, 1997). According to Kauzeni (1989), for extension activities to be effective certain requirements have to be satisfied. These include properly trained personnel, necessary working facilities, effective communication and good national policy. Mattee (1994) adds that insufficient manpower, financial constraints, the haphazard nature of agents' contact with farmers, irrelevant technological packages, services reliance on a large number of paraprofessionals are the most cited problems hindering effectiveness. Mattee and Mollel (1990) asserted that extension activities are likely to be effective if they are accessible to farmers and that they address practical problems. Sustainable extension should be self-generating in terms of funding, staffing and clientele support to allow it to function at a constant level of activity. The type of organization arrangements, the nature of the technology used, the amount of training, institutional capacity building, the level and the

duration of the investment and the attention given to the current manpower costs have a significant influence on sustainability.

On the other hand sustainable agricultural technologies influenced by availability of resources including funds. Some new ideas are costly to adopt and require large initial outlays of capital. Income may enhance labour and ability to purchase farm inputs. Low level of income implies difficulties in buying farm inputs like improved seeds (Msuya-Bengesi, 2005).

2.3 Achievements and Benefits for Creating the Link Between Research, Extension and Farmers

According to FAO (1997), the reasons for the need for strong linkages include influencing formulation of research agendas based on problem identification, and the need to evolve technology suitable for the prevailing socio-economic and ecological environment. Extension can provide information and facilitate interaction between researchers and farmers. Simultaneously, extension also requires a constant flow of information on new and improved practices, necessitating a two-way communication process. The concept of technology flow is fundamental to the design of research and extension systems. This facilitates diagnosis of research-extension linkage problems. Effective communication links between researchers and extension staff are vital in the modification of technological recommendations and in initiating further research; such links enable new technologies and management practices to be suited to local ecological conditions (Agbamu, 2000). Institutional links and networking facilitates exchange of knowledge and information among stakeholders (URT, 2003a). To improve their livelihoods and achieving their goals, rural people need new things and ways that work; this may be solutions to particular constraints or new opportunities. New things that work can be better varieties and breeds,

improved production/husbandry practices, new crops/animals, more profitable marketing channels, more ecological land use practices and new ways of organizing themselves (PROLINNOVA, 2007). The participation of extension workers in adaptive research trials allows them to become familiar with the technologies they are expected to promote and also helps to ensure that the sociological dimensions of farming are not neglected (Agbamu, 2000).

2.4 Strengthening Research-Extension-Farmer Linkage

2.4.1 How can strong productive linkages and partnerships be developed?

Linkages are key importance as they create channels through which products, data, information, knowledge and wisdom are exchanged between various partners in the development process and utilization (Rutatora and Rwenyagira, 2005). Various attempts have been made over the years to improve research-extension linkages. Some of the attempts are the adoption of the farming system approach (FSA) which is a perspective on research and development (Byerlee and Winkelmann, 1982), adoption of the Training and Visit (T&V) system of extension, adoption of participatory approaches in research and extension programmes and activities and the adoption of the client-oriented demand driven research and extension approaches (Mattee and Isinika, 2002). However, a general condition for success in research and extension linkage would be: awareness of the importance of linkages among partners involved in the linkage process; consensus among key actors involved; commitment to linkage planning and implementation efforts at all levels; adequate fund for the linkage process; and involvement of key donors and policy makers (Agbamu, 2000). Furthermore, dissemination of existing improved technologies including indigenous knowledge are made easier by involving all stakeholders in the link through workshops, seminars and meetings (MAFC, 2003).

2.4.2 Involvement of various agricultural stakeholders in the link

Increased stakeholder involvement can lead to significant improvement in the relevance, sustainability, efficiency, effectiveness and impact of agricultural research. Most agricultural research and particularly zonal research aims to benefit people in a specific location. The priorities of such research should therefore be determined by local stakeholders, the research projects should be designed in partnerships with stakeholders and ideally, the research projects concerned must be financed, regulated, operated and maintained by local stakeholders (Anandajayasekaram and Rukuni, 1989). According to Shoo (2004), development can no longer be left to chance or to a few groups of individuals; initiatives from actors acting together as stakeholders of development are the rightful means to the development on the right path. Any effective and meaningful development must involve different players; the people, the state, non governmental organizations, civil societies, the private sector and the donor community acting together but in a coordinated manner, with internal dynamics taking upper hand.

In many developing countries, functions for improved agricultural development have been assigned to different agencies. For example, the function of generating improved technologies has been assigned to national agricultural research institutes, while that of transferring the improved technologies to the end users is a function of the agricultural extension organization (Agbamu, 2000). For these technologies to realize their full potentials, effective linkage must be fostered among the agencies and their personnel to form an integral system. The actors in any system have different capacities and advantages, and play different roles. Once these are understood, their responsibilities and objectives can be coordinated to avoid overlap and achieve complementarities in terms of shared goals.

2.5 Opportunities for Creating a Strong Link between Research, Extension and Farmers

2.5.1 Information and communication mechanisms

An organization routine is a mechanism that supports knowledge integrated through efficient and effective communication of knowledge among individuals. Through daily interactions, individuals are assigned implicit roles to foster more smooth communication, which cannot be fully covered by a conversation (Desouza, 2003b). Cross *et al.* (2002) suggested to build better networks focus on who knows what' informal information which contributes knowledge integration capability on which might affect competitive advantage by by influencing knowledge integration. Informal networks can be defined as networks where individuals are connected based on their social or personal relationships rather than work or task formally related relationship (Borgatti and Cross, 2003). Extension is about the communication of information among various actors, but primarily to farmers and among farmers, in order to motivate them to improve their agricultural practices (Garfoth, 1993). This requires the use of various communication media and facilities. The government has established various organs including the FEPU at national level and the ZCCs at zonal level to facilitate the communication of information to farmers and other stakeholders (URT, 2006). In addition, some Local Government Authorities have established District Resource Centres as well as radio and television programs for disseminating information to the public. According to MAFC (2003), the current sources of agricultural information and communication channels for the researchers, extension workers and farmers for improving linkages include reference materials, internet, radio and TV programs, stakeholders meetings coordinated by ZRELO and ZILO, on-farm trials (involving farmer-researcher groups and farmer- extension groups), farmer field days and agricultural shows organized jointly by DALDOs, researchers and farmers, on-station

farmers open days, whereby farmers and stakeholders visit the research station, leaflets, posters and brochures.

2.5.2 Decentralization of services

The national efforts to deconcentrate services to the District level provide an opportunity for building rural constituency capacity and increased involvement of different stakeholders in research, and this should be complemented with intensive human resource development program to improve management and coordination skills (URT, 2003a). Decentralization of extension services delivery to the district level and below enables decision making and management of resource use at grassroots level. Therefore, there is a high possibility of designing agricultural research and extension programmes that are community-based and drawing on local opportunities and constraints (Blackie *et al.*, 2003). The idea behind decentralized agricultural extension services lies with increased or active participation of farmers as key stakeholders in the agricultural production (Rutatora and Mattee, 2000). Farmers who were regarded in the past as end users of developed technologies are the key stakeholders on decision making of what type of technology to develop, for whom, how and when.

The on-going decentralization process encourages research stations and extension organizations to be more autonomous at zonal and district level respectively. The current institutional policies and arrangement aim at breaking the communication barriers which existed in the past. In this respect, Zonal Agricultural Research and Development Institutes (ZARDIs) have established Information and Liaison Offices whose objective is to improve communication and collaboration with other agricultural development stakeholders at the zonal, national and international levels (MAFC, 2003).

2.5.3 Organizational and institutional arrangements

According to Elfaki (2008), organizational factors such as size of institutions to be involved, division of tasks and responsibilities and sharing of goals and commitment influence the linkage among stakeholders. The desire of governments and development partners to involve farmers' organizations is more obvious when supported by a legislative framework and a favourable overall political and economic context. The more frequent participation of farmers' representatives in research decision making bodies is a key marker demonstrating the advances made in establishing linkages. Besides this, the achievement of true collaborative linkages depends on National Research Institutes integrating support to development into their scientific planning processes and implementing a policy of incentives which are sufficient to lead to researchers working closely with farmers. It is also necessary that farmers' organisations acquire greater intellectual, operational and financial autonomy. According to Lancini (2004), in order to strengthen the research/extension linkage, members of each programme should come together for a series of workshop meetings. Specific commodity steering committees should be formed with members from various disciplines. Each steering committee would act as the planning and co-coordinating body and serve as subject matter specialists. The linkages are influenced through integration of functions, creation of linkage units, integration through regular joint activities and integration through *ad hoc* activities. Also technology availability and relevance, responsiveness and sustainability influence linkages (FAO, 1997). Management factors involve issues such as the division of tasks, resources, authority among different organizations, units and individuals, and the internal management and informal dynamics of the organizations and their components (FAO, 1997).

2.5.4 Financial support

According to URT (2003a) the current funding of agricultural research is mainly through Government subventions, donor funds, and cess for few cash crops. However the government has not been able to fund agricultural research adequately due to financial constraints. Various funding mechanisms such as ZARDEFs, self help, contract research and collaborative research funds have been initiated by the NARS to supplement government and donor funding.

2.5.5 Human capacity

Staff is the most important resource through which an organization achieves its objectives and eventually realizes its mission. To effectively execute research programs, it is essential for the NARS organizations to have a defined workforce in terms of relative number of scientists and technical and support staff, the necessary qualifications and skills, appropriate distribution by qualification and discipline (URT, 2003b). The formal linkages with research would be through the Zonal Research Extension Liaison Officer (ZRELO) who works from zonal research headquarters. His/her role is to work with research scientists to produce zonal and area specific information for dissemination to farmers. Presence of ZRELO in the zone facilitates easy flow of agricultural information as he is a bridge between research and extension.

According to URT (2003a), Zonal Agricultural Research and Development Institutes (ZARDIs) have established Information and Liaison Offices (ZILOs) whose objective is to improve communication and collaboration with other agricultural development stakeholders in the zone, national and international levels. The ZARDI perceives that in order to speed up transformation from a “close” to an “open” organization, it is deemed necessary to pay special attention to improved networking. The networking includes

strengthening good relationship with all types of stakeholders in agricultural development in the zone, directing all ZARDI services towards key demand driven issues and improving production of user friendly products like leaflets and posters.

2.6 Challenges and Problems Affecting the Effective Research, Extension Farmer

Linkage

2.6.1 Communication barriers

On the part of extension, sources of information such as radio, TV programmes, stakeholder meetings, on-farm trials, farmer field days, leaflets, brochures and posters are relevant. However, unless there is an agricultural project in a particular District or Region, new information is not printed nor disseminated due to lack of funds. Another problem is related to the modality of distributing the agricultural information materials. The level of illiteracy of some farmers is also a snag (MAFC, 2003). According to URT (2006), some of the weaknesses hindering flow of information include inadequate communication facilities at zonal, District and local (field) level, inadequate knowledge and skills among extension personnel in the use of communication equipment, facilities and materials, inadequate opportunities for networking among stakeholders and unavailability of resource centers in many Districts. Organizational reasons for poor linkage include the orientation and work style of scientists, who are more oriented towards the general scientific community and have a longer time horizon compared to extension staff that are oriented towards farmers and pressed with immediate concerns (FAO, 1997).

According to Agbamu (2000) the research and extension linkage problems relate to lack of, or weak research and extension policy, poor institutional arrangement for the linkages, inadequate and poor quality of personnel, inappropriate decision-making methods, poor conditions at on-farm level trials, and inadequate finances. Other causes of the weak or

absence of effective linkages between research and extension identified are: poor capacity building for research staff where the technical capability of the research staff is still low in developing countries when compared with that of developed countries. Even where the personnel exist there is lack of adequate modern facilities for conducting useful research exercise. Poor funding of linkage programmes and problems of extending research results were also identified to cause linkage problems.

2.6.2 Personal differences

According to FAO (1997), Agricultural Knowledge and Information System (AKIS), for effective linkage, stresses similarities in culture, language and socio-economic status of the personnel so as to facilitate communication. Extension workers frequently find it difficult to communicate with poor, illiterate farmers and tend to find prosperous and model farmers to work with, because these farmers usually have a more favorable attitude to change and may seek out the extension workers (Belay and Abebaw, 2004). Another problem is the perceived status differences between researchers and extension staff. This is considered by many authors as one of the main reasons underlying the weak link. (Elfaki, 2008). In general, researchers are better rewarded at least by having opportunities to study for advanced degrees, by being posted near large cities where there are better facilities for family living. Moreover, nowadays international research centers and their consultative groups offer researchers exciting possibilities of meeting colleagues, exchange information and even financial incentives by sharing in programs, workshops, seminars and conferences arranged by these institutions. On the contrary, extension staff are posted in remote areas with poor salaries, lack of transport and no or limited career development, no chances for meeting other colleagues except for those at the top senior management level (Elfaki, 2008). Perceived status differences between researchers and technology transfer workers or even on-farm workers, often impede collaboration. Status

problems have no simple solutions. Managers have three basic options; reduce the differences through training or increased professionalism, accept differences but work to minimize their negative impact or in very difficult situations, avoid status problems by finding alternative partners or building up their own capacity in technology transfer.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

This study was conducted in three Districts of Dodoma Region namely Mpwapwa, Chamwino and Dodoma Municipality using Central Zone Research and Development Institutions (Makutupora Viticulture Research and Training Institute, Hombolo Research Institute and Mpwapwa Livestock Production Research Institute). The Central Zone comprises Dodoma and Singida administrative Regions, which are part of the semi-arid zone with a total of 12 Districts. Dodoma Region was purposely selected due to resource limitation to cover both regions. The three Districts were purposively selected based on the fact that research institutions have operated and conducted their activities in them for several years.

3.2 Study Design

This study adopted a cross-sectional survey design. According to Babbie (1990), this design allows collection of data at a single point in time.

3.3 Study Population

The target population of this study comprised of 43 researchers from the three research institutions in the central zone, 229 extension staff of the three selected Districts and all farmers in the selected three villages out of 202 villages within the three Districts. The selected villages were Chinangali in Chamwino District, Zepisa in Dodoma Municipality and Ving'hawe in Mpwapwa District.

3.4 Sampling Procedure and Sample Size

From the sampling frame of 43 researchers, a sample of 30 researchers was selected randomly using systematic sampling technique where respondents were chosen at regular intervals. From the sampling frame of 229 extension staff in the three Districts, 45 extension staff was selected randomly through systematic sampling technique. Three villages were selected purposively, one from each District which have worked with research institutions for several years. 45 farmers were selected randomly, 15 from each village so as to get representative sample from the total population. Systematic sampling technique was used whereby respondents were chosen at regular intervals from the sampling frame of all farmers of a particular village.

3.5 Data Collection Methods

3.5.1 Primary data

Primary data involved quantitative and qualitative data which were collected by the use of survey research instrument (structured questionnaires) with open and close-ended questions. Two modes of data collection were used: interviewing and self-administered questionnaire. The data comprised opportunities created to strengthen linkage between research, extension and farmers in the current institutional arrangement, achievements that have been registered so far in the linkage, challenges and constraints that were still being faced in the linkage and ways that could be used to strengthen the linkage.

3.5.2 Secondary data

Information related to opportunities created to strengthen the linkage between research, extension and farmers such as research funds, research and extension projects were collected from SNAL, research institutions offices, Mpwapwa, Chamwino and Dodoma Municipality offices, unpublished reports and personal correspondence concerning

background of study area. In the case of District offices, data obtained include the number of villages, extension staff and farmers where the sample was drawn. Also information about the number of reading materials generated in each District was collected.

3.6 Data Analysis

Data collected from primary sources using questionnaires were organized, coded processed and analyzed using Statistical Package for Social Sciences (SPSS) 11.5 Computer Programme, Descriptive Statistical analysis performed to yield frequencies and percentages. Tables were used in organizing and presenting information. This kind of organizing data was particularly useful in visualizing data and drawing conclusions. The choice of this kind of data analysis procedure was done due to the descriptive nature of the study.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Basic Characteristics of Respondents

This section deals with the description of basic characteristics of three categories of respondents, research staff from research institutions in central zone, extension staff and farmers from the three Districts of Dodoma Region namely Mpwapwa, Chamwino and Dodoma Municipality. Basic characteristics of respondents examined were age, sex, marital status and education level as indicated in Table 1. These were analyzed to look at the distribution and differences among respondents.

4.1.1 Age of respondents

The age of respondents ranged from 21 to 58 years. The average age of research staff was 44 years, extension staff was 47 years and for farmers the average age was 40 years. The results show that there is a difference in age composition amongst research staff, extension staff and farmers. On the other hand, Table 1 show that the majority of researchers and extension staff were over 40 years, that is, 70% of research staff fall between 40-60 years old while only 30% were below 40. For extension staff, 86.6% fall between 40 and 60 years and 13.4% were below 40 years. This implies that majority of researchers and extension staff were adults who have more experience in linkage activities. According to Rwambali (1990), adults are well experienced and have wisdom and knowledge so one can learn from them and consider their ideas. On the other hand, results show that majority of farmers (51.2%) were below 40 years while 48.8% were above 40. This implies that majority of farmers interviewed were of productive age therefore have the ability to adopt and participate in research and extension activities.

Table 1: Basic characteristics of respondents

| | Researchers (n=30) | | Extension staff (n=45) | | Farmers (n=45) | |
|------------------------|--------------------|------|------------------------|------|----------------|------|
| | No | % | No | % | No | % |
| Age in years | | | | | | |
| 20-29 | 3 | 10.0 | 3 | 6.7 | 7 | 15.6 |
| 30-39 | 6 | 20.0 | 3 | 6.7 | 16 | 35.6 |
| 40-49 | 12 | 40.0 | 20 | 44.4 | 11 | 24.4 |
| Over 49 years | 9 | 30.0 | 19 | 42.2 | 11 | 24.4 |
| Sex | | | | | | |
| Male | 21 | 70.0 | 31 | 68.9 | 24 | 53.3 |
| Female | 9 | 30.0 | 14 | 31.1 | 21 | 46.7 |
| Marital status | | | | | | |
| Single | 9 | 30.0 | 8 | 17.8 | 5 | 11.1 |
| Married | 21 | 70.0 | 37 | 82.2 | 40 | 88.9 |
| Education level | | | | | | |
| PhD | 6 | 20.0 | 0 | 0.0 | 0 | 0.0 |
| MSc | 9 | 30.0 | 6 | 13.3 | 0 | 0.0 |
| Bachelor | 13 | 43.3 | 6 | 13.3 | 0 | 0.0 |
| Diploma | 2 | 6.7 | 30 | 66.7 | 0 | 0.0 |
| Certificate | 0 | 0.0 | 3 | 6.7 | 0 | 0.0 |
| Secondary education | 0 | 0.0 | 0 | 0.0 | 3 | 6.7 |
| Primary education | 0 | 0.0 | 0 | 0.0 | 34 | 75.5 |
| Never attended school | 0 | 0.0 | 0 | 0.0 | 8 | 17.8 |

4.1.2 Sex of respondents

The results show that majority of respondents were males, that is, of the 30 research staff majority 70% were males and 30% were female, among 45 extension staff 68.9% were males and 31.1% were female. Among 45 farmers, 53.3% were males and 46.7% were female.

4.1.3 Marital status of respondents

Result show that majority of respondents in this study were married. Among 30 research staff, 70% were married while 30% were single due to some being separated or not had experienced married life. 82.2% of extension staff was also married. On the other hand, 88.9% of farmers were married.

4.1.4 Education level of respondents

On the level of education results show that more than half of the research and extension staff had scientific and professional training in agricultural practices. This enables them to easily disseminate agricultural technologies. According to Axinn and Thorat (1972) one key measure of personnel has to do with the level of training of those employed in the extension system. Good supervision, coverage and using appropriate extension methods need professionalism to enable farmers gain skills and to adopt improved practices. Furthermore, the results show that half (50%) of researchers attained postgraduate education level while on the part of extension staff only 13.3% had attained postgraduate level.

This implies that there were significant status differences between researchers and extension staff. This is considered as one main reason underlying the weak link as reported by Elfaki (2008). He argued that in general, researchers are better rewarded at least by having opportunities to study for advanced degrees and by being posted near large cities where there are better facilities for family living. Perceived status differences between researchers and technology transfer workers or even on-farm workers, often impedes collaboration. On the other hand, majority of farmers (82.2%) had formal education; this implies that most farmers in the area where research institutions are conducting their activities were literate. Literate farmers make good link between research and extension because they can read, write and keep records therefore causing easy flow of information and feedback.

The study also examined the field of specialization and major activities of respondents as well as the number of years where respondents worked in the field of specialization as indicated in Table 2. The study purposely selected equal number of research staff with

similar fields of specialization that is 50% crop specialists and 50% livestock specialists. For the randomly selected extension staff, the study shows that 55.6% specialized in crops production while 44.4% extension staff were livestock specialists.

Furthermore, results show that almost half of farmers (44.4%) their major activity were crop production, 40% both crop and livestock production, 11.1% livestock production only and 4.4% farmers were employed and engaged on crop production just for supplementing their income. With regard to the number of years in the field of specialization, results show that 80% of research staff as well as for extension staff were in a particular field for a period of 10 years and above as indicated in Table 2.

Table 2: Field of specialization of respondents

| | Researchers (n=30) | | Extension staff (n=45) | | Farmers (n=45) | |
|-------------------------------------|-----------------------|------|---------------------------|------|-------------------|------|
| | No | % | No | % | No | % |
| Field of specialization | | | | | | |
| Crops | 15 | 50.0 | 25 | 55.6 | 0 | 0 |
| Livestock | 15 | 50.0 | 20 | 44.4 | 0 | 0 |
| Major activity | | | | | | |
| Crop production | 0 | 0 | 0 | 0 | 20 | 44.4 |
| Livestock production | 0 | 0 | 0 | 0 | 5 | 11.1 |
| Crop and livestock production | 0 | 0 | 0 | 0 | 18 | 40.0 |
| Employed | 0 | 0 | 0 | 0 | 2 | 4.4 |
| Number of years in the field | | | | | | |
| Less than 10 years | 6 | 20.0 | 9 | 20.0 | 0 | 0.0 |
| 10-20 years | 12 | 40.0 | 12 | 26.7 | 0 | 0.0 |
| 21-30 years | 6 | 20.0 | 17 | 37.8 | 0 | 0.0 |
| Over 30 years | 6 | 20.0 | 7 | 15.6 | 0 | 0.0 |

4.2 Linking Research, Extension and Farmers

4.2.1 Linking researchers and extension staff

Agricultural research and extension services are two systems which are linked by information flow and feedback. For agro technologies to be relevant to local needs, researchers, extension workers and farmers must play important roles in identifying

research problems, adapting the recommendations to local conditions and providing feedback to researchers about the innovations that have been developed. Agbamu (2000) observed that effective communication links between researchers and extension staff are vital in the modification of technological recommendations and in initiating further research; such links enable new technologies and management practices to be suited to local ecological conditions. In linking researchers and extension staff in the study area, various information was obtained so as to analyze the extent to which linkages have been created. Among them the study analyzed the frequencies of visits, channels of communication and participation in research and extension activities. Based on information obtained through this study about visits to extension, majority (77.8%) of extension staff admit that researchers visited their work stations for various purposes including conducting on farm trials (31.1%), conducting on site training (13.3%), for data collection (11.1%) and technical advice (11.1%). Other (22.2%) extension staff reported that they have not been visited by researchers as indicated in Table 3.

Table 3: Views of extension staff about visits of researchers to their work stations (n=45)

| | Frequency | Percent |
|---|-----------|---------|
| Have researchers visited your work station? | | |
| Yes | 35 | 77.8 |
| No | 10 | 22.2 |
| If yes, what was the purpose of their visit? | | |
| Analysis of soil fertility | 2 | 4.4 |
| Data collection | 5 | 11.1 |
| Conducting on site training | 6 | 13.3 |
| Conducting on farm trials/experiments | 14 | 31.1 |
| Provision of improved seed varieties | 3 | 6.7 |
| Technical advice to farmers and extension staff | 5 | 11.1 |

Furthermore, extension staff was asked to state if they have ever visited any research institution in the zone for the past three years. The findings show that 71.1% of the

respondents had visited the institutions. Among them, 26.7% had visited research institutions once, 17.8% twice and 26.7% more than twice during the last three years. On the other hand, 28.9% of extension staff had never visited research institutions at all because they were not supported to visit the institutions (15.6%), not involved in research activities (6.7%) and did not have the specific tasks for visiting the institutions (6.7%). For those who visited the institutions it was for various reasons including seeking technical advice, training and study tours. Other purposes are as per Table 4.

Table 4: Views of extension staff on visits to research institutions (n=45)

| | Frequency | Percent |
|--|-----------|---------|
| Have you ever visited a research institution during the last three years? | | |
| Yes | 32 | 71.1 |
| No | 13 | 28.9 |
| If yes, how many times? | | |
| Once | 12 | 26.7 |
| Twice | 8 | 17.8 |
| More than twice | 12 | 26.7 |
| Not visited | 13 | 28.9 |
| What was the purpose of your visit? | | |
| Study tour for on station trials | 5 | 11.1 |
| Own interest | 2 | 4.4 |
| Sending sample of crop disease | 1 | 2.2 |
| To report on outbreak of diseases | 1 | 2.2 |
| To seek technical advice | 3 | 6.7 |
| For training on crop production | 15 | 33.3 |
| Attending a workshop | 5 | 11.1 |
| If not, what was the reason? | | |
| Not supported to go there | 7 | 15.6 |
| Not involved in research activities | 3 | 6.7 |
| Lack of specific task to visit the institutions | 3 | 6.7 |

4.2.2 Linking researchers and farmers

Agricultural research and extension services are two systems which are linked by information flow and feedback from research institutions to farmers. For effective

agricultural extension work, feedback from clients to extension agencies and from extension agencies to research centres is necessary. An extension agent is responsible not only for disseminating information on new farming techniques but also to gather feedback information on problems and needs of farmers for research institutions. Rutatora and Rwenyangira (2005) contended that there was a need of having a competent and dynamic extension cadre that will be able to address the changing roles of the extension services by providing appropriate advice and support for farmers. Subject-matter specialists (SMSs) in agricultural extension organizations form the prime channels of communication between research and extension, in linking research and clients, which is vital to the success of research and extension work. In this view, research staff were asked to indicate the channels through which they use in the process of information dissemination to farmers. The results in Table 5 show that 36.7% of researchers communicate agricultural information with farmers by going direct to the field. Others (33.3%) via extension offices, 20% both directly and via extension offices. Few respondents (10.0%) responded that they communicate with farmers through the liaison officer. From these findings, it is noted that there was no effective and specific channel of communication in the linkage between research, extension and farmers. In order to attain an effective communication among stakeholders an effective linkage unit is important, as indicated by MAFC (2003) that the ZARDIs have established ZILOs so as to improve communication among stakeholders.

Table 5: Distribution of researchers according to ways used to link with farmers (n=30)

| How do researchers link with farmers? | Frequency | Percent |
|--|------------------|----------------|
| Direct to the Field | 11 | 36.7 |
| Through extension offices | 10 | 33.3 |
| Through liaison officer | 3 | 10.0 |
| Both direct and via extension offices | 6 | 20.0 |

4.2.3 Farmers' views about contact with researchers

Frequency of farmers' contact with extension staff and research institutions has the effect of bringing the desired change in agricultural development through giving technical advice, distribution of improved technologies, and in general to solve farmers' problems. According to MAI'C (2003), clients' needs are identified when they are involved in planning meetings and when they are visited regularly. Farmers were therefore asked about the frequency of visits made by researchers to their villages for the past three years and the results show that majority of farmers (62.2%) indicated to have been visited by researchers in their villages, 20.0% did not know whether researchers visited their villages or not, and some farmers (17.8%) reported that they had not been visited at all. Moreover, farmers were asked to state the purpose of researchers' visits and the majority of farmers (46.7%) mentioned conducting on farm research and others (11.1%) for training farmers on various agricultural practices. It was reported that research institutions were conducting on farm training programs so as to allow participation of large number of farmers. A few (4.4%) respondents said that the purpose of researchers was to provide technical advice to farmers. The results are summarized in Table 6.

Table 6: Views of farmers on researchers' visits to their villages (n=45)

| Have researchers visited your village during the last three years? | Frequency | Percent |
|---|------------------|----------------|
| Yes | 28 | 62.2 |
| No | 8 | 17.8 |
| Don't know | 9 | 20.0 |
| Purpose of their visits | | |
| Technical advice on agricultural technologies | 2 | 4.4 |
| Training farmers on agricultural production | 5 | 11.1 |
| Conducting on farm research | 21 | 46.7 |

Furthermore, farmers were asked about the visits they made to research institutions. Visiting research institutions is one way of communicating with researchers about new

technologies, although some extension staff and farmers failed to visit the institutions. The study found that most farmers failed to visit research stations due to various reasons. Results in Table 7 show that majority (68.9%) of farmers never visited any research institution. Among the farmers interviewed, only 31.1% had visited research stations during the last three years. Their purposes as indicated in Table 7 were to attend training (15.5%), to be aware of improved technologies (8.9%) and to purchase animal breeds.

Table 7: Views of farmers on their visits to research institutions (n=45)

| Have you visited any research institution during the last three years? | Frequency | Percent |
|---|------------------|----------------|
| Yes | 14 | 31.1 |
| No | 31 | 68.9 |
| If yes, what was the purpose? | | |
| Purchasing improved animal breeds | 3 | 6.7 |
| To be aware with improved technologies | 4 | 8.9 |
| Training on crops production | 7 | 15.5 |

4.2.4 Participation of extension staff and farmers in research activities

The more frequent participation of farmers' representatives in research decision making bodies is a key marker demonstrating the advances made in establishing linkages. Besides this, the achievement of true collaborative linkages depends on National Research Institutes integrating support to development into their scientific planning processes and implementing a policy of incentives which are sufficient to lead to researchers working closely with farmers. According to Lancini (2004), in order to strengthen the research/extension linkage, members of each programme should come together for a series of workshop meetings. Researchers were therefore asked to give their views about participation of extension staff and farmers in research activities. The results are summarized in Tables 8 and 9.

Results in Table 8 show that extension staff were involved in research activities including identifying research agenda (46.7%) through participatory problems identification. Although only few extension staff and farmers were provided with this opportunity, their ideas play a big role in attaining clients oriented research. The study found that some of the extension staff and farmers participate in the ZTC and IPR as members. In developing research programmes, extension staff were involved in the process of implementation of programmes including on farm research whereby extension staff and farmers fully participated in the whole process.

Table 8: Views of researchers about participation of extension staff in research activities (n=30)

| Does extension staff participate in the following activities? | Frequency | Percent |
|--|------------------|----------------|
| Identifying research agenda | 14 | 46.7 |
| Developing research programs, plans or budgets | 7 | 23.3 |
| Monitoring or monitoring research process | 12 | 40.0 |
| Collecting data | 23 | 76.7 |
| Evaluating results | 10 | 33.3 |
| Disseminating results | 16 | 53.3 |
| Covering part of research costs | 8 | 26.7 |
| How does extension staff participate? | | |
| Participatory problem identification (PRA,ZTC,IPR) | 14 | 46.7 |
| Implementation of on farm trials | 7 | 23.3 |
| Joint monitoring of on farm trials | 12 | 40.0 |
| Assist farmers to collect data and record information | 23 | 76.7 |
| Joint evaluation of on farm trials | 10 | 33.3 |
| Take research findings to farmers | 16 | 53.3 |
| Use own transport, communication facilities and skills | 8 | 26.7 |

Furthermore, monitoring, evaluation, data collection and dissemination of research results of on farm trials involves both extension staff and farmers as indicated in Table 8. On the issue of cost sharing in research activities, this is still a problem, as was found that funds disbursement in the districts for collaboration with service providers including research institutions and private sector are very small leading to poor contribution. Apart from that,

during implementation of on- farm trials, extension staff use their facilities including transport.

On the other hand, Table 9 shows the distribution of farmers according to their participation in research activities. Just like the extension staff involved in research work, a number of farmers were also provided with opportunities to participate in research activities. Some of the farmers are members of ZTC and IPR, some of their views and problems regarded as researchable agenda to be implemented. Furthermore, farmers are involved in the process of on farm trials including data collection and results dissemination.

Table 9: Views of researchers about participation of farmers in research activities
(n=30)

| Do farmers participate in the following activity? | Frequency | Percent |
|---|------------------|----------------|
| Identifying research agenda | 9 | 30.0 |
| Developing research programs, plans or budgets | 7 | 23.3 |
| Monitoring or monitoring research process | 13 | 43.3 |
| Collecting data | 15 | 50.0 |
| Evaluating results | 4 | 13.3 |
| Disseminating results | 11 | 36.7 |
| Covering part of research costs | 15 | 50.0 |
| How do farmer participate? | | |
| Participatory problem identification | 9 | 30.0 |
| Conduct and implement on farm trials/experiments | 7 | 23.3 |
| Joint monitoring on farm trials/experiments | 13 | 43.3 |
| Record information and give their views when needed | 15 | 50.0 |
| Joint evaluation of on farm trials/experiments | 4 | 13.3 |
| Interviewing, FFS, agricultural shows | 11 | 36.7 |
| Use own resources (land, labor, communication facilities) | 15 | 50.0 |

4.2.5 Participation of research staff and farmers in extension activities

4.2.5.1 Participation of research staff in extension activities

The study found that extension offices through DADPs have managed to involve research institutions and farmers in their extension activities, These include identifying extension

agenda through stakeholders' meetings and joint monitoring and evaluation of DADPs projects, Others were capacity building to farmers and extension staff where research staff act as facilitators, They also involved in the collection of various information from farmers which could be used in planning extension programmes (Table 10). Although involvement of research staff in extension activities is rarely done in the Districts it was found to influence a close partnership among researchers and extension staff and this needs to be improved so as to create a strong link.

Table 10: Views of extension staff on participation of researchers in extension activities (n=45)

| Do researchers participate in the following activities? | Frequency | Percent |
|---|------------------|----------------|
| Identifying extension agenda | 14 | 31.1 |
| Developing extension programs, plans or budgets | 15 | 33.3 |
| Monitoring or monitoring extension process | 17 | 37.8 |
| Collecting data | 31 | 68.9 |
| Evaluating results | 27 | 60.0 |
| Disseminating results | 26 | 57.8 |
| Covering part of extension program costs | 18 | 40.0 |
| How does research staff participate? | | |
| Stakeholder meetings | 14 | 31.1 |
| Conduct on farm trials | 15 | 33.3 |
| Joint monitoring of DADPs projects | 17 | 37.8 |
| Collect various information from farmers | 31 | 68.9 |
| Joint evaluation of DADPs projects | 27 | 60.0 |
| Through on farm trials, agricultural shows and media | 26 | 57.8 |
| Research costs for on farm trials, training materials and transport | 18 | 40.0 |

4.2.5.2 Participation of farmers in extension activities

Extension must be perceived by farmers as a useful tool for improving their livelihood. Through participatory approaches, farmers identify their needs, priorities and facilitate development of close partnership between them therefore contributing much in agricultural development. In the study area, participation of farmers in extension activities is influenced by the presence of DADPs which targets farmers' needs and priorities.

The study found that farmers were provided with opportunities to identify their priorities through participatory problem identification including PRA, group discussions and meetings. Furthermore, results in Table 11 show that farmers were involved in the process of development of DADPs including planning, implementation, monitoring and evaluation. Moreover, farmers used their resources including land and manpower for implementing DADPs. The results are summarized in Table 11 below.

Table 11: Views of extension staff on participation of farmers in extension activities (n=45)

| Do farmers participate in the following activity? | Frequency | Percent |
|--|------------------|----------------|
| Identifying extension agenda | 11 | 24.4 |
| Developing extension programs, plans or budgets | 19 | 42.2 |
| Monitoring or monitoring extension process | 16 | 35.6 |
| Collecting data | 21 | 46.7 |
| Evaluating results | 18 | 40.0 |
| Disseminating results | 25 | 55.6 |
| Covering part of extension program costs | 28 | 62.2 |
| How do farmers participate? | | |
| Participatory problem identification for DADPs projects, stakeholders meetings | 11 | 24.4 |
| Plan for DADPs projects, FFS and implement the projects | 19 | 42.2 |
| Monitor the progress of all projects | 16 | 35.6 |
| Record information and give their views when needed | 21 | 46.7 |
| Joint evaluation of projects and FFS | 18 | 40.0 |
| Through field visits, tours, FFS and agricultural shows | 25 | 55.6 |
| Use resources (land, labour, communication facilities) | 28 | 62.2 |

4.3 Opportunities Created to Strengthen Linkage Between Research, Extension and Farmers

The current NARS system faces opportunities and factors that influence the linkage between research, extension and farmers. Decentralization of services to district and lower levels also provides good opportunity to link research with various stakeholders. One of the objectives of this study was to identify opportunities that influence the strong link between research, extension and farmers. In that regard the respondents were asked to give

their views regarding the opportunities created so far to strengthen the linkage as indicated below.

4.3.1 Linking research, extension, farmers and private sector

There are different non-governmental organizations working with farmers in the study area. Besides the communication between researchers, extension staff and farmers, the external communication with private sector affects organizational performance. Hence researchers and extension staff were asked about their working relationship with different private organizations that have direct relation to their work and the nature of work relationship among the mentioned organizations. The results show that research institutions and extension offices have had working relationship with different organizations including credit institutions, NGOs and other service providers. The result in Table 12 indicates the views of researchers about the involvement and contribution of private sector in the process of influencing the link between research and extension. As indicated by URT (2003a), effective linkages between the public and private sectors are vital to ASDP, for without this the ASDP will not be able to facilitate growth in production, trade and processing. Therefore the link between research, extension and farmers can also be influenced by the presence of the private sector in a particular area.

According to this study, there were a number of private sector actors facilitating the effectiveness of research and extension work in the zone. Identified private sector actors included INADES, PELUM-Tanzania, CRDB Bank, IITA and RLDC. INADES and PELUM Tanzania are involved in collaborative research for mobilization of farmers, capacity building and as technical field service providers; they are also members of the Zonal Steering Committee and Zonal Technical Committee. On the other hand, RLDC is supporting farmers in improving production of oil seeds such as sunflower and simsim.

IITA is collaborating with Hombolo Research Institute in multiplying and distributing improved cassava planting materials in the zone. It was also found that CRDB Bank provides loans to farmers' groups for the purpose of development of grapes production in the Region as a major cash crop. Therefore, through private sector services, researchers, extension staff and farmers should be brought together because they depend on each other thus influencing a close partnership among them. The results are summarized in Table 12.

Table 12: Views of research staff about collaboration/involvement of different stakeholders other than extension staff and farmers in research activities (n=30)

| Do you involve any stakeholder in research activities? | Frequency | Percent |
|---|------------------|----------------|
| Yes | 30 | 100.0 |
| No | 0 | 0.0 |
| If yes, what are these stakeholders? | | |
| Bank (CRDB) | 7 | 23.3 |
| NGOs (INADES, PELUM, RLDC, IITA) | 9 | 30.0 |
| Universities | 8 | 26.7 |
| Local Government | 6 | 20.0 |
| Nature of collaboration/involvement | | |
| Provision of loans to farmers | 6 | 20.0 |
| Participatory research (members of research committees), support establishment of seeds plots | 12 | 40.0 |
| Collaborative research (on farm, on station trials) | 8 | 26.7 |
| Mobilization of farmers | 4 | 13.3 |

4.3.2 Presence of research technologies and projects

Results from the study show that research institutions have a number of research projects and technologies development programmes such as pasture improvement, breeding and selection of Mpwapwa cattle breeds by using the open nucleus breeding system, improvement of rural chicken through improved health and management and breeding and use of improved management practices for utilization of Tanzania Shorthorn Zebu (TSZ) cattle being conducted on-farm with livestock keepers. Other technologies identified were

breeding of grape vine, oil crops, cereal crops and cassava, plant protection, natural resource management and social economic activities. Such activities have brought researchers close to the participating farmers and extension staff.

4.3.3 Involvement of various stakeholders in research and extension activities

There is no single mechanism, which can by itself lead to establishment of strong linkages and partnerships in all situations. Rather, different combinations of methods and practices have been used depending on projects, circumstances and orientation. In order to forge links between stakeholders, involvement in different activities in the link is vital. Dissemination of existing improved technologies including indigenous knowledge are made easier by involving all stakeholders in the link through workshops, seminars and meetings (MAFC, 2003).

The findings from this study indicated that there are conventional mechanisms that have helped research to forge links with farmers and extension staff in the zone, these have been identified as; involving farmers and extension agents in identifying the research agenda through participatory problem identification (PRA, ZTC, IPR), where extension staff and farmers are involved in identifying and discussing agricultural problems and come up with possible solution on which researchers work on some of them, implementation of research programs like on-farm trials, data collection and recording information, joint monitoring and evaluation of on-farm trials and disseminating research results to farmers. On the other hand, the study also found that extension offices under DADPs have managed to involve research institutions and farmers in their extension activities such as identifying extension agenda through stakeholders' meetings, PRA, joint monitoring and evaluation of DADPs projects, capacity building to farmers and extension staff and collection of various information from farmers.

4.3.4 Information and communication mechanisms for linking research, extension and farmers in dissemination of agricultural information

Linkage mechanisms bring together the stakeholders in agriculture development as equal partners in agricultural development. It provides the structures and mechanisms for collaboration in technology generation, adaptation, dissemination and utilization with clear roles and responsibilities for all partners. The presence of joint activities in any organization enables participants to share their views in improving organizational programmes therefore build up strong linkage between participants. This finding is supported by Blackie *et al.* (2003), who in their study found that farmers, NGOs and extension staff participate in IPR, ZTC and ZEC meetings and it was reported that some of the research problems are brought up by the stakeholders in such meetings. Zonal training workshops which are held in the zone bring together researchers, NGOs and extension staff. Subject matter specialists from the Districts bring up research problems received from farmers. For this study, respondents were therefore asked to mention the opportunities created for influencing the effective link between research, extension and farmers. The study identified a number of methods and activities which provided stakeholders in the link with opportunities to participate and share their views. Identified opportunities are summarized in Tables 13 and 14.

Table 13: Distribution of researchers according to methods created to link with extension and farmers (n=30)

| Method | Frequency | Percent |
|--|------------------|----------------|
| Reading materials (leaflets, pamphlets, posters, brochures, books) | 24 | 80.0 |
| Agricultural shows | 23 | 76.7 |
| On farm trials/experiments | 19 | 63.3 |
| Stakeholder's meetings | 14 | 46.7 |
| Radio programs | 9 | 30.0 |
| Field days | 8 | 26.7 |
| Television programs | 7 | 23.3 |
| Workshops/conferences | 5 | 16.7 |
| Study tours | 5 | 16.7 |
| On station trials | 4 | 13.3 |
| FFS | 3 | 10.0 |

4.3.4.1 Views of researchers about methods created to link with extension and farmers

Results from Table 13 indicate that majority of research staff (80%) reported reading materials such as pamphlets, leaflets and posters which were the easiest way of linking and spreading agricultural technologies and research results to a large number of extension and farmers compared to other methods in the zone, although the level of illiteracy of some farmers is a snag they get information from those who are literate. The reasons given when probing were that it seems to be easy to disseminate research results to a large number of people in a short time compared to other methods. In addition, more than 2000 leaflets and posters are distributed to extension staff and farmers each year especially through agricultural shows and some are used in district resource centers.

Agricultural shows as indicated by 76.7% of respondents were also an effective method used by researchers to build up strong linkage among stakeholders and a way of disseminating agricultural information. The study found that one agricultural show at national level was organized in the zone each year. Farmers and other stakeholders in the

zone including the area of this study were provided with opportunities to participate in the show. Some of the farmers participate in the demonstration of technologies adopted through research trials and experiments. The show also consists of research technologies published through reading materials such as leaflets, brochures, pamphlets and video cassettes which enable farmers and other visitors to get different agricultural information. Also exhibitions on different technologies such as crop and livestock pests and diseases, samples of botanicals, pasture seeds, crops varieties and agricultural tools were demonstrated.

Another method created to link with extension and farmers as indicated in Table 13 was on-farm trials/experiments. 63.3% of research staff reported that preliminary research conducted on station was then transferred to farmers' fields for further investigation. This approach enables researchers to work in collaboration with extension staff and farmers. Other authors also reported the importance of conducting research on farmers' environment that influences a close link between research, extension and farmers. As indicated by MAFC (2003) through on-farm trials researchers work in collaboration with extension staff and farmers. Furthermore, depending on their characteristics, some experiments should be carried out on farms, under the farmers' own production conditions. This facilitates the active and effective participation of producers, permitting the generation and transfer of technology, acceptable to producers more speedily than by other methods. According to this study, Makutupora and Hombolo research institutions conducted a number of on farm trials in Bahi, Chamwino, Kondoa, Dodoma urban, Manyoni, Singida rural, Iramba and Bunda Districts. On the other hand, Mpwapwa research institute conducted their on farm experiments in Mpwapwa, Kongwa, Bahi, Chamwino, Manyoni, Iramba and Singida urban Districts.

Stakeholder's meetings were reported by 46.7% to be a useful linking tool where researchers, extension staff, NGOs and farmers come together; ideas can be openly discussed and analyzed. According to key informants, NGOs, extension staff and farmers are members of Zonal Agricultural Technical Committee and Zonal Steering Committee therefore some of the research problems are brought up by the stakeholders in such meetings. The zone conducts stakeholder's meetings at least once per year which include researchers, extension staff, farmers and the private sector. For example among ten stakeholders invited in the Zonal Steering Committee, five of them were farmers and in the Zonal Agricultural Technical Committee three farmers are members among seven stakeholders. Participation of farmers, extension staff and private sector actors in these meetings facilitates development of close partnership between them therefore contributing much in agricultural development. The findings are supported by others such as MAFC (2003) that noted that stakeholders (clients) have various issues which can contribute towards agricultural development. These issues are identified when clients are involved in planning meetings and usually when visited regularly. Many stakeholders are able and willing to share the cost for these services. For example, through stakeholders meetings, they agree in principle on the cost sharing policies.

Workshop/conferences (16.7%) were reported as another way of collaboration between researchers, extension staff and farmers in the zone. Although they are rarely conducted they give an opportunity for stakeholders to share their views. The zone conducts one training workshop per year which involves various stakeholders including farmers and extension staff involved in reviewing all research programmes and promoting technologies. For example Zonal training workshops on grape production which were held in the zone in 2008 brought together researchers, NGOs, crop processors, extension staff and farmers. Priority setting and collaborative research were discussed during these

workshops. Also a workshop conducted by research institutions to introduce ZARDEF, brought together various stakeholders including researchers, extension staff and farmers in the zone therefore stakeholders were provided with an opportunity to identify their problems on which researchers are working.

Radio programs are relatively easier source of information and channel of disseminating agricultural information to a large number of people although some stakeholders do not have access to these media. Data on Table 13 reveal that 30% of the respondents reported the use of radio programs as the method of linking research, extension and farmers. Research institutions through ZIELU produced seven radio programs per year for the purpose of disseminating research findings to farmers for the past three years.

Farmer field days as indicated by 26.7 % respondents were held on farmers' fields where on farm trials and other experiments were conducted. Researchers working in collaboration with extension staff and farmers normally organize farmers' field days so as to enable farmers from different Districts or villages with the same farming environment to learn from others. Researchers, extension staff and farmers bring their own observation and problems in the field. Researchers and extension staff may demonstrate the potential new technologies at these meetings for review and critique. It was further found that 13.3% of the respondents said that on-station trials enable researchers to link with extension staff and farmers. Although they are conducted in research institutions, farmers and extension staff are provided with the chance to visit the trials and learn from them. However, through informal discussion it was revealed that on station trials and experiments do not give opportunity to many farmers and extension staff to learn and get information about agricultural technologies. Only a small number of farmers and extension staff visited the institutions. For example, this study found that only 31.1% of

the farmers interviewed visited research institutions when asked whether they have ever visited. Furthermore, when asked to give their reasons for their visits they responded that they visited research institutions for the purpose of purchasing improved animal breeds (6.7%), to get knowledge on crop production (8.9%) and training on crop production (15.5%).

Findings from Table 13 also revealed that 23.3% of respondents were of the view that television programmes are useful sources of information and channels of communication among stakeholders. However these are only available in areas with reliable source of power especially in towns, respondents found that if available is a good channel of communicating agricultural information. The study found that under ZIELU, research institutions were able to prepare TV programmes when they wanted to release research results after conducting experiments.

Other methods as indicated in Table 13 were FFS where research findings and agricultural technologies disseminated through demonstrations and experiments with farmers participation. The FFS grew due to the fact that people learn better by doing and by being involved in experimentation, observation, discussion and decision making as indicated by Rutatora *et al.* (2005) that involvement of farmers in development of appropriate solutions to their problems help to develop sense of ownership and autonomy. The key factor that is important in FFS is to provide farmers with analytical tools that will enable them to analyse their production practices and identify solutions to specific problems that affect production (Niyegila, 2007). In this study, researchers are not fully involved in FFS by the Districts though research technologies were disseminated through this approach. Although study tours were reported to influence linkage, they were rarely organized and sometimes when organized only heads of department and key farmers are involved in the tours.

The main objectives for organizing tours are to identify research priorities, to define collaboration and to monitor on-going research assignments.

4.3.4.2 Views of extension staff about methods created to link with research and farmers

The results found that at the District extension level, the same methods used by research institutions as the means of establishing and strengthening linkage between research, extension and farmers were used by extension offices but they have different views. Respondents (extension staff) when asked to give their views on the use of various methods created as the source of information and communication channels for researchers, extension and farmers had responses as summarized in Table 14 below.

Table 14: Distribution of respondents (extension staff) according to methods used to link with research institutions and farmers (n=45)

| Method | Frequency | Percent |
|--|-----------|---------|
| Reading materials (leaflets, pamphlets, posters, brochures, books) | 43 | 95.6 |
| Agricultural shows | 41 | 91.1 |
| On farm trials/experiments | 30 | 66.7 |
| Stakeholders meetings | 22 | 48.9 |
| FFS | 21 | 46.7 |
| Workshops/conferences | 19 | 42.2 |
| Radio programs | 16 | 35.6 |
| Field days | 15 | 33.3 |
| Study tours | 13 | 28.9 |
| Television programs | 12 | 26.7 |
| On station trials | 11 | 24.4 |

Majority of extension staff (95.6%) reported reading materials as the easiest way of disseminating agricultural information to farmers. The reason given through probing was that they can reach many farmers and other stakeholders without physical contacts and visits to the field. Large number of reading materials is produced in the Districts in

collaboration with research institutions. For example, through DADPs the Districts contract research stations such as Makutupora, Mpwapwa and Naliendele to produce reading materials related to agricultural technologies produced in their institutions. These are distributed to farmers through agricultural shows, districts resource centers and visits. Some of them are available in the offices of extension staff. The study found that about 480 reading materials including pamphlets and leaflets were produced in Dodoma Municipality each year, 600 in Mpwapwa and about 550 in Chamwino District.

From Table 14 agricultural shows were mentioned by 91.1% of respondents who said that they contribute much in linking research with extension and farmers. Agricultural shows are organized so as to provide further opportunities for interaction between researchers, extension staff, farmers and other stakeholders. The results indicate that many stakeholders participated in the shows where various exhibitions and demonstrations are displayed. The districts organize one agricultural show each year parallel to the national agricultural show. Various stakeholders including researchers and farmers are provided with the opportunity to visit and participate in demonstrating various technologies established by farmers in their areas of farming.

On-farm trials/experiments facilitate the active and effective participation of farmers and extension staff, permitting the generation and transfer of technology, acceptable to producers more speedily than by other methods. According to the research findings, 66.7% of extension staff reported that use of on farm trials bring together researchers, extension and farmers thus facilitating strengthened linkage between them. The study found that research institutions conducted a number of trials and experiments in each District of this study. These are participatory methods and approaches that enable people to demonstrate, express and analyze the realities of their lives and conditions, and so

monitor and evaluate the results. Belay (2003) in his study in Ethiopia contended that due to few number of extension workers, agents have to communicate with farmers through demonstrations. In this context, the scientists facilitate the development of ideas and help to define options rather than entering with already identified solutions.

Another method which provides opportunities for stakeholders to link was stakeholders' meetings as indicated by 48.9% of the respondents. The study found that in recognizing the importance of conducting stakeholders meetings, the Districts plan to conduct one meeting per year but failed to achieve their objectives due to shortage of funds. On the other hand, only one District (Dodoma Municipality) among the three Districts under study has managed to organize one stakeholders meeting during the past five years. This involved researchers, private sector actors, extension staff and farmers. The District Facilitation Teams (DFTs) in every District involving researchers, extension staff, private sector and farmers also conducted their meetings each year for the purpose of reviewing DADPs projects and budgets.

Farmer Field Schools (FFSs) plays a big role in the Districts for disseminating agricultural technologies to farmers and in facilitating linkage between research, extension and farmers. FFSs provide farmers with analytical tools that will enable them to analyze their production practices and identify solution to specific problems that affect production (Niyegila, 2007). From this study, 46.7% of the respondents reported that FFSs are a useful tool used by extension staff to disseminate research findings to a large number of farmers. FFSs were conducted in farmers' fields with full participation of farmers where different types of technologies were tried out. In this way research results were demonstrated on farmers' environment with farmers' participation.

Field days within and outside the District were also used by extension staff for the purpose of exchanging information, ideas and disseminating agricultural technologies. Some (33.3%) of the extension staff reported that field days influence linkage since farmers can learn and adopt agricultural technologies more quickly when they observe what their fellow farmers are doing. Other (42.2%) respondents said that workshops/conferences were a good way of communicating agricultural information between researchers, extension staff and farmers. The study through probing found that the Districts did not conduct workshops involving various stakeholders, but organized training workshops for extension staff and farmers where researchers acted as facilitators. Through contracts, the Districts incurred the cost of training. Radio programmes (35.6%) and television programmes (26.7%) were reported to be used by the District extension offices for dissemination of agricultural information to farmers and other stakeholders. These were crucial for information dissemination and public education. However, they are mostly urban-based and therefore have limited coverage of rural development activities and issues (MAFC, 2003). Each District was able to organize one radio program per year with support from DADPs. The programs include livestock and crop production.

Furthermore, other (28.9%) respondents indicated that study tours were used to strengthen linkage between research, extension and farmers when organized. Although the Districts were rarely organizing tours the main objective is to learn through observation from research stations, from farmers' fields, to identify research priorities, and to monitor on-going research activities. About a quarter (24.4%) of the respondents indicated that on station trials can also influence linkage between stakeholders. The study through probing found that farmers and extension staff get opportunities to learn through on station trials when they visit research stations for various purposes including study tours, own interest, sending samples of crop diseases, to report an outbreak of diseases, to seek technical

advice, and when attending training workshops conducted in the institutes. The results show that visiting research institutions is one way of communicating with researchers, although some extension staff and farmers failed to visit the station for various reasons including lack of funds and other resources. Furthermore, the study found that large number of farmers failed to visit research stations due to the same reasons. Among 45 farmers interviewed, only 31.1% had visited research stations during the last three years, these were provided with an opportunity to learn agricultural technologies generated on stations.

4.3.5 Human resources

Findings from this study reveal that the zone has skilled, qualified and committed human resources at all levels in research institutions and in the Districts. This enables them to undertake their research activities more efficiently and effectively (Ref. Table 1). This is supported by URT (2003b) and ASDP (2003) in their studies which showed that the NARS has a critical mass of skilled scientists, technicians and support staff for developing the necessary information and technologies required by the sector stakeholders. This is enhanced by the availability of graduate students in the universities which if mobilized can contribute to the mainstream agricultural research while building a reservoir of new research scientists for the NARS. Furthermore, the zone appointed the ZRELO who works from zonal research headquarters (Mpwapwa research institute).

At the District, ward and village levels, there are also a number of qualified extension staff who can help build the combined research/extension/farmer development process. Adequate number of well-trained extension personnel is the basic resource for a successful extension system. Without adequate numbers of well trained people, extension will be seriously limited in its ability to plan and execute effective educational programmes and other technology transfer activities (URT, 2003b).

4.3.6 Financial resources

Adequate funding of agricultural programmes is essential for effective performance on the agricultural development. The Ministry of Agriculture Food and Cooperatives (MAFC) and the Ministry of Livestock and Fisheries Development are among the Agricultural Sector Lead Ministries. These two Ministries have set up Zonal Agricultural and Livestock Development Funds (ZARDEFs) that will foster agricultural and livestock development in the zones by addressing priority areas of research that were identified by stakeholders in respective zones (Blackie *et al.*, 2003). In order to develop truly farmer-responsive research, resource-poor farmers must organize themselves and gain the political and financial power to put pressure on service providers for improved relevance and performance. In collaboration with Local Government Authorities (largely District Councils under DADPs) the ZARDEFs help in influencing the research, extension, farmer linkage activities to the key stakeholders.

In this study, the zone in its effort to strengthen linkage between research, extension and farmers uses research funds (ZARDEF) for conducting client-oriented research activities. The funds facilitate linkage between research, extension and farmers through conducting collaboration activities including on farm trials and experiments. The ZARDEF is proving to be a very important source of research funds in the zone. This is supported by Blackie *et al.* (2003) in their review of the CORMA and the ZARDEFs which concluded that all research done under the ZARDEFs has a credible client base actively interested in the results and involved in the initial research concepts and design. It allows researchers to thumb through their 'best bets' and to go to work convincing outsiders that here is a useful product. On the other hand, the Districts through DADPs have organized and conducted various linking activities which enabled researchers, extension staff and farmers to improve and sustain linkage between them. Private sector is also increasingly supporting

research and extension work therefore building up strong relationships with research, extension and farmers.

4.4 Achievements that Have Been Registered so far in Research, Extension and Farmer Linkage

Effective agricultural research can only be measured in terms of its contribution to solutions of the farmer and to the national development problems. It is not enough to do research, obtain results and develop technology, the research results and technology developed must rapidly be transferred to farmers' fields and be adopted. There is therefore, need not only for effective research-extension-farmer linkages, but also linkages with all those complementary services which play a role in the farmers adoption of the developed technology (Orodho, 2005). The delivery of extension services requires close linkages among key actors including the national extension unit, LGAs, research, training and the farmers themselves. Such close linkages will facilitate efficient flow of information on farmers' needs and priorities, new innovations and feedback on these innovations, as well as information on markets, inputs and other services (URT, 2006).

According to MAFC (2003), the traditional view of agricultural research and extension as being mainly a government responsibility is changing rapidly. The on-going decentralization process in Tanzania encourages research stations and extension organizations to be more autonomous at zonal and district level respectively. However, in the past research has been working almost in isolation without involving other stakeholders in agricultural development. The current institutional policies aim at breaking such communications barriers which existed in the past. With regards to this study, respondents identified several achievements created in the current institutional arrangements of research and extension as indicated below.

4.4.1 Achievements that have been registered by research institutions

Based on the information obtained through this study, respondents identified various achievements registered on the linkages based on the current institutional arrangement. In general research institutions in the zone targeted clients' needs and therefore the farmers, extension staff, NGOs and other stakeholders in agricultural development are involved in research activities. The zone has managed to establish on farm trials and experiments in farmers' fields in about eleven Districts. Around 40% of research experiments in the zone were conducted in farmers' fields. Results from Table 15 show various views of respondent on achievements. The results show that through linking research and extension, Makutupora research institute managed to establish 300 acres of grape vine in Chinangali block farm in Chamwino District as indicated by 33.3% respondents. Efforts of farmers in the adoption of modern technologies of establishing grape vine, enabled research institutions and extension offices to link with bank institutions for the purpose of financial support in development of grape vine as a major cash crop in the Region. Research funds (ZARDEF), funds from DADPs and loans from the private sector such as CRDB Bank influenced the efficiency and effectiveness of agricultural development in the Region.

Other (31.1%) respondents reported improvement on agriculture and livestock production. Through involvement of farmers in research activities, adoption of improved technologies increased and farmers have boosted their yields significantly as results of linking with research institutions. 28.9% research staff reported that the link between research, extension and farmers increased interaction among stakeholders. This is through various collaborative activities including on farm-trials, meetings, agricultural shows and visits. More interaction among stakeholders is important in strengthening linkage. Information on agricultural technologies is easily disseminated through interaction. Other (6.7%)

respondents stated that the link also facilitates easy feedback for technologies disseminated to farmers. Linking research with extension facilitates close supervision and follow-up of research projects conducted on farmers' environment through which extension staff work closer with farmers. Furthermore, they stated that through establishing an effective ZIELU flow of information about research findings and feedback from farmers could be easier.

4.4.2 Achievements that have been registered by extension offices

Findings from extension staff in Table 15 reveal that about 44.4% improved their skills and knowledge in agricultural production through linking with research institutions. This is due to participation and involvement in research activities. Other 28.9% reported that the spread of diseases was controlled as a result of interacting with researchers through normal visits, on the spot advice and on farm training and experiments.

Table 15: Views of respondents about achievements registered on linking research, extension and farmers

| | Frequency | Percentage |
|---|-----------|------------|
| Research staff (n=30) | | |
| Establishment of 300 acres of grapevine | 15 | 33.3 |
| Increased interaction among stakeholders | 13 | 28.9 |
| Improving crop and animal production | 14 | 31.1 |
| Easier feedback for technologies disseminated | 3 | 6.7 |
| Extension staff (n=45) | | |
| Control disease spread | 13 | 28.9 |
| Improving skills and knowledge | 20 | 44.4 |
| Improving agricultural production | 11 | 24.4 |
| Improving market information | 1 | 2.2 |
| Farmers (n=45) | | |
| Control increase of diseases | 2 | 4.4 |
| Easy provision of agricultural services | 1 | 2.2 |
| Exchanging ideas | 4 | 8.9 |
| Early adopt modern methods of farming | 1 | 2.2 |
| Improve agricultural production | 24 | 53.3 |
| Improve skills on agricultural production | 13 | 28.9 |

As indicated by research staff, extension staff also asserted that agricultural production has improved by increasing crop yields and quality. Very few respondents (2.2%) reported that the link enabled farmers and other stakeholders to be aware about market information.

4.4.3 Achievements that have been registered by farmers

More than half of the farmers (53.3%) indicated having improved their agricultural production through participation in various research and extension activities. They learnt new methods and techniques of farming by doing thus leading to increasing production. Based on information from key informants in research institutions, for example, the production of local chicken in the zone has improved through increased egg production much more during the rainy season (an increase of between 20% and 36%) and an increase between 13% and 65% during dry season. The study also shows that 28.9% of farmers improved their skills and knowledge about agricultural production. Their learning capacities enabled them to work independently in the absence of extension staff and/or researchers. Findings in Table 15 also indicate that the linkage also enables farmers to exchange agricultural information and ideas with different kinds of stakeholders, control the spread of diseases, easier provision of agricultural services and to influence early adoption of agricultural technologies.

4.5 Challenges and Constraints that are Still Being Faced in Linking Research, Extension and Farmers

This section presents the challenges and constraints still facing three categories of respondents, researchers, extension staff and farmers in their linkage activities. For many years linkage between research, extension and farmers has faced many challenges and constraints. Research and extension tend to identify problems separately and there is no well developed plan to bring the two groups together effectively (although research

scientists are encouraged to work with farmer groups) (Blackie *et al*, 2003). According to MAFC (2003) farmers have inadequate knowledge and information due to weak information communication system. Smallholder farmers and other stakeholders are unable to express their needs in terms of investments in agricultural extension services and research. Farmers and other stakeholders are not well informed about new agricultural technologies in general, livestock or marketing information that will help them perform their activities better.

Table 16: Distributions of respondents by challenges that still facing linkage activities

| Challenges | Frequency | Percent |
|--|------------------|----------------|
| Research staff (n=30) | | |
| Inadequate Education about linkage | 3 | 10.0 |
| Lack of adequate funds | 12 | 40.0 |
| Linkage unit is not effective | 9 | 30.0 |
| Lack of reliable transport | 1 | 3.3 |
| Lack of willingness among stakeholders | 2 | 6.7 |
| Inadequate joint meetings | 3 | 10.0 |
| Extension staff (n=45) | | |
| Lack of reliable transport | 9 | 20.0 |
| Lack of information about importance of the link | 13 | 28.9 |
| Lack of adequate funds to conduct joint activities | 15 | 33.3 |
| Language problem | 1 | 2.2 |
| Lack of effective liaison unit | 7 | 15.6 |
| Farmers (n=45) | | |
| Lack of participation in linking activities | 15 | 33.3 |
| Lack of funds to visit research institutions | 5 | 11.1 |
| Lack of information about linking activities | 3 | 6.7 |
| Lack of regular meetings with research and extension | 9 | 20.0 |
| Lack of regular visits by research staff | 13 | 28.9 |

Furthermore, it was noted that, although the research centers have managed to come up with a large number of agricultural technologies, only few are disseminated to farmers and other users. This has been due to limited attempt to popularize the technologies through various information and communication strategies such as radio, TV, posters, leaflets, and

brochures that are user friendly to farmers. Lack of adequate funding is the main reason for this obstacle.

According to Kirway *et al* (2003), the disappointing impact of research is partly due to lack of sustainable research funding (with poor incentives for researchers). Most governments in Africa have reduced direct funding for agricultural support services such as research, extension and rural credit, and started to separate funding from implementation among others, to create greater opportunity for private sector involvement. It is within this context that the study, among others, also aimed at identifying the challenges that still face linkage between research, extension and farmers in the current institutional arrangement. In that regard respondents were asked to identify challenges they normally face in the link. Their responses are as indicated in Table 16.

4.5.1 Challenges facing research institutions

The results in Table 16 show that 40% of researchers reported lack of adequate and timely funding of research as the major challenge that impairs effective linkage between research, extension and farmers. Research institutions fail to conduct sufficient number of on farm experiments, regular joint activities such as meetings, joint planning, monitoring and evaluations and visits which are the important ways of creating linkage, due to lack of enough funds. Similar findings on problems of funding research were reported by Kirway *et al.* (2003) who noted that the disappointing impact of research is partly due to lack of sustainable research funding (with poor incentives for researchers). It was also observed that the linkage unit is not so effective as indicated by 23.3% of research staff, although the liaison officer has been appointed, effective flow of information between stakeholders is still a problem because there is no permanent office for ZRELO and ZILO. Also the unit lacks working facilities and other supporting staff as well as adequate funding. From the

results other challenges were inadequate education about linkage where some of the researchers did not have enough information on how to link with other stakeholders as indicated by 10% of the research staff.

Inadequate joint meetings which involve various stakeholders as reported by 10% of the researchers was still a constraint identified in the link. Joint meetings enable stakeholders to identify priorities and share views in agricultural development but these were observed to be irregularly conducted. As mentioned by other authors that when involved, many stakeholders are able and willing to share the cost for agricultural services. For example through stakeholders meetings, they agree in principle on cost sharing policies (MAFC, 2003). Lack of regular meetings in the zone is largely attributed to lack of enough funds for conducting the meetings. Other challenges identified as indicated in Table 16 were lack of willingness among stakeholders to participate in research activities. Information from respondents show that some of the extension staff and farmers do not participate in research activities especially on farm trials and experiments unless they have been paid. Lack of reliable transport in research centers is still constraining the effective implementation of research activities especially field visits. Regular visits to farmers and extension influence much the sustainability of linkages.

4.5.2 Challenges facing extension staff

According to the study done by Belay (2002), extension staff in different regions in the country reported that insufficiency of relevant technologies is one of the constraints to agricultural work. These can be contributed by several reasons. According to this study, extension staff like research staff had several challenges facing them in linking with research and farmers in developing agricultural technologies. These challenges are as summarized in Table 16. One third (33.3%) reported that lack of adequate funds limits the

Districts to plan for enough linkage activities leading to ineffective communication among stakeholders. Other 28.9% reported lack of information on the importance of the linkage as a problem in dissemination of agricultural technologies. Some of the extension staff and farmers were not aware and did not know the importance of linkage. Inadequate opportunities for networking among stakeholders and especially among farmers affect them to be aware about agricultural information. Most farmers and extension staff were not involved in linkage activities and communication tools such as meetings and training workshops which would enable them to improve their skills. URT (2006) also underscore the importance of communication among stakeholders by emphasizing that extension is about the communication of information among various actors, but primarily to farmers and among farmers, in order to motivate them to improve their agricultural practices. This requires the use of various communication media and facilities.

It was also observed that lack of reliable transport in the Districts is another limitation that impairs the performance of effective link. It was revealed that although some of the extension staff were given bicycles or motorcycles often on loan, so as to ensure they are mobile, lack of adequate supply and high fuel cost complicates the situation. From the results, it is obvious that extension staff fail to visit research institutions and farmers regularly due to the mentioned limitations. Language barrier was indicated by few respondents (2.2%) as limiting effective communication between extension personnel and farmers. Through probing one extension staff said that professionals have a background of livestock production but in their working station they deal with both livestock and crop production, therefore terminologies used in crop production sometimes affect them in disseminating accurate information to farmers.

4.5.3 Challenges facing farmers

A strong research, extension, farmer linkage can be achieved through close collaboration and participation of all stakeholders in linking opportunities. However, results show that 33.3% farmers lack participation in linking activities including meetings, training, on farm-trials and field days, therefore they lack important information on new agricultural practices. Although research and extension offices organize various linkage activities but are rarely organized and only few farmers participate. Participation in various research and extension activities enables farmers to express their needs and problems related to agricultural practices. This is supported by MAFC (2003) in that farmers have inadequate knowledge and information due to weak information and communication system. Smallholder farmers and other stakeholders are unable to express their needs in terms of investments in agricultural extension services and research. Farmers and other stakeholders are not well informed about new agriculture techniques in general, livestock or marketing information that will help them perform their activities better.

Lack of regular visits by research staff to farmers is also reported to be one of the challenges facing farmers in linking with researchers. 28.9% of the farmers said that they can be visited once a year by researchers or not at all unless they have participated in on-farm trials. Furthermore, through probing they reported that without participating in research activities such as on-farm trials and experiments it become difficult to meet with researchers. Lack of regular meetings with researchers and extension staff was also reported to be a challenge to farmers. Other challenges facing farmers are lack of funds which can enable them to visit research centers and lack of information about linkage activities as indicated in Table 16. Suggestions provided by respondent to overcome those challenges and strengthening linkages are presented in Table 17 and discussed below.

4.6 Ways that can be used to Strengthen Linkage Between Research, Extension and Farmers

Effective collaboration between research, extension and farmers is of paramount importance in transforming the current agricultural research and extension system to be able to address quickly and effectively the needs of the poor. The link and networking facilitate exchange of knowledge and information sharing, enable various stakeholders to come together to facilitate learning, advocacy and to come up with sustainable agriculture. In order to come up with a sustainable linkage between research, extension and farmers, respondents were asked to suggest what can be done so as to strengthen linkage. These opinions and suggestions are as summarized in Table 17.

4.6.1 Researchers' opinions on strengthening linkage between research, extension and farmers

About 26.7% respondents suggested that the ministries should disburse enough research funds so as to meet their goals and should be disbursed early so that they can cope with their time table. Another 23.3% of respondents suggested that the linkage unit should be improved by establishing an effective ZIFLU and other facilities so as to influence effective communication. Although the ZARDIs have established ZIFLUs in each zone still the central zone office is not effective. The situation was that there was no permanent office for Zonal Research and Extension Liaison Officer and the Zonal Information Liaison Officer, but they work separately, ZRELO at Mpwapwa Research Institute and ZILO at the office of MAFC in Dodoma Municipality, this affects effectiveness of collaboration. However, URT (2003a) emphasized that all zones should have Research Extension Liaison Offices and Zonal Communication Centers for linkages and technology dissemination whose specific roles are: to meet on a regular basis with Regional and District authorities, NGOs and other stakeholders to identify gaps in zone specific

technologies and give feedback to research; and to organize in collaboration with relevant authorities, stakeholder workshops and seminars at zonal, Regional and District level targeting specific issues related to agricultural development in the zone.

Other suggestions given by research staff were capacity building for stakeholders in understanding the importance of linking research, extension and farmers as indicated by 20.0% of respondents who said that some of the staff have their own training needs which when satisfied will enable them to improve their technical skills so as to meet their goals more effectively. Regular training in relation to linking activities for different stakeholders influences the willingness in the participation in research activities. To achieve this, we have to firstly identify areas of training needs of the personnel involved and then embark on a long-term training for the different cadres of staff. The gap and status differences between the personnel in research institutes and those of extension should be bridged so that there will be a narrower institutional boundary, which will make for an effective and smoother communication link.

On the issue of cost sharing, 16.7% of the researchers suggested that the Districts in their budgets should consider the issue of cost sharing in research activities so as to meet objectives of client-oriented research in improving agricultural production. Cost sharing plays a big role in establishing conducive environment for linking research and other stakeholders. According to MAFC (2003), many stakeholders are able and willing to share the cost of research services when involved in the planning and stakeholders meetings where they can agree in principle on the cost sharing policies. Cost sharing is still a problem to many Districts including the Districts in this study. There is no contribution of Districts to the ZARDEFs. Other respondents (13.3%) suggested that in order to

strengthen research-extension-farmer linkage there is a need for ensuring that stakeholders in the link conduct joint activities such as planning, meetings and workshops.

Table 17: Distribution of respondents according to their opinions on what can be done to strengthen linkage

| | Frequency | Percent |
|---|-----------|---------|
| Research staff (n=30) | | |
| Capacity building to stakeholders on importance of linkage activities | 6 | 20.0 |
| Early disbursement of enough funds | 8 | 26.7 |
| Establishment of effective linkage unit | 7 | 23.3 |
| Improving cost sharing in research activities | 5 | 16.7 |
| Ensuring joint activities (planning, meetings, workshops) | 4 | 13.3 |
| Extension staff (n=45) | | |
| Provision of enough funds for research and extension activities | 19 | 42.2 |
| Establishment of effective communication unit | 7 | 15.6 |
| Improving motivation for research and extension staff | 8 | 17.8 |
| Conducting regular meetings | 11 | 24.4 |
| Farmers (n=45) | | |
| Organize regular joint meetings | 18 | 40.0 |
| Improving participation in research activities | 3 | 6.8 |
| Conducting regular visits | 6 | 13.3 |
| Increase awareness on importance of linkage | 2 | 4.4 |
| Increasing the number of on farm trials and experiments | 16 | 35.6 |

4.6.2 Extension staff's opinions on strengthening linkage between research, extension and farmers

As indicated by researchers, 42.2% of extension staff also suggested the provision of enough funds for research and extension activities so as to increase effective and sustainable collaboration of various stakeholders in the link. They suggested that responsible ministries should disburse funds on time so as to allow research and extension activities to cope with their plans. Funds provided to the Districts were limited for linkage functions such as publications, testing of research results, joint planning meetings and training of extension staff. Also 24.4% suggested that regular meetings at all levels should

be organized regularly and effectively from which various stakeholders can share experiences, identify priorities and contribute ideas on the development of agriculture. The study found that meetings involving various stakeholders in the link were rarely conducted and there was no specific schedule for organizing meetings. Another opinion given by extension staff on strengthening linkage was to improve motivation for research and extension staff as indicated in Table 17. Motivation in terms of training, better salaries and other incentives enables staff to participate effectively in development activities. Motivation is one of the most pervasive concerns of human endeavor. Most people believe that motivation is inextricably related to organizational performance; and that highly motivated individuals are more productive in quantity and quality. Productivity is achieved through excellence, and excellence is achieved by having an organization of highly motivated individuals. Thus, employees' motivation is clearly important for better performance of any organization. Therefore there is the need to identify areas of training needs and promotion for personnel involved in the link so as to achieve effective link.

4.6.3 Farmers' opinions on strengthening linkage between research, extension and farmers

Many challenges facing research and extension staff in the link also face farmers. In order to overcome the challenges and strengthen the linkage between research, extension and farmers, farmers were asked to give their opinions and suggestions on how to come up with a strong link. Their opinions are indicated in Table 17. Majority (40.0%) suggested that research and extension offices should organize joint meetings regularly so as to influence close collaboration between stakeholders involved in the link. Joint meetings allow farmers to contribute to various issues towards agricultural development. Others (35.6%) suggested research institutions to increase the number of on-farm trials and experiments so as to allow many farmers to learn by doing in their farming environment.

They suggested researchers to conduct at least one experiment in each village within the Districts. This will influence the effective participation of many farmers in research activities. Other suggestions are as per Table 17.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings of the study, the following conclusions can be drawn

- i. The study identified several opportunities in the current institutional arrangement which to some extent were found to influence the linkages between researchers, extension staff and farmers. The number of qualified research and extension staff at all levels can facilitate flow of agricultural information. The presence of ZRELO is an opportunity which can be fully utilized as a link between researchers, extension staff and farmers, based on the decentralization of services to the district level which builds rural constituency capacity and strengthens participation of different stakeholders. Also existence of funded agricultural programmes such as DADPs enables farmers and extension staff to access services from the research institutions necessary to their activities, whereas ZARDEFs give researchers the opportunity to conduct client-oriented research activities. Private sector actors including RLDC and financial institutions such as CRDB also increase opportunity to support research and extension activities thus facilitating effective linkage among research, extension and farmers.

- ii. As a result of the created opportunities there have been some achievements in strengthening the linkage between research, extension and farmers in the zone. Identified achievements include increased number of research experiments and trials on farmers' fields. These facilitate effective participation and adoption of technologies by farmers. On the other hand, establishment of block farms in

collaboration of research institutions and Districts was found to enhance the linkage between stakeholders as each of them has a role to perform. Researchers are also using trials and block farms to demonstrate efficiency and relevance of the technology packages produced at research centers.

- iii. Apart from the efforts made by the government to break communication barriers which existed in the past, the linkage between research, extension and farmers in the current institutional arrangements still faces several challenges and constraints. Lack of adequate and timely funding for both research and extension was found to be a major problem that impairs the effective planning for regular joint activities which could enable them to establish a stronger relationship and participation of stakeholders. ZIELU in the zone was found to be ineffective as ZRELO and ZILO are working in separate offices without working facilities whereas stakeholders in the link fail to share and exchange information for a lack of a specific channel of communication. It was also found that the issue of cost sharing for research activities was still a problem. Although on-farm trials facilitate adoption and improvement of rural communities, Districts Councils still regard these as the responsibility of research institutions, and are not to contribute for research activities unless they applied for services like training for farmers and extension staff. Some of the extension staff also do not participated fully in research activities including on-farm trials unless they are provided with allowances.
- iv. With regard to limitations facing linkage between research, extension and farmers, it was suggested that timely provision of enough funds for research

and extension will enable them to plan for activities which will involve several stakeholders in the linkage and which will therefore influence participation and linkage between research, extension and farmers.

5.2 Recommendations

The following recommendations are proposed on the basis of this study:

- i. The ZRELO is an important actor in the linkages, therefore should be given support to perform their duties as it was planned during formation of this post that is becoming a vehicle and a bridge for dissemination research findings and agricultural information to stakeholders in time. Effective communication between research, extension and farmers should be established through improving ZIFLU. The unit should have the recommended facilities and supporting staff. Cost sharing in research activities should be considered by local government authorities during their budgeting plans aiming at improving farmers' livelihoods. There is a need for training and awareness creation on the importance of linkage between researchers, extension staff and farmers. The existing funded agricultural programs such as DADPs and ZARDEFs should be improved. Early disbursement and increasing the amount of research and extension funds will strengthen the link through establishing participatory and joint activities. Constraints to effective involvement in the linkage activities should be eliminated and that more stakeholders in the zone and districts should be involved in order for the research-extension linkage mechanism to give way to a sustainable agricultural development.
- ii. On farm trials/experiments and block farms were found to facilitate strong link between researchers, extension staff and farmers. The research institutes should

ensure that there are adequate on-farm trials to allow effective participation of stakeholders.

- iii. Formulation of agricultural policy that will give backing to Research-Extension-Farmer linkage system should be improved so as to overcome challenges hindering a strong link between research, extension and farmers. This should be strengthened through legislation.
- iv. The government in collaboration with local authorities should provide enough funds for linkage activities and should be disbursed on time so as to ensure timely implementation of programs.

REFERENCES

- Agbamu, J. U. (2000). Agricultural Research-Extension Linkage Systems. An International Perspective. Network Paper No 106, July, 2000, Department of Agricultural Economics and Extension, Delta State University, Asaba Campus, Delta State, Nigeria. [http://www.odi.org.uk/work/projects/agren/papers/agren_paper_106.pdf] site visited on 22/6/2010.
- Anandajayasekaram, P. and Rukuni, M. (1989). Institutionalization of of-farm research with farming systems perspectives (OFRIFSP) in Eastern and Southern African Region: Achievements and future directions. *The Zimbabwe Journal of Agricultural Research* 29(2): 67-82.
- ASDP (2003). Agricultural Extension Reform, Final Report, November 2003. Working Group 1: Extension. Dar es Salaam, Tanzania. 74pp.
- Axinn, G. H. and Thorat, S. (1972). *Modernizing World Agriculture: A Comparative Study of Agriculture Extension Education Systems*: Praeger Publishers, New York. 216pp.
- Babbie, E. R. (1990). *Survey Research Methods*. 2nd Edition. Wordworth Publishing Company, London. 395pp.
- Belay, K. and Abebaw, D. (2004). Challenges facing agricultural extension agents: A case study from South-Western Ethiopia. *Journal of African Development Review* 16(1): 139-168.

- Belay, K. (2003). Agricultural Extension in Ethiopia; The case of Participatory Demonstration and Training Extension Systems (PADETES): *Journal of Social Development in Africa* 18(1): 49-83.
- Blackie, M., Chema, S., Kinyawa, P., Lyimo, S., Moshi, A. and Ngatunga, E. (2003). Review of The Client-Oriented Research Management Approach (CORMA) and the Zonal Agricultural Research Funds (ZARFs) in Tanzania. MAFC. 16pp.
- Borgatti, S. P. and Cross, R. (2003). A relational view of information seeking and learning in a social network. *Management Science* 49(4): 432-445.
- Byerlee, D. L. H. and Winkelmann, D. (1982). Farming Systems Research. Issues in research strategy and technology design. *American Journal of Agricultural Economics* 64(1): 897-904.
- Cross, R., Nohria, N. and Parker, N. (2002). Six myths about networks and how to overcome them. *Sloan Management Review* 43(3): 67-76.
- Desouza, K. C. (2003b). Facilitating tacit knowledge exchange. *Communication of the ACM* 46(6): 85-88.
- Elfaki, H. M. (2008). The Effect of Research-Extension and Farmer Linkage on Development, Adoption and Diffusion of Agricultural Technologies. [[http://www.apec.upm.edu.my/agrex/FULL%20PAPER%20PDF%20\(AGREX0\)/musa%20hago-121.pdf](http://www.apec.upm.edu.my/agrex/FULL%20PAPER%20PDF%20(AGREX0)/musa%20hago-121.pdf)] site visited on 30/7/2010.

- FAO (1997). Management of Agricultural Research. A Training Manual Module 8. [<http://www.fao.org/docrep/w7508e/w7508e05.htm>] site visited on 25/6/2010.
- Garfoth, C. (1993). Rural people's Organization and Extension Communication in Northern Thailand. *Journal of Extension Systems* 9(2): 33-64.
- Kirway, T. N., Lema, N. M. and Lyimo, R. O. (2003) Farming System Approaches: Training Manual Vol. I DRD/MAFS, Tanzania. 213pp.
- Lancini, J. B. (2004) Strengthening the research/extension linkage through appropriate technology: ACIL Australia Pty Ltd., AML House, 50 Burwood Road, Hawthorn, Melbourne, Australia. 2pp.
- Lwoga, E. (2006). An Approach to Promote Collaboration and Sharing of Agricultural Research Knowledge in Tanzania: A Dissertation Submitted for the Master in Engineering Management, Industrial and Information Technology Management. University of Dar es Salaam. 135pp.
- Mattee, A. Z. and Isinika, A. C. (2002). The Role of SUA in Spreading Linkage of Research to Extension, and Enhancement of Participatory Methodologies. In: *Poverty Eradication and Sustainable Development. The role of Research in Agriculture and Sustainable Management of Natural Resources*. Proceedings of the Second University-Wide Scientific Conference held at the Institute of Continuing Education, Sokoine University of Agriculture, Morogoro, Tanzania, 9 – 10 May, 2002. pp. 106-119.
- Mattee, A. Z. (1994). Reforming Tanzania's Agricultural Extension Systems: The Challenges Ahead. *African Study Monographs* 15(4): 177-188.

- Mattee, A. Z. and Mollel, N. M. (1990). Farmers Accessibility to Extension Services: The Role of Training and Visit System of Extension. In: *Proceedings of National Workshop on the Training and Visit System of Agricultural Extension and its Application in Tanzania*: (Edited by Mattee, A.Z., Lupanga, I.J., Mollel, N.M. and Lugeye, S.C.). 28th November 1990, Dodoma, Tanzania. pp. 28-33.
- MAFC (2003). Study on the Institutional Arrangements and Capacity Assessment of Public Sector Agricultural Extension. 21 November, 2003. 59pp.
- Msuya-Bengesi, C. P. (2005). Factors that affect adoption of hybrid maize in Mwanza District: Implication for Continuing Education. *Journal of Continuing Education and Extension* 2(1): 31-42.
- Niyegila, T. K. (2007). Effectiveness of Farmer Field Schools (FFSs) in the Dissemination of Agricultural Knowledge in Kagera Region. A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Agricultural Education and Extension of Sokoine University of Agriculture, Morogoro, Tanzania, 104pp.
- Orodho, A. B. (2005). Dissemination and utilization of research technology on forages and Agricultural by-products in Kenya. Western Agricultural Research Centre, Kakamega, Kenya. [<http://www.ilri.org/InfoServ/Webpub/fulldocs/X5536e/X5536E05.HTM>] site visited on 14/7/2010.

PROLINNOVA-Tanzania (2006). Farmer- Extension- Research Linkages Workshop for PROLINNOVA Tanzania Partners held at Ruaha University College, 9th-11th October, 2006, Iringa, Tanzania. 43pp.

Rutatora, D. F. and Mattee, A. Z. (2001a). Towards A Farmer – Centered – Extension Services: The Case of Uluguru Mountains Agricultural Development Project (UMADEP) Morogoro, Tanzania. *South African Journal of Agricultural Extension and Education* 30: 89-101.

Rutatora, D. F. and Mattee, A. Z. (2001b). Major Agricultural Extension Providers in Tanzania. *African Study Monograph*. 22(4): 161-163.

Rutatora, D. F. and Rwenyagila, B. W. (2005). Agricultural extension reform in Tanzania: Vision and guiding principles. *Journal of Continuing Education and Extension* 2(1): 1-15.

Rutatora, D. F., Mattee, A. Z. and Mgumia, A. H. (2005). Agricultural Extension Through participatory Approaches: Lessons from UMADEP, Morogoro, Tanzania. *Journal of Continuing Education and Extension* 2(1): 65-74.

Rwambali, G. E. (1990). Women and Cooperatives in Rural Development in Tanzania. MSc. Thesis. National University of Ireland. 102pp.

Shoo, I. F. (2004). Challenges of Development; A Theoretical and Conceptual Overview. *Tanzania Journal of Development Studies* 5(3). 73-80.

URT (2003a). Reforming Tanzania NARS, Main Report, November 2003, Dar es Salaam, Tanzania. 31pp.

URT (2003b). Medium Term Plan 2004/5-2008/9. National Agricultural Research System (NARS). Second Draft, May 20, 2003. 73pp.

URT (2006). Agricultural Extension Policy, First Draft. Ministry of Agriculture, Food Security and Cooperatives, Dar es Salaam, Tanzania. 37pp.

Woods, J. I. (1985). Farmer-Extension-Research Workshop Proceedings and Trainer's Guide. Workshop on Research-Extension Linkages Farming Systems Programmes. Kafun, Zambia. *In: Policy Brief 13. Strengthening the Link between Research, Extension and the Farmer.* [<http://www.pak-nigeria.org/pdfs/12-PolicyBrief13.pdf>] site visited on 16/3/2011.

APPENDICES

Appendix 1: A Study of Research-Extension-Farmer Linkage in the Central Zone, Tanzania

RESEARCHERS QUESTIONNAIRE

A study of Research-Extension-Farmer linkage in Central Zone, Tanzania. The meaning of linkage: Implies the communication and working relationship established between two or more organizations pursuing commonly shared objectives in order to have regular contact and improved productivity.

SECTION A: SOCIO-ECONOMIC INFORMATION

1. Respondent number.....
2. Name of research institution.....
3. What is your age in years?
4. Sex of respondent
 - 1 = Male
 - 2 = Female
5. What is your marital status?
 - 1 = Single
 - 2 = Married
2. What is your highest level of education?
 - 1 = PhD
 - 2 = MSc/MA
 - 3 = Bachelor
 - 4 = Diploma
 - 5 = Certificate
7. What is your field of specialization?
 - 1 = Crops
 - 2 = Livestock
8. How many years have you been in this field?

SECTION B: RESEARCH-EXTENSION-FARMER LINKAGE (Awareness and Participation)

9. Have you ever heard about research, extension and farmer linkage?

1 = Yes

2 = No

10. How do you link with farmers?

1= Going direct to the field

2= Through extension office

3=Through liaison officer

4= Other (Specify).....

11. Have you ever visited extension offices?

1=Yes

2=No

12. If yes, how many times per year (2009/2010)?

1=Once

2=Twice

3=More than twice

13. Have extension staff ever visited your research institution?

1=Yes

2=No

14. How do you evaluate your work relationship with extension offices?

1=Strong

2=Moderate

3=Weak

4=No at all

15. How do you evaluate your work relationship with farmers?

1=Strong

2=Moderate

3=Weak

4=No at all

16. Do extension staff participate in the following activities?

| Activity | (Tick where applicable) | How do they participate? (Explain) |
|--|-------------------------|------------------------------------|
| Identifying research agenda | | |
| Developing research programs, plans or budgets | | |
| Monitoring or monitoring research process | | |
| Collecting data | | |
| Evaluating the results | | |
| Disseminating the results | | |
| Covering part of the research costs | | |
| Other..... | | |

17. Do farmers participate in the following activities?

| Activity | (Tick where applicable) | How do they participate? (Explain) |
|--|-------------------------|------------------------------------|
| Identifying research agenda | | |
| Developing research programs, plans or budgets | | |
| Monitoring or monitoring research process | | |
| Collecting data | | |
| Evaluating the results | | |
| Disseminating the results | | |
| Covering part of the research costs | | |
| Other..... | | |

SECTION C: SERVICE PROVISION AND OPPORTUNITIES FOR LINKAGE

18. What are the technologies generated in your research institution?

1.....

2.....

19. Have you ever received any request for services from extension offices?

1=Yes

2=No

20. What are the services requested by extension offices?

1.....

2.....

21. What are the services delivered to extension offices?

1.....

2.....

22. Do you have linkage officer in your institution?

1=Yes

2=N

23. What methods do you use to link with extension staff? (Tick where applicable)

| S/N | METHOD | YES | NO |
|-----|--|-----|----|
| 1 | Meetings | | |
| 2 | Workshops/Conferences | | |
| 3 | Radio | | |
| 4 | Television | | |
| 5 | Field days | | |
| 6 | On-farm trials | | |
| 7 | On-station trials | | |
| 8 | FFS | | |
| 9 | Study tours | | |
| 10 | Agriculture shows | | |
| 11 | Reading material (leaflets, pamphlets, posters, brochures) | | |
| 12 | Other..... | | |

24. What methods do you use to link with farmers? (Tick where applicable)

| S/N | METHOD | YES | NO |
|-----|--|-----|----|
| 1 | Meetings | | |
| 2 | Workshops/Conferences | | |
| 3 | Radio | | |
| 4 | Television | | |
| 5 | Field days | | |
| 6 | On-farm trials | | |
| 7 | On-station trials | | |
| 8 | FFS | | |
| 9 | Study tours | | |
| 10 | Agriculture shows | | |
| 11 | Reading material (leaflets, pamphlets, posters, brochures) | | |
| 12 | Other..... | | |

SECTION E: FACTORS INFLUENCING LINKAGES

25. Are there any other institutions collaborating with your institution?

1=Yes

2=No

26. If yes,

(a) What are these institutions? (Mention)

1

2.....

(b) In which area(s)/field(s) do you collaborate?

1.....

2.....

27. Does your institution involve different stakeholders in research activities? (Tick one)

1= Yes

2= No

28. If yes, who are these stakeholders? (Mention)

| NO | Stakeholder | Nature of collaboration/Involvement |
|----|-------------|-------------------------------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

29. How can you evaluate the participation level of different stakeholders in research activities? (Tick one)

- 1 = High
- 2 = Moderate
- 3 = Low
- 4 = No at all

30. In your view, do you think the number of research staff available satisfies the requirement of the institution to perform research activities? (Tick one)

- 1 = Yes
- 2 = No

31. What are the factors you think can influence the linkage between research, extension and farmers? (Mention)

- 1.....
- 2.....

SECTION D: ACHIEVEMENTS IN RESEARCH, EXTENSION, FARMER LINKAGE

32. In your opinion, do you think the link between research, extension and farmers play a greater role in agricultural development? (Tick one)

- 1 = Yes
- 2 = No

33. If yes, what are the achievements registered on the link?

- 1.....
- 2.....
- 3.....

34. Please, give concrete examples of where this has happened

- 1.....
- 2.....

SECTION E: CHALLENGES AND CONSTRAINTS

35. What are the challenges and constraints that you feel are still facing your institution in linking with extension and farmers

- 1.....
- 2.....

36. What do you think can be done to strengthen linkages between research, extension and farmers?

- 1.....
- 2.....

Thank you for your contribution

Appendix 2: Extension Staff Questionnaire

A study of Research-Extension-Farmer linkage in Central Zone, Tanzania

The meaning of linkage: Implies the communication and working relationship established between two or more organizations pursuing commonly shared objectives in order to have regular contact and improved productivity.

SECTION A: SOCIO-ECONOMIC INFORMATION

1. Respondent number.....
2. District.....
3. Work station.....
4. What is your age in years? (Tick one)
 - 1 = 20-29
 - 2 = 30-39
 - 3 = 40-49
 - 4 = 50 and above
5. Sex
 - 1= Male
 - 2=Female
6. Marital status of respondent
 - 1 = Single
 - 2 = Married
 - 3 = Divorced
 - 4 = Widowed
 - 5 = Separated
7. What is your highest level of education?
 - 1 = PhD
 - 2 = MSc/MA
 - 3 = Bachelor
 - 4 = Diploma
 - 5 = Certificate

8. What is your field of specialization?

1 = Crops

2 = Livestock

9. How many years have you been in this field?

SECTION B: RESEARCH-EXTENSION-FARMER LINKAGE (Awareness and Participation)

10. Have you ever heard about research, extension and farmer linkage?

1 = Yes

2 = No

11. Have you ever visited a research institution?

1 = Yes

2 = No

12. If yes, how many times per year?

1 = Once

2 = Twice

3 = More than twice

13. What was the purpose of your visits?

1.....

2.....

14. If no, why? (Give reasons)

1.....

2.....

15. Have researchers visited your work station?

1 = Yes

2 = No

16. If yes, what was the purpose of their visits?

1.....

2.....

17. How do you evaluate the linkage and work relationship between research and extension?

1 = Strong

2 = Moderate

3 = Weak

4 = No at all

18. How do you evaluate the linkage and work relationship between extension and farmers?

1 = Strong

2 = Moderate

3 = Weak

4 = No at all

19. How do you evaluate the linkage and work relationship between research and farmers?

1 = Strong

2 = Moderate

3 = Weak

4 = No at all

20. As an extension professional, how do you feel about your linkage with researchers?

1 = I am encouraged by my DALDO to consult them in case of problem

Agree ()

Disagree ()

2 = I visit researchers in case of problem

Agree ()

Disagree ()

2 = Researchers come to my working station therefore I get an opportunity to express my problems

Agree ()

Disagree ()

4 = I ask for advice about my problems during training sessions with researchers

Agree ()

Disagree ()

5 = I ask for advice during meeting sessions with researchers

Agree ()

Disagree ()

21. Do researchers participate in the following activities?

| Activity | (Tick where applicable) | How do they participate? (Explain) |
|--|-------------------------|---------------------------------------|
| Identifying extension agenda | | |
| Developing extension programs, plans or budgets | | |
| Monitoring or monitoring extension program process | | |
| Collecting data | | |
| Evaluating the results | | |
| Disseminating the results | | |
| Covering part of the extension program costs | | |
| Other..... | | |

22. Do farmers participate in the following activities?

| Activity | (Tick where applicable) | How do they participate? (Explain) |
|--|-------------------------|---------------------------------------|
| Identifying extension agenda | | |
| Developing extension programs, plans or budgets | | |
| Monitoring or monitoring extension program process | | |
| Collecting data | | |
| Evaluating the results | | |
| Disseminating the results | | |
| Covering part of the extension program costs | | |
| Other..... | | |

SECTION C: SERVICE PROVISION AND OPPORTUNITIES FOR LINKAGE

23. Are there any services provided by research institution in your area?

1=Yes ()

2=No ()

24. If yes, what are they? (Mention)

1.....

2.....

25. Have you sent any request to research institution?

1 = Yes

2 = No

26. If yes, what are services requested from research?

1.....

2.....

27. What are the sources of technical advice other than reading materials you have?

| S/N | SOURCE | YES | NO |
|-----|-----------------------|-----|----|
| 1 | Head of department | | |
| 2 | Research institutions | | |
| 3 | DSMS | | |
| 4 | NGOs | | |
| 5 | Other (Specify)..... | | |

28. What methods do you use to link with researchers? (Tick one)

| S/N | SOURCE | YES | NO |
|-----|-----------------------|-----|----|
| 1 | Meetings | | |
| 2 | Workshops/Conferences | | |
| 3 | Radio | | |
| 4 | Television | | |
| 5 | Field days | | |
| 6 | On-farm trials | | |

| | | | |
|----|--|--|--|
| 7 | On-station trials | | |
| 8 | FFS | | |
| 9 | Study tours | | |
| 10 | Agriculture shows | | |
| 11 | Reading material (leaflets, pamphlets, posters, brochures) | | |
| 12 | Other..... | | |

29. What methods do you use to link with farmers? (Tick one)

| S/N | SOURCE | YES | NO |
|-----|--|-----|----|
| 1 | Meetings | | |
| 2 | Workshops/Conferences | | |
| 3 | Radio | | |
| 4 | Television | | |
| 5 | Field days | | |
| 6 | On-farm trials | | |
| 7 | On-station trials | | |
| 8 | FFS | | |
| 9 | Study tours | | |
| 10 | Agriculture shows | | |
| 11 | Reading material (leaflets, pamphlets, posters, brochures) | | |
| 12 | Other..... | | |

SECTION E: FACTORS INFLUENCING LINKAGES

30. What are the factors do you think can influence the linkage between research, extension and farmer? (Mention)

- 1.....
- 2.....
- 3.....
- 4.....

SECTION E: ACHIEVEMENTS IN LINKAGE

31. In linking extension with research do you have any achievements?

1 = Yes

2 = No

32. If Yes, mention

- 1.....
- 2.....
- 3.....
- 4.....

SECTION D: CHALLENGES AND CONSTRAINTS FOR LINKAGE

33. What are the constraints and challenges that still affect your communication with research? (Tick one)

| S/N | CONSTRAINT/CHALLENGE | YES | NO |
|-----|---|-----|----|
| 1 | Lack of transport | | |
| 2 | Lack of relevant information | | |
| 3 | Lack of improved technologies | | |
| 4 | Lack involvement in research activities | | |
| 5 | Language problems | | |
| 6 | Other..... | | |

34. What can be done to strengthen linkage with research? (Give your opinions)

- 1.....
- 2.....
- 3.....
- 4.....

35. What is your opinion toward the farmers with whom you are working? (Tick one)

1 = They are reluctant to listen my advice

Agree ()

Disagree ()

2 = They need always to be forced

Agree ()

Disagree ()

3 = They are ready to accept new knowledge, technologies and practices

Agree ()

Disagree ()

4 = They can identify their own problems and needs

Agree ()

Disagree ()

Thank you for your contribution

SECTION B: INFORMATION DISSEMINATION

9. Have you ever heard about research institutions? (Tick one)

1=Yes

2=No

10. If yes, what did you hear about research institutions?

1.....

2.....

3.....

4.....

11. What is the source of extension services in your village? (Tick one)

1= Government ()

2 = NGO ()

3= Both Government and NGO ()

12. Have researchers visited your village? (Tick one)

1 = Yes ()

2 = No ()

13. If yes, what was the purpose of their visit?

1.....

2.....

14. Did you visit any research institution? (Tick one)

1 = Yes ()

2 = No ()

15. If yes, what was the purpose of your visit?

1.....

2.....

16. If you experience problems in your practices, do you contact extension staff? (Tick one)

1 =Yes ()

2 = No ()

17. In your routine production activities, where do you get information about agricultural technologies? (Tick where applicable)

| S/N | INFORMATION SOURCE | YES | NO |
|-----|--------------------|-----|----|
| 1 | Extension Officers | | |
| 2 | DALDO office | | |
| 3 | Research | | |
| 4 | NGOs | | |
| 5 | Other | | |

18. Have you ever attended any meetings organized by researchers? (Tick one)

1 = Yes ()

2 = No ()

19. If yes, how many times? (Tick one)

1 = Once ()

2 = Twice ()

3 = Three times ()

4 = More than three times ()

20. Did you participate in any research activity in your village? (Tick one)

1 = Yes ()

2 = No ()

21. If yes, in which activities did you participated?

1.....

2.....

22. Did you attend the following extension methods organized by extension office?

(Tick one)

| S/N | EXTENSION METHOD | YES | NO |
|-----|------------------------|-----|----|
| 1 | Farmer visit elsewhere | | |
| 2 | Demonstration | | |
| 3 | Field day | | |
| 4 | Agricultural shows | | |
| 5 | Farmers training | | |
| 6 | Meetings | | |
| 7 | Workshops/Seminars | | |
| 8 | Other (Specify) | | |

23. Did you attend the following extension methods organized by research? (Tick one)

| S/N | EXTENSION METHOD | YES | NO |
|-----|------------------------|-----|----|
| 1 | Farmer visit elsewhere | | |
| 2 | Demonstration | | |
| 3 | Field day | | |
| 4 | Agricultural shows | | |
| 5 | Farmers training | | |
| 6 | Meetings | | |
| 7 | Workshops/Seminars | | |
| 8 | Other (Specify) | | |

24. What are your sources of agricultural information? (Tick one)

| S/N | SOURCE | YES | NO |
|-----|------------------|-----|----|
| 1 | Extension worker | | |
| 2 | Research | | |
| 3 | NGOs | | |
| 4 | Neighbors | | |
| 5 | Farmers groups | | |
| 6 | Other (specify) | | |

25. In your opinion, what do you think are the benefits obtained from linking with extension and research?

- 1.....
- 2.....

26. What are the constraints still facing you in linking with extension and research?

- 1.....
- 2.....

27. What do you do to overcome such constraints?

- 1.....
- 2.....

Thank you for your contribution

**Appendix 4: Checklist for the Zonal Agricultural Research Development Institutes
(ZARDIs) Directors/Liaison Officers of Research Institution**

1. Work station.....
2. Sex.....
3. Age (Years).....
4. Level of education.....
5. Job title.....
6. How long have you been with this office at this title (Years)
7. How many visits to extension and farmers did you plan per year (2009/2010)?
8. Do you have linkage officer in your institution?
9. How many visits did you do per year (2009/2010)?
10. How many extension staff visited your research institution per year (2009/2010)?
11. How many farmers visited your research institution per year (2009/2010)?
12. How many meetings involving researchers, extension staff and farmers did you plan per year (2009/2010)? (Zonal Technical Committee, Zonal Executive Committee, Annual Donors' Conference, Annual Stakeholders' Conference, Annual Commodity Meetings, Annual Agricultural Conferences and Annual Agricultural Show)
13. How many of them were conducted?
14. How many research-extension-farmer linkage workshops organized per year (2009/2010)?
15. How many on-farm trials, study tours and demonstrations organized per year (2009/2010)?
16. How many technologies established in your research institution per year (2009/2010)?
17. How many disseminated to extension and farmers per year (2009/2010)?
18. How many leaflets/pamphlets developed by your institution per year (2009/2010)?
19. How many disseminated to extension and farmers?
20. How many stakeholders' institutions involved in research-extension-farmer linkage meetings and workshops?
21. Do you have joint planning of research programs?
22. Who are stakeholders involved in joint planning?
23. What opportunities created in your institution to strengthen linkage between research, extension and farmers?

24. What achievements that have been registered so far in research-extension-farmer linkage?
25. Please, give concrete examples of where these have happened
26. Based on the current institutional arrangement, what challenges and constraints is your institution still facing in linking research, extension and farmers?
27. What means can be used to further strengthen research-extension-farmer linkage?

Appendix 5: Checklist for the DALDOs/Liaison Officers of Extension office

1. Work station.....
2. Sex.....
3. Age..... (Years)
4. Level of education.....
5. Job title.....
6. How long have you been with this office at this title..... (Years)
7. Do you have linkage officer in your office?
8. How many visits to research institution did you plan per year (2009/2010)?
9. How many visits did you done per year?
10. How many extension staff visited research institution per year?
11. How many farmers visited research institution per year?
12. How many meetings involving researchers, extension staff and farmers did you plan per year?
13. How many of them were conducted?
14. How many research-extension-farmer linkage workshops organized per year?
15. How many stakeholders' institutions involved in research-extension-farmer linkage meetings and workshops?
16. Do you have joint planning of extension programs?
17. Who are stakeholders involved in joint planning?
18. Based on the current institutional arrangement, what challenges and constraints is your institution still facing in linking research, extension and farmers?
19. What means can be used to further strengthen research-extension-farmer linkage?