

**FACTORS INFLUENCING RESEARCH –EXTENSION – FARMER
LINKAGES IN TANZANIA: A CASE OF THE WESTERN AGRICULTURAL
RESEARCH ZONE**

BY

JONATHAN ERNEST CHILIGATI

**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.**

2010

ABSTRACT

Research and extension must collaborate effectively through research - extension –farmer linkages in order to bring increased agricultural productivity, income and reduction of rural poverty. However, these linkages have been reported to be weak. This study examined factors influencing research – extension – farmer linkages in the Western Agricultural Research Zone of Tanzania. It focused on four districts in the zone namely Kasulu and Kigoma in Kigoma Region and Urambo and Uyui in Tabora Region. Specific objectives were to: identify existing research - extension - farmer linkages, identify innovative linkages, and describe factors enhancing and/or affecting linkages and to recommend ecologically sustainable strategies for strengthening linkages. Research design of this study was cross sectional. Data were collected through personal interviews and focused group discussions with extension workers, researchers and farmers and through discussions with key officials of the Ministry of Agriculture Food Security and Cooperatives and NGOs. A sample of 73 respondents composed of 39 farmers, 23 extension workers and 11 researchers was drawn from sampling frames that were developed. A table of random numbers was used for random selection of farmers and extension workers while purposive selection was applied for researchers. Findings show that existing linkages are farm trials, demonstrations and Farmer Field Schools while innovative linkages are through cell phones and internet. Furthermore, findings show positive factors which enhance linkages and negative factors that inhibit linkages. Majority of researchers (91%) and extension workers (57%) reported that positive factors are innovative mechanisms and government policy initiatives. Innovative mechanisms included cell phones and internet while policy initiatives include the ASDP and the National Agricultural Policy (2008). In case of negative factors, majority of researchers

(91%) and extension staff (87%) mentioned inadequate funds. Based on findings the study recommends the following strategies for strengthening linkages in the Western Zone: increased internal funding of linkage activities instead of donor funding which is unsustainable and crop seed multiplication in the zone to ensure increased availability of recommended seeds. Another strategy is strengthening coordination through establishment of a national liaison unit which will link extension and research units of MAFC and coordinate zonal liaison units (ZIELUs), and through promotion of teamwork, commitment and doing business unusual among Agricultural Sector Lead Ministries.

DECLARATION

I, **Jonathan Ernest Chiligati**, do hereby declare to the Senate of the Sokoine University of Agriculture that, this dissertation is my own original work and has not been submitted for a higher degree award in any other University.

Jonathan Ernest Chiligati

(MSc. Candidate)

Date

The above declaration is confirmed

Prof. D.F. Rutatora

(Supervisor)

Date

COPYRIGHT

No part of this dissertation may be produced, 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.

ACKNOWLEDGEMENT

I wish to express my gratitude to my employer the Ministry of Agriculture Food Security and Cooperatives for financial support. I highly appreciate support from the Ministry headquarters as well as from my work station, the Western Zonal Agricultural Research Institute Tumbi.

I wish to extend special gratitude to my supervisor Professor D.F. Rutatora for his supervision and tireless guidance which made this dissertation come to conclusion. Similarly, I wish to extend my sincere thanks to members of academic staff of the Department of Agricultural Education and Extension of the Sokoine University of Agriculture and to fellow course mates for their support and advice.

I also wish to express my sincere gratitude to all farmers, extension workers, researchers and officials of the Ministry of Agriculture, Food Security and Cooperatives and NGOs contacted for the study. I highly appreciate their cooperation and readiness to share information which made this study successful.

Finally, I wish to pay special tribute to my dear wife Lucy and our children. Their prayers, support and perseverance during my long absence from the family was a source of encouragement. In conclusion, I wish to express my revered gratitude to Almighty God for granting me health and strength for pursuing this course to conclusion.

DEDICATION

I dedicate this dissertation to my uncle the late Mzee Zefania Chiligati and my brother John Chiligati for laying down the foundation of my education and life in general.

TABLE OF CONTENTS

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION OF SOKOINE		I
UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.....		I
ABSTRACT.....		II
DECLARATION.....		IV
COPYRIGHT.....		V
ACKNOWLEDGEMENT.....		VI
DEDICATION.....		VII
TABLE OF CONTENTS.....		VIII
LIST OF TABLES.....		XI
FIGURE.....		XII
LIST OF APPENDICES.....		XIII
LIST OF ABBREVIATIONS.....		XIV
CHAPTER ONE.....		1
1.0 INTRODUCTION.....		1
1.1 BACKGROUND INFORMATION.....		1
1.2 PROBLEM STATEMENT.....		7
1.3 JUSTIFICATION.....		8
1.4 OBJECTIVES		9
1.4.1 General objective.....		9
1.4.2 Specific objectives.....		9
1.5 CONCEPTUAL FRAMEWORK		10

CHAPTER TWO.....	14
2.0 LITERATURE REVIEW.....	14
2.1 OVERVIEW.....	14
2.2 THE CONCEPT AND IMPORTANCE OF RESEARCH – EXTENSION – FARMER LINKAGES.....	14
2.3 PRINCIPLES FOR EFFECTIVE RESEARCH – EXTENSION – FARMER LINKAGES	16
2.4 LINKAGE MECHANISMS.....	19
2.4.1 Linkage mechanisms in the Western Zone.....	21
2.4.2 Innovative research – extension – farmer linkage mechanisms	23
2.5 LINKAGE STUDIES	25
2.5.1 Linkage studies in developing and developed countries.....	25
2.5.2 Linkage studies in Tanzania.....	29
2.6 FACTORS INFLUENCING RESEARCH – EXTENSION – FARMER LINKAGES	33
2.6.1 Positive factors	34
2.6.2 Negative factors	35
CHAPTER THREE.....	41
3.0 METHODOLOGY.....	41
3.1 OVERVIEW.....	41
3.2 DESCRIPTION OF THE STUDY AREA.....	42
3.3 RESEARCH DESIGN	45
3.4 STUDY POPULATION	46
3.5 SAMPLING PROCEDURES.....	46
3.6 Data Collection Methods and Tools.....	47
3.7 DATA ANALYSIS.....	49
CHAPTER FOUR.....	49
4.0 RESULTS AND DISCUSSION.....	49
4.1 SOCIO - DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS.....	50
4.2 EXISTING RESEARCH – EXTENSION – FARMER LINKAGES IN THE WESTERN ZONE.....	55

4.2.1 Strengths of existing linkages	60
4.2.2 Weaknesses of existing linkages	61
4.2.3 Useful aspects of existing research – extension – farmer linkages in the Western Zone.....	63
4.2.3.1 Usefulness of on farm trials.....	64
4.2.3.2 Usefulness of demonstrations, Farmer Field Schools and field days.....	65
4.2.4 Implementation level of planned linkage activities	67
4.2.5 Level of collaboration and involvement of partners in linkages.....	69
4.3 INNOVATIVE RESEARCH –EXTENSION – FARMER LINKAGES IN THE WESTERN ZONE.....	73
4.4 FACTORS INFLUENCING RESEARCH – EXTENSION – FARMER LINKAGES IN THE WESTERN ZONE.....	75
4.4.1 Positive factors	75
4.4.2 Negative factors	77
4.5 STRATEGIES FOR STRENGTHENING RESEARCH - EXTENSION – FARMER LINKAGES.....	79
4.5.1 Strategies for strengthening existing linkages.....	79
4.5.2 Strategies for strengthening innovative linkages.....	83
CHAPTER FIVE.....	85
5.0 CONCLUSION AND RECOMMENDATIONS.....	85
5.1 CONCLUSION.....	85
5.2 RECOMMENDATIONS.....	87
REFERENCES.....	90
SWANSON, B.E. (EDITOR) (1996). IMPROVING AGRICULTURAL EXTENSION. CHAPTER 19 IN STRENGTHENING RESEARCH-EXTENSION-FARMER LINKAGES.FAO, ROME. [HTTP://WWW.FAO.ORG/DOCREP/W5805E/W583E0L.HTM] SITE VISITED ON 13/05/2008.....	95
APPENDICES.....	99

LIST OF TABLES

TABLE 1: DISTRIBUTION OF EXTENSION WORKERS AND RESEARCHERS ACCORDING TO SOCIO – DEMOGRAPHIC CHARACTERISTICS.....	51
TABLE 2: DISTRIBUTION OF FARMERS ACCORDING TO SOCIO – DEMOGRAPHIC CHARACTERISTICS (N = 39).....	53
TABLE 3: RESEARCH - EXTENSION - FARMER LINKAGES IN THE WESTERN ZONE IDENTIFIED BY EXTENSION WORKERS AND RESEARCHERS	55
TABLE 4: RESEARCH – EXTENSION - FARMER LINKAGES IDENTIFIED BY FARMERS (N=39).....	57
TABLE 5: INSTITUTIONS WHICH INITIATED THE EXISTING LINKAGES	59
TABLE 6: NUMBER OF FARMERS REACHED THROUGH LINKAGE ACTIVITIES BETWEEN 2004 AND 2008 IN THE WESTERN ZONE.....	61
TABLE 7: USEFUL ASPECTS OF LINKAGES TO EXTENSION WORKERS AND RESEARCHERS	63
TABLE 8: CHALLENGES ENCOUNTERED BY FARMERS IN THEIR COLLABORATION WITH RESEARCHERS IN ON FARM TRIALS (N=39).....	68
TABLE 9: REASONS FOR LOW LEVEL OF IMPLEMENTATION OF LINKAGES.....	69
TABLE 10: LEVEL OF FARMERS’ INVOLVEMENT IN LINKAGES.....	70
TABLE 11: LEVEL OF INVOLVEMENT OF EXTENSION WORKERS IN LINKAGES	70
TABLE 12: LEVEL OF COLLABORATION OF NGOS IN LINKAGES.....	72
TABLE 13: INNOVATIVE LINKAGES IDENTIFIED BY EXTENSION WORKERS AND RESEARCHERS.....	73

TABLE 14: POSITIVE FACTORS ENHANCING LINKAGES IN THE WESTERN ZONE76

**TABLE 15: NEGATIVE FACTORS INHIBITING LINKAGES IDENTIFIED BY EXTENSION
WORKERS AND RESEARCHERS78**

FIGURE

**FIGURE 1: CONCEPTUAL FRAMEWORK OF FACTORS INFLUENCING RESEARCH
-EXTENSION - FARMER LINKAGES13**

LIST OF APPENDICES

APPENDIX 1: SELF ADMINISTERED QUESTIONNAIRE FOR LOCAL GOVERNMENT EXTENSION WORKERS	99
APPENDIX 2: A SELF ADMINISTERED QUESTIONNAIRE FOR ARI TUMBI RESEARCHERS	105
APPENDIX 3: INTERVIEW SCHEDULE FOR FARMERS COLLABORATING WITH ARI TUMBI RESEARCHERS	110
APPENDIX 4: AN INTERVIEW GUIDE FOR KEY OFFICIALS OF THE MINISTRY OF AGRICULTURE, FOOD SECURITY AND COOPERATIVES.....	113
APPENDIX 5: A CHECKLIST FOR DISCUSSIONS WITH NGOS.....	114
APPENDIX 6: MAP OF TANZANIA SHOWING LOCATION OF STUDY AREA THE WESTERN AGRICULTURAL RESEARCH ZONE - KIGOMA AND TABORA REGIONS.....	115

LIST OF ABBREVIATIONS

ADB	African Development Bank
ARI	Agricultural Research Institute
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
ASLM	Agricultural Sector Lead Ministries
ATS	Agricultural Technology System
CORDEMA	Client Oriented Research and Development Management Approach
CRDB	Cooperative and Rural Development Bank
DADP	District Agricultural Development Plans
DALDO	District Agricultural and Livestock Development Officer
DCD	Director for Crop Development
DED	District Executive Director
DESC	District Extension Steering Committee
DFP	District Farmer Forum
DRD	Director for Research and Development
DRTE	Department of Research, Training and Extension
FAO	Food and Agriculture Organisation
FF	Farmer First
FFS	Farmer Field School
FRG	Farmer Research Group
FSA	Farming Systems Approach
FSR	Farming Systems Research
GDP	Gross Domestic Product
GOT	Government of Tanzania
IAD	Integrated Agricultural Development
ICRAF	International Centre for Research in Agroforestry
ICT	Information Communication Technologies
IPR	Internal Programme review
IRD	Integrated Rural Development
ISNAR	International Service for National Agricultural Research
ITK	Indigenous Technical Knowledge
JAST	Joint Assistance Strategy for Tanzania
LGA	Local Government Authority
LGC	Land Grant Colleges
LGRP	Local Government Reform Programme

M and E	Monitoring and Evaluation
MAC	Ministry of Agriculture and Co-operatives
MAFC	Ministry of Agriculture, Food Security and Co-operatives
MAFS	Ministry of Agriculture and Food Security
MDG	Millennium Development Goal
MITM	Ministry of Industry, Trade and Marketing
MKUKUTA	<i>Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania</i>
MLDF	Ministry of Livestock Development and Fisheries
MOA	Ministry of Agriculture
MWI	Ministry of Water and Irrigation
NAEPII	National Agricultural Extension Project Phase II
NALERP	National Agricultural and Livestock Extension Rehabilitation Project
NALRP	National Agriculture and Livestock Research Project
NARC	National Agriculture Research Committee
NGO	Non-Governmental Organizations
NSGRP	National Strategy for Growth and the Reduction of Poverty
NTRC	National Technology Recommendation Committee
O&OD	Opportunities and Obstacles to Development
OFCOR	On Farm Client Oriented Research
PARA	Participatory Rural Appraisal
PEA	Participatory Extension Approach
PMO-RALG	Prime Minister's Office – Regional Administration and Local Government
PTDD	Participatory Technology Development and Dissemination
RAA	Regional Agricultural Adviser
RAS	Regional Administrative Secretary
REDESO	Relief and Development Society
REO	Regional Extension Officer
RLA	Regional Livestock Adviser
SACCOS	Savings and Credit Cooperative Societies
SMS	Subject Matter Specialist
SNAL	Sokoine National Agricultural Library
SPAT	Small Plot Adoption Technique
SPSS	Statistical Package for Social Sciences
T & V	Training and Visit
TACARE	Lake Tanganyika Catchment Rehabilitation Project
TARP II	Tanzania Agricultural Research Project Phase II
TDFT	Tabora Development Foundation Trust
TDV 2025	Tanzania Development Vision 2025
TORITA	Tobacco Research Institute of Tanzania
ToT	Transfer of Technology
UNDP	United Nations Development Programme
USAID	United States Agency for International Aid
VEO	Village Extension Officer
VIC	Veterinary Investigation Centre
WARC	Ward Agricultural Resource Centres
WFF	Ward Farmer Forum
ZARDEF	Zonal Agricultural Research and Development Fund
ZARF	Zonal Agricultural Research Fund

ZaTC	ZARDEF Technical Committee
ZDRD	Zonal Director for Research and Development
ZEC	Zonal Executive Committee
ZIELO	Zonal Information and Extension Liaison Officer
ZIELU	Zonal Information and Extension Liaison Unit
ZRC	Zonal Research Coordinator
ZRELO	Zonal Research and Extension Liaison Officer
ZRELU	Zonal Research Extension Liaison Unit
ZSC	Zonal Steering Committee
ZTC	Zonal Technical Committee

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The agriculture sector plays an important role in the Tanzanian economy and has the potential to advance the country's objectives of growth and poverty reduction. While agriculture is the main source of income, it also provides food and employs about 75 per cent of the total labour force. The sector contributes about 26.5 per cent of the Gross Domestic Product (GDP) and about 30 per cent of export earnings (URT, 2008a). Specifically, agriculture is important to Tanzania's immediate and long term development goals for reduction of rural poverty, food security and for the overall economic development now and in the near future (URT, 2001a).

The Government of Tanzania (GOT) in collaboration with its development partners has made efforts to revamp agriculture. Such efforts include release of policies like Tanzania Development Vision - TDV 2025 (URT, 1999), Cooperative Development Policy (URT, 2002a) and National Agricultural Policy (URT, 2008b). Alongside these policies, the government released strategies like the Poverty Reduction Strategy Paper (PRSP 2000) and Rural Development Strategy (RDS) (URT, 2001b). Other strategies were the National Strategy for Growth and Reduction of Poverty (NSGRP) (URT, 2005) popularly known in Kiswahili as MKUKUTA and the Agricultural Sector Development Strategy (ASDS) (URT, 2001a). In order to operationalise the ASDS, the GOT launched the Agricultural Sector Development Programme (ASDP) (URT, 2003) and ASDP Support through Basket Fund 2006). ASDP is in harmony with the 2005 Paris Declaration on Aid Effectiveness and the Joint Assistance Strategy for Tanzania (JAST) (URT, 2006a) and is aimed at

achieving the NSGRP and Millennium Development Goals targets (URT, 2001a and 2006a).

In order to achieve the MDGs and NSGRP objectives, the TDV 2025 states that poverty level and food insecurity should be halved by 2015 (URT, 1999). The ASDS sets the framework for achieving the sector's objectives and the ASDP provides the overall framework and processes for implementation of the ASDS (URT, 2006a). ASDP's key objectives are twofold first is to increase farm productivity, profitability and incomes through better access to and use of agricultural knowledge, technologies and marketing systems and infrastructure. Secondly, ASDP aims at promoting private investment through improved regulatory and policy environment. Research and extension services are important in the realisation of the first objective of increased farm productivity, profitability and incomes therefore they must collaborate through effective linkages.

The current research – extension - farmer linkages have evolved from way back in the colonial era. During the colonial era, research and extension services mostly focused on export crops to supply raw materials to metropolises. Agricultural extension services were that implemented through the Focal Point Approach (FPA), were coercive in nature and focused on agricultural inspection and enforcement of rules, regulations and by – laws. With this background therefore, farmers' involvement in research - extension linkages were limited. After independence, in the period between 1961 and 1967 agricultural extension services were provided through the Improvement and Transformation extension approaches. A Task Force on Extension Reform (URT, 2000b) reported that the two approaches concentrated on cash crops which were cultivated by few progressive farmers with larger farms in the northern and western parts of the country. As such, majority of

farmers were left unattended and their involvement in research and extension decisions was limited.

A series of extension approaches were employed between 1967 and 1980s. These approaches were the Frontal, Commodity, Integrated Agricultural Development (IAD), the Integrated Rural Development (IRD) and the Farming Systems projects (FS). Most of these approaches were projects which were supported by donors like the World Bank and USAID, and attempted to alleviate poverty. However, these approaches had little impact in improving rural incomes and strengthening research – extension- farmer linkages. Major setbacks were the coercive nature of the villagisation programme and incompatible extension packages to local farming conditions. Other setbacks were top – down bureaucratic planning of extension and the overall lack of active involvement of farmers in decision making processes.

Between 1972 and 1984, the Tanzanian government decentralized extension services without commensurate efforts to coordinate the ministries responsible for the development of the agricultural sector. This move weakened research – extension – farmer linkages. For example, during this period, administration of extension was transferred to the Prime Minister's Office and most extension officers were reassigned administrative duties. According to Mattee (1989), this move shifted the control of district and regional agricultural officers from the Ministry of Agriculture to District and Regional Development Directors. Due to this unfavourable situation, the Tanzanian government introduced the National Agriculture and Livestock Extension Rehabilitation Project (NALERP) and the National Agriculture and Livestock Research Project (NALRP) in 1980s supported by the World Bank. Conclusion of these projects was followed by second

phases of the same projects namely the National Extension Project Phase II (NAEP II) and the Tanzania Agricultural Research Project Phase II in the mid 1990s. These projects enhanced farmers' roles in research and extension linkages through group and committee meetings, on farm trials, workshops and agricultural shows (URT, 2000a).

In 1999, extension services were decentralized (decentralisation by devolution) and were placed under Local Government Authorities (LGAs) under the President's Office - Regional Administration and Local Government (URT, 1995 and 2000b). Decentralisation affected extension services and led to low uptake of technologies by farmers because LGAs inherited demoralised extension staff and lacked expertise and working facilities. In addition, Local Government Act of 1982 made education, health, roads and water as LGAs obligatory functions while agriculture was considered non obligatory. Therefore, most LGAs continued ranking agriculture after these four sectors (URT, 2000b; Rutatora *et al.*, 2008).

In an attempt to strengthen research – extension –farmer linkages the Ministry of Agriculture and Cooperatives appointed Zonal Research Extension Liaison Officers (ZRELO) in all zones in 2000. Thus, from the late 1990s linkage mechanisms initiated were as follows: Internal Programme Review (IPR), Zonal Technical Committee (ZTC), Zonal Executive Committee (ZEC) and the District Extension Steering Committee (DESC). These fora had representatives from research, extension, NGOs and farmers (URT, 1995). Other linkages were on farm trials, quarterly training workshops and seminars - for District Subject Matter Specialists (SMSs), field days, study visits, demonstration plots and agricultural shows. In addition, research adopted the Farming

Systems Approach which later became Farming System Research and Socioeconomics in order to make research participatory and more client oriented (Lema *et al.*, 2003).

During the implementation of the TARP II and NAEP II, performance of research – extension – farmer linkages improved due to functioning of linkage mechanisms in place which brought together researchers, extensionists and farmers. The above linkage mechanisms namely ZEC, IPR, on farm trials and Quarterly workshops functioned up to the end of TARP II and NAEP II in the early 2000s, and then slackened (URT, 2000a). Among the reasons for weak linkages reported by a Task Force on Extension Reform (URT, 2000b) and the first National Workshop on Linkages (URT, 1995) included the following:

- Restructuring of the Ministry of Agriculture and Cooperatives (MAC), the deployment exercise and retrenchment within MAC and other ministries. This exercise coupled with the Government's freeze on employment, deaths, abscondment and poor remuneration left few and demoralised extension staff to cover extensive work areas;
- poor coordination among the Agricultural Sector Lead Ministries (ASLMs) as well as between research and extension departments;
- improper coordination and little collaboration between the MAC and other extension providers;
- over dependence on donors for implementation of research and extension programmes which led to lack of sustainability upon conclusion of donor funded projects;
- inadequate funding to support linkage activities;

- lack of understanding among researchers and extensionists of the concept of farmer - extension – research linkage which made them to cling to the traditional paradigm of research – extension – farmer linkage which relegates the farmer to a receiver instead of a source of the linkage process; and
- inefficient support services like seed multiplication system, input supply, agricultural markets, communication infrastructure and credits.

The above factors led to inefficient and unsustainable research – extension – farmer linkages, by reducing the number of frontline extension staff and demoralising researchers and extensionists. Other effects were slowing down implementation of linkage activities and creating a non enabling environment to farmers for adoption of technologies.

Research and extension are among public services addressed by the Local Government Reform Programme (LGRP) which was launched in the late 1990s. The LGRP's main goal is to contribute to the Government's efforts of reducing the proportion of Tanzanians living in poverty (URT, 2008c). Its purpose is to improve quality, access and equitable delivery of public services. ASDS and ASDP are the implementation tools towards this endeavour to bring research and extension services closer to people at grassroots. ASDP is implemented at two levels at national level and district. At national level ASDP is based on the strategic plans of the line ministries while at district level it is implemented by LGAs based on District Agricultural Development Plans (DADPs) (URT, 2006a and Lema *et al.*, 2003).

Implementation of ASDP started in 2006/07 and is geared towards improving management of the Zonal Agricultural Research and Development Institutes (ZARDIs). Based on the ASDP Joint Implementation Review Report (Rutatora *et al.*, 2008), Zonal

Information and Extension Liaison Units have been launched in all seven research zones although the units have not fully taken off. Also, the Zonal Agricultural Research and Development Fund (ZARDEF) was nationally launched in 2008 and its committees, namely the Zonal Steering and Zonal Technical Committees (ZSC and ZaTC) have been formed in all zones. However, operationalisation of CORDEMA, ZARDEF and ZIELUs are still lagging behind due to the following reasons:

- Failure of ASLMs to function as one unit because of lack of a shared vision, strong commitment, linkages and effective coordination among key stakeholders;
- delays in fund release and paying too much attention to stakeholders' sensitisation; and
- frequent changes of Government ministries and reorganisation of government departments.

The slow pace of implementation of ASDP research sub component concerning and especially the operationalisation of CORDEMA, ZARDEF and ZIELU has contributed to the continued weak research – extension – farmer linkages.

1.2 Problem Statement

Research and extension need to collaborate through effective linkages in order to bring about increased agricultural productivity, incomes and poverty reduction. Due to the importance of agriculture in poverty alleviation and in achieving MDGs, the Tanzanian Government has made several efforts to strengthen research – extension – farmer linkages. Such efforts included implementation of World Bank supported extension and research projects (NALERP and NAEP II and, NALRP and TARP II). These projects established linkage mechanisms like committee meetings (ZEC, ZSC and IPR), on farm trials and

quarterly training workshops (URT, 1995). Nevertheless, despite of all these efforts research – extension – farmer linkages have remained weak.

The problem of weak research- extension – farmer linkages is an important issue in many developing countries and a number of studies have been conducted internationally on how to enhance linkages (Agbamu, 2000; Oladimeji *et al.*, 2006). However, no specific studies have been conducted under Tanzanian context although linkage issues have been addressed in a number of reports from workshops and task forces (URT/MAC, 2000a; 2000b; URT, 2003) and recommendations have been advanced. Therefore, the problem of weak linkages still persists and is demonstrated by low agricultural productivity (Lema *et al.*, 2003). As a result, a knowledge gap exists on factors influencing research – extension – farmer linkages.

This study therefore, aimed at investigating on factors influencing research - extension- farmer linkages and eventually recommending strategies for improved linkages which would lead to increased productivity, production and income. Also, study findings are indispensable at this time when the ASDP is in the first years of implementation. This is based on the fact that, ASDP is geared towards improving linkages among stakeholders and increasing farmer influence in determining research agenda (URT, 2006a).

1.3 Justification

The study has identified positive and negative factors influencing research – extension – farmer linkages from researchers, extensionists and farmers. Positive factors enhance linkages while negative factors inhibit linkages. Study findings suggested strategies for addressing negative factors in order to strengthen linkages. These strategies are therefore

expected to contribute towards improved linkages among farmers, extension workers and researchers. Improved linkages mean higher participation of farmers, extension officers and other stakeholders in owning and determining research agenda.

Findings of this study are expected to benefit all linkage partners namely farmers, extension workers, researchers and policy makers. Farmers are expected to benefit through increased technology adoption and improved agricultural productivity and incomes. Likewise, public and private extension services (like NGOs) are expected to benefit from their effective participation in linkage activities like on farm trials and field days by simplifying their work of technology development and dissemination. Similarly, findings are expected to shed light to policy makers, western zone researchers, extensionists, farmers and the ZIELU for valuing relationships and partnerships for strengthening of linkages. Finally, study findings are expected to assist in planning for stronger coordination between extension and research and among ASLMs and for more efficient implementation of ASDP at national level and DADPs at LGA level.

1.4 Objectives

1.4.1 General objective

The overall objective of the study was to assess factors influencing research- extension – farmer linkages in the western zone of Tanzania, namely Tabora and Kigoma regions.

1.4.2 Specific objectives

Specific objectives of this study were to:

- i. describe existing research –extension – farmer linkage mechanisms in the western zone;

- ii. identify innovative research – extension – farmer linkage mechanisms in the zone;
- iii. identify and describe factors enhancing and/or impairing linkages among research, extension and the farming community; and
- iv. determine ecologically sound strategies for strengthening research- extension – farmer linkages on a sustainable manner.

1.5 Conceptual Framework

The conceptual framework of this study (Figure 1, page 14) demonstrates positive and negative factors influencing research – extension – farmer linkages. Positive and negative factors are independent variables while linkages are dependent variables. Positive factors enhance partners' participation whereas negative factors inhibit partners' participation in linkages activities. Positive factors facilitate communication and enhance contact among researchers, extension workers and farmers through joint implementation of linkage activities. Positive factors include the following:

- Innovative mechanisms like Information Communication Technologies (ICTs) such as internet and cell phones which allow fast information exchange and contacts among partners (Munyua *et al.*, 2002);
- Government policy initiatives like extension and research projects (NAEP II and TARP II), Agricultural Sector Development Programme (ASDP) and National Agricultural Policy of 2008. Implementation of these policies requires involvement of target communities and other partners through participatory approaches (URT, 2000b; 2008b); and
- informal contacts like farmer – farmer contacts (mutual farmer visits) and farmer – researcher contacts during formal linkage activities such as PRAs facilitate

technology dissemination and diffusion and enhance linkages (CIESIN, 1993; FAO,1997).

On the other hand, negative factors limit ability of researchers, extensionists and farmers from full participation in implementation of linkage activities such as on farm trials.

Negative factors include the following:

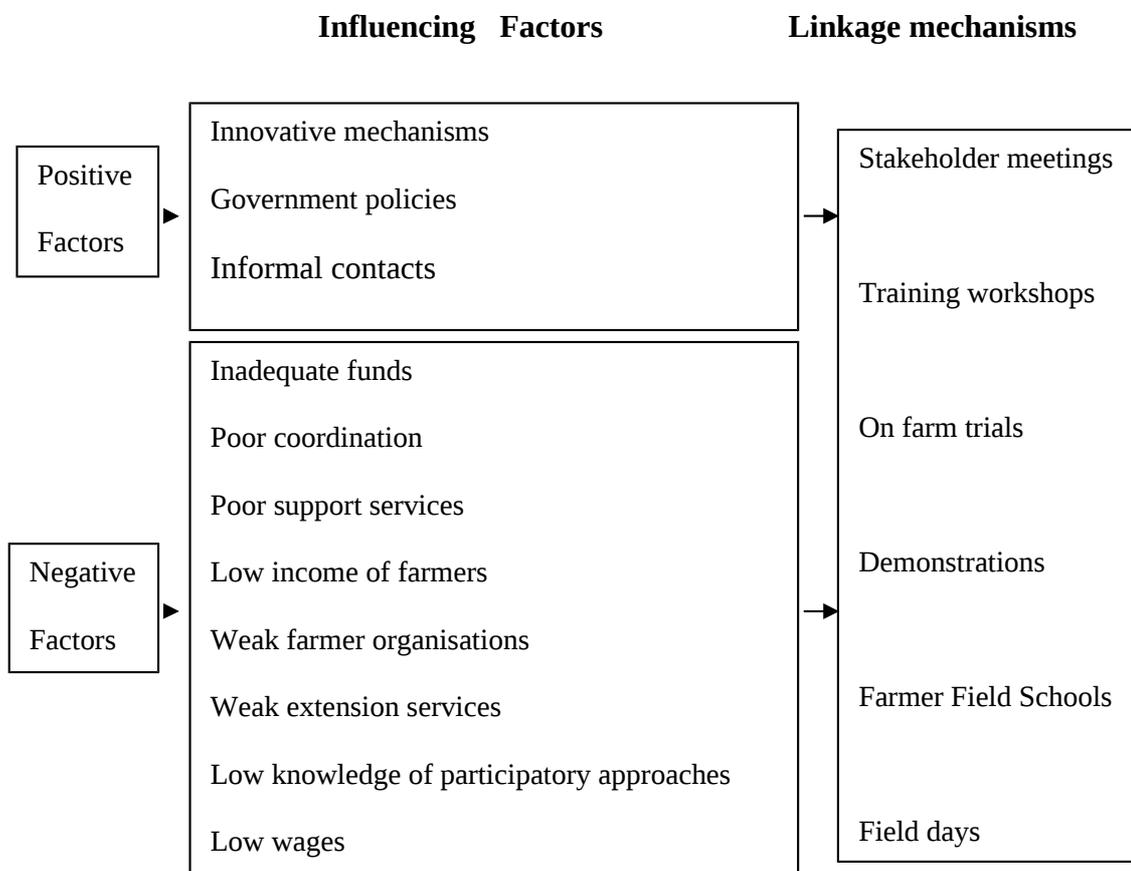
- Poor coordination between research and extension departments of MAFC as well as among the five Agriculture Sector Lead Ministries –ASLMs. The ASLMs are namely Ministry of Agriculture Food Security and Cooperatives -MAFC, Ministry of Livestock Development and Fisheries –MLDF and Ministry of Water and Irrigation-MWI. Other ministries are Ministry of Industries, Trade and Marketing -MITM and Prime Minister’s Office – Regional Administration and Local Government –PMO RALG (URT, 2003);
- inadequate funds for supporting participation of partners in linkage activities, in the whole process of technology generation and dissemination (URT,1995; URT, 2006b);
- poor support services (like credit, input supply and rural infrastructure like roads), low income of farmers and high prices of inputs. These deny farmers’ access to inputs (seeds and fertilisers) and competitive markets therefore limit their capacity to adopt technologies and reduce their morale for participating in linkages (URT, 2006a);
- low level of education of farmers particularly inability to read and write as this limits their capacity of effectively participating in linkage activities like on farm trials (Oladimeji *et al.*, 2006);

- weak farmer organisations and cooperatives reduce farmer influence on and demand for extension and research services and affects their participation in linkages (URT, 2006b);
- weak extension services like few extension staff and inadequate facilities like transport reduces number of farmers covered by extension services (URT, 2006a);
- low knowledge of participatory approaches among extension staff make them play instructive role instead of facilitative role thus suppressing farmers' active participation in linkages (FAO,1997); and
- low wages of extension workers which makes them to engage in other income generating activities which reduces their time for linkage activities and diminishes their work morale (Rivera *et al.*, 2005).

On the other hand, dependent variables are linkage mechanisms which include the following: research planning and review meetings (like Internal Programme Review –IPR and Zonal Executive Committee – ZEC), PRAs and quarterly training workshops. Other linkages are on farm trials, demonstrations, Farmer Field Schools (FFSs), field days and exchange visits.

The following illustration in Figure 1 gives a summary of positive and negative factors influencing research – extension – farmer linkages.

Figure 1: Conceptual Framework of Factors Influencing Research -Extension - Farmer Linkages



Source: Adapted from Mlozi (2004)

In summary, the first chapter briefly presented the background to the study problem which includes importance of agriculture to Tanzanian economy, evolution of research – extension – farmer linkages, study objectives and the conceptual framework.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

This chapter reviews relevant literature pertaining to the study. It reviews aspects like the concept and importance of research - extension - farmer linkages, linkage principles, linkage mechanisms, linkage studies and factors influencing linkages.

2.2 The Concept and Importance of Research – Extension – Farmer Linkages

The concept of research – extension – farmer ‘linkages’ refers to structured collaboration, communication and working relationships among stakeholder organisations. It is based on achieving shared objectives and diversifying sources of income (Agbamu, 2000; Peterson, *et al.*, 2001). Linkages, are further elaborated by Seegers and Kaimowitz (1989) cited by Munyua *et al.* (2002) that may be officially sanctioned and follow specific patterns or they may be informal based on personal relationships.

Research – extension – farmer linkages started with agricultural extension in the United States of America (USA) in the early 1900s. Agricultural extension involved extending agricultural education to the general public and later to farming communities as a non-formal education. Later, the Land Grant Colleges (LGC) Act was enacted under which research, extension and training were placed under one umbrella and shared personnel thus linkages were inbuilt. Due to success of LGC in the USA colonial powers transferred the LGC system to Africa and other developing countries however, research and extension were separate. In those years, research and extension mostly served large scale farmers producing export crops. Small scale farmers involved in the production of those crops

were minimally served with research and extension and it was through a top down and coercive approach (Shumba *et al.*, 1990).

After independence, research and extension remained separate. Flow of information under successive extension approaches (Transformation, Improvement, Commodity and Training & Visit) was unidirectional and top down from research to farmers. In all these approaches linkages were weak with little involvement of farmers in research and extension programmes. Criticisms to the linear top down approach led to the evolution of participatory approaches from 1990s like the Farming Systems Approach (FSA), Farmer Research Groups (FRGs), Farmer Extension Groups (FEGs) and Farmer Field Schools (FFS). These participatory approaches placed emphasis on farmers' involvement through the Participatory Technology Development and Dissemination (PTDD) (Kirway *et al.*, 2003).

With the concept of research – extension – farmer linkages in mind, importance of linkages can be summarised as follows:

- Connect researchers who generate new technologies with extensionists who communicate the technologies to farmers (FAO, 1997);
- ensure formulation of research agenda based on problem identification and prevailing socio-economic and ecological environment and makes research more relevant;
- facilitate the technology dissemination process and adoption (Kirway *et al.*, 2003);
- ensure fast feedback through exchange of information which plays a very important part in the technology transfer process (Mensah, 1999);

- facilitate communication through direct connection of researchers, extensionists and farmers in implementation of linkage activities like on farm trials and field days;
- improve resource use through coordination and collaboration of linkage partners in activities; and
- increase active farmer involvement at all levels of Participatory Technology Development and Dissemination (PTDD) (Swanson, 1996; FAO, 1997).

2.3 Principles for Effective Research – Extension – Farmer Linkages

In order for research – extension - farmer linkages to be effective FAO (1997) identified important principles as follows:

- the groups or institutions should have a shared vision;
- all parties should perceive as advantageous to participate in linkage activities;
- there should be proximity of location among the groups;
- the linkage activities should be compatible with other activities of each group;
- there should be rewards for individuals participating in linkage activities; and
- there should be effective communication and free flow of information.

In Tanzania, according to a Task Force Report on Extension Reform (URT, 2000a), research –extension – farmer linkages were formally initiated under NALERP in the 1990s. Linkages were based on a common decision pertaining to the following issues:

- agreement on the types of farmer problems that would be solved by researchers;

- researchers would communicate solutions to extensionists who would in turn deliver them to farmers as recommendations; and
- extensionists would convey feedback of adoption results by farmers together with fresh issues and problems to be worked upon by researchers and the cycle would continue.

The above process was based on the Training and Visit extension approach, which used the linear transfer of technology (ToT) model – a supply driven and top down approach. Under this approach, linkages involved researchers communicating solutions to extensionists who delivered the solutions as recommendations to farmers. Extensionists conveyed feedback of results of farmers' adoption of recommendations to research plus new issues and problems for researchers to work on and the cycle continued. In the above linkage set up, three important aspects were lacking and these are as follows:

- limited proximity between researchers and extensionists caused by their belonging to different ministries. In addition, this was aggravated by poor coordination at all levels;
- the absence of rewards for outstanding performance in linkage activities exhibited by researchers, extensionists and farmers; and
- little involvement of farmers in technology generation and dissemination and little follow up of technology field performance by researchers (URT, 2000a; 2000b).

However, the Ministry of Agriculture and Cooperatives (MAC) in the late 1990s decided to make farmers have a more pro-active role in technology generation and dissemination, and thus make the process participatory. Increased farmer involvement meant that the linkage paradigm should change from a research –extension- farmer into farmer –

extension- research meaning that the whole process should begin with the farmer. Thus, the MAC during implementation of the National Extension Project phase II (NAEP II) decided to follow a multi -pronged approach which involved use of farmer groups in place of individuals. The approach also involved strengthening the regular research – extension institutional interface through committees and meetings and basing all research on the Farming Systems Approach (FSA) (URT, 2000b).

Besides the measures taken by the MAC that aimed at increasing farmers' involvement and making technology generation and dissemination participatory, research - extension - farmer linkages remained much the same. Linkages continued to be weak and the practice was “business as usual”. Kirway *et al.* (2003) cited the following reasons for this situation:

- The attitude of most researchers stresses scientific values and their orientation to clients needs is weak;
- institutional performance systems for researchers do not generally reward those who work with end – users and does not make researchers accountable to clients;
- researchers generally lack the skills to explain their work to farmers in simple terms;
- lack of funds for financing effective participation of stakeholders in research bodies; and
- researchers do not take much consideration about farmers' concerns like marketing, input supply, credit and processing. In most research institutes, socio – economic and policy research is very weak.

According to Kirway *et al.* (2003), the intention of making technology generation and dissemination participatory fell short as it remained much of the ToT linear model. Following the above deficiencies of the ToT model in promoting farmers' involvement and effective research – extension – farmer linkages, there evolved participatory technology development and dissemination approaches from the 1980s. These approaches were like the Farmer First Approach (FF) by Chambers, Pasey and Tripp (1989) and the Participatory Extension Approach (PEA) by Hagman *et al.* (1998) both cited in Kirway *et al.* (2003). Both FF and PEA emphasized on involvement of farmers as active collaborators in the development of technologies and diffusion.

2.4 Linkage Mechanisms

Linkage mechanism is the concrete procedure, regular event, or channel which bridges the gap between components of the system and allows communication between them. Various literature (Swanson, 1996 and FAO, 1997) classify research – extension - farmer linkage mechanisms into two basic types namely organisational and managerial. Organisational linkage mechanisms involve structural modification of research and extension organisations involved in an Agricultural Technology System (ATS). Organisational linkage mechanisms include the following:

- Formal merger of research and extension to avoid duplication of activities like the US Land Grant Model which combines research, extension and training. Another such merger is in South Korea where research and extension are under one institution (Agbamu, 2000; Doamekpor, 2005); and
- creation of a coordination position such as a research-extension liaison officer and establishment of permanent committees with representation from member units.

In Tanzania, one of the important organisational linkages implemented was the creation of Zonal Research Extension Liaison Units in 2000 to coordinate research –extension – farmer linkages. Previous organizational linkages implemented in the late 1990s were the establishment of zonal research management committees namely Zonal Executive Committees (ZEC) and Zonal Technical Committees (ZTC). Other committees were District Extension Steering Committees (DESC) which had representatives from linkage partner groups (URT/MOA and ISNAR, 1992). Besides all these attempts research – extension – farmer linkages did not perform to a satisfactory level. Poor performance of linkages was mainly caused by resource limitation and restructuring of the Ministry of Agriculture. Other reasons were staff transfers, retrenchment and demoralisation of the few staff who remained due to poor remuneration (URT, 2000a; ADB, 2004).

On the other hand, the major types of managerial linkage mechanisms identified by Swanson (1996) and FAO (1997) are collaboration of research and extension on joint planning, implementation and review of programmes. Such activities could be Participatory Rural Appraisal (PRA) to assess farmers' technology needs, on-farm trials and demonstrations. Through collaborative programmed activities research and extension personnel develop a positive professional relationship which facilitates the flow of technology and feedback information. In the Tanzanian context, such managerial linkage mechanisms were Internal Programme Reviews (IPRs), quarterly training workshops and stakeholder meetings (Lema *et al.*, 2003).

2.4.1 Linkage mechanisms in the Western Zone

In the western Zone, the above linkage mechanisms (organisational and managerial) basically functioned during the implementation of TARP II (from mid 1990s to 2003/2004) and their performance was as follows:

- Zonal Executive Committees and Zonal Technical (ZEC and ZTC): These committees met annually and four ZEC and four ZTC meetings were held between 2000 and 2004. During this period ZEC reviewed and approved over 30 new research plans and progress reports while ZTC reviewed technical aspects of research projects. ZEC members included RAS for Tabora Region, representatives of District Executive Directors (DEDs), NGOs, farmers and DALDOs while ZTC was composed of scientists from research, extension and NGOs;
- District Extension Steering Committees (DESC): These committees were composed of all relevant departmental heads and all extension providers in the district. However, in many districts not all extension providers were involved and the committees did not function as planned and their reports were not submitted to the Zone and Ministry of Agriculture and Cooperatives (MAC) headquarters. DESC did not function as expected due to low priority given to the agricultural sector by LGAs;
- Internal Programme Review (IPR) meetings: Three IPR meetings were held between 2000 and 2003 and reviewed and approved research plans and progress reports. IPRs were attended by representatives from Central Government Departments in the zone like Regional Agricultural and Livestock Advisors (RAAs & RLAs), Irrigation, Veterinary Investigation Centre (VIC) and researchers. From LGAs participants were farmers, DALDOs, NGOs and Agribusinesses;

- Quarterly Training Workshops (QWs): These workshops were conducted for District Subject Matter Specialists (SMSs) and facilitators were researchers and other scientists from the zone and outside the zone. A total of 10 QWs involving about 290 extension workers were held in Tabora and Kigoma regions between 2000 and 2004 (ZDRD/WZ; 2001 – 2004);
- Stakeholders' workshops: Two stakeholder workshops were held in Tabora one in 1995 and another in 2001 with 45 and 70 participants respectively, up to the end of TARP II. Participants of the workshops included researchers, extensionists, administrators, farmers, NGOs and members of agribusiness. The first workshop set research priorities while the second workshop passed three resolutions namely (1) research agenda to be determined by farmers' problems (2) research to increase focus to Kigoma Region and (3) Local Government Authorities (LGAs) to contribute Tanzania shillings (TZS) 3 million annually to the Zonal Agricultural Research Fund (ZARF) (ZDRD/WZ; 2005); and
- On farm trials, demonstrations and field days: These were conducted from 1980s in Tabora Region while Kigoma Region was involved from 2001. About 31 on farm trials were conducted in the zone between 1999 and 2004 involving over 2 533 farmers including about 531 women in crops, livestock, soil and Agroforestry technologies. In addition, over 7 600 other farmers were reached in the same period through field days, seminars, video and agricultural shows (ZDRD/WZ; 2001 – 2004).

Generally, performance of the above linkage activities was low. For instance, IPR and ZEC meetings ceased and over 50% of on farm trials stopped from 2004, while QWs were not held quarterly as required even during implementation of NAEP II and TARP II

projects. The basic reason for this low performance was inadequate and irregular funding. On the other hand, LGAs did not fully honour their resolution to contribute to ZARF. Total contribution for the whole duration of the fund (2002 to 2007) amounted to TZS 19.8 million, about 22 % of the total amount expected. LGAs attributed their failure to contribute to the Central Government's decision to abolish most of their levies (labelled as nuisance taxes) which reduced Councils' internal revenue sources (ZDRD/WZ, 2005).

2.4.2 Innovative research – extension – farmer linkage mechanisms

The word “innovate” according to the Concise Oxford English Dictionary means to make changes in something already existing as by introducing new methods, ideas, or products (COD, 2001). Innovative research – extension – farmer linkages therefore are new or different linkages from those practised by partners. From this understanding, innovative linkages may be formal or informal. According to FAO (1997) and Munyua *et al.* (2002), formal linkages are linkages that are specified, agreed to by organisations and are to an extent institutionalized like joint research committees and meetings. In contrast, informal linkages are direct person-to-person contacts, based on the need for collaboration between individuals. Informal contacts occur when farmers participate in formal linkage activities like PRA, on farm trials and field days and get opportunities to articulate technological needs and concerns. However, to become demand driven research and extension personnel must be listening to what farmers are communicating through both formal and informal linkage mechanisms.

Linkages serve as information sources for both research and extension however, it is well documented that research-extension –farmer linkages in developing countries are weak (Agbamu, 2000; Doamekpor, 2005; FAO, 1997). Due to this weakness in linkages,

researchers and extensionists do not get adequate and continuous information for their purposes. Based on this fact, Munyua *et al.* (2002) and Kimenye (2006) suggested that alternative or innovative linkages were important sources of information to fill in the gap left by the weak linkages.

Some of these innovative linkages that can be useful in bridging the information gap for researchers and extension workers are explained as follows:

- Informal farmer to farmer communication: This forms the major source of technology dissemination in the same village and neighbouring villages where technologies are developed. Antholt (1992) cited by CIESIN (1993) found that informal indigenous communication systems in agricultural communities worked incredibly well for the spread of farmer-selected rice and cotton varieties in India. Informal farmer to farmer communication was also reported by a Survey Report of farmers participating in on – farm research in the western zone of Tanzania (URT, 2004a). This report showed that collaborating farmers were sharing research results with their neighbours through informal discussions and visiting research plots. Among technologies involved were maize varieties and Agroforestry; and
- Evaluation and dissemination of indigenous technical knowledge: Rural people are an important source of knowledge for agricultural development. Researchers and extension workers are thus encouraged to assist in evaluating and disseminating this knowledge (Van Crowder *et al.*, 1999 cited by Munyua *et al.*, 2002). Along this understanding, researchers in collaboration with extension workers in the Western zone conducted surveys on indigenous fruits and medicinal trees. These surveys identified over 20 edible fruit tree species and 228 livestock medicinal trees. The zone developed indigenous fruit processing technologies for juice, jam

and wine and disseminated the technologies to more than 2 500 farmers, who now earn income out of this business. In addition, the four most promising indigenous fruit trees and three species of most common medicinal trees were propagated at ARI Tumbi for further research (ZDRD/WZ, 2006).

From the above evidence, it can be argued that innovative linkages have potential to improve the current weak research – extension – farmer linkages in the Western zone, Tanzania and other developing countries. What is needed is making effective use of existing potential sources of information and communication channels. Both research and extensionists should be encouraged to utilise existing communication channels like market days, local women societies and cooperative market points for technology dissemination. Furthermore, researchers and extensionists should use information communication technologies (ICTs) like cell phones and internet for accessing and disseminating technological information. However, success of this requires commitment of all partners and recognition of each other as equal partners in technology development and dissemination (Munyua *et al.*, 2002).

2.5 Linkage Studies

A number of studies on research – extension - farmer linkages have been conducted in developed and developing countries. Some of such studies are by Seegers and Kaimowitz (1989), Agbamu (2000), Oladimeji *et al.*, (2006) and Doamekpor (2005; 2006).

2.5.1 Linkage studies in developing and developed countries

Agbamu (2000) for instance, studied research extension linkage systems in seven countries namely Indonesia, Japan, Mexico, Nigeria, South Korea, Tanzania and Thailand. This

study focused on identifying existing linkage systems and how they could be enhanced and results indicated the following:

- Japan: Research – extension linkage system was strong based on decentralised research and extension organisations. Research and extension organisations had equal status and operated at state level using bottom up management approach. Decision making was through committees which involved researchers, Subject Matter Specialists (SMSs), extensionists, farmer representatives, administrators and knowledgeable people. Linkages were through Subject Matter Specialists, technical committees and staff exchanges between state research and extension organisation;
- South Korea: Research and extension were under the same institution and had equal status so linkages were easier. However, linkages with lower levels were weak because decision making followed a top down management approach. Final decisions on research themes and research – extension linkages were made at national level by researchers, SMSs and other officers. Research – extension linkages were through joint evaluation committees and on - farm adaptive experiments;
- Indonesia, Mexico, Nigeria, and Tanzania: These countries had weak research – extension linkages due to unequal status of research and extension organisations. In addition, these countries applied top down decision making process in determining research and linkage issues. However, Mexico was an exception as it had strong participation of farmers’ cooperatives in decision making on linkages. Research – extension linkage mechanisms found in these countries included joint committees, annual meetings, quarterly technology review meetings and joint activities like on farm trials; and

- Thailand: This country had no systematised research – extension linkages. There were neither joint on farm trials nor farmer participation. Each department of the Ministry of Agriculture and Cooperatives (agriculture, fisheries, extension, livestock, irrigation and forestry) had its research institutes administered separately.

The study recommended policy changes, institutional reorganisations and strengthening of research and extension institutions for strengthening linkages in the six countries.

Further, two consecutive studies were conducted in Volta Region in Ghana by Doamekpor (2005; 2006). One study was on effectiveness of research – extension linkages while another was on the communication link of research – extension – farmer interface. These studies found that linkage mechanisms that fostered effective links were field days, result and method demonstrations, personal contacts and participatory training workshops. Other linkage mechanisms were on farm trials, farm visits, monitoring tours, planning workshops and meetings with farmer groups. Nevertheless, the studies found that linkages were weak due to inadequate communication skills among extensionists and researchers and economic inability of most farmers to implement research findings. Consequently, the studies recommended training in communication methods for extension and Research Extension Linkage Committee personnel and increased funds for linkage activities. Another recommendation for strengthening linkages was supporting farmers with cost effective inputs to enhance adoption and diffusion of technologies.

Another linkage study in South - Western Nigeria was reported by Oladimeji *et al.* (2006). This study examined the research–extension–farmer linkage system to establish reasons for failure of agricultural extension services reaching many farmers. Results showed that

existing linkage mechanisms were Small Plot Adoption Testing (SPAT), training, group meetings and identification of problems for research. Other linkage mechanisms identified were field days and technical committees. Despite all these linkage mechanisms, linkages were weak because the study found uneven participation of the three partners as follows: extension workers were involved by 68%, researchers were involved by 44 % while farmers were involved by 39%. The reasons for uneven participation were as follows:

- inefficient planning of research institutes and extension organisations which led to inadequate participation of farmers in problem identification, priority setting and technology evaluation;
- differences in institutional mandate and focus between research institutes and extension organisation, which caused low participation of researchers in linkage activities.

The study concluded by emphasising closer collaboration and involvement of all linkage partners namely researchers, extension workers and farmers in the whole process of technology development and dissemination.

In another earlier work, Seegers and Kaimowitz (1989) reported a study on linkages from surveys which were conducted in 18 different countries from Asia and Oceania, Latin America and the Caribbean, Africa and the Middle East. Focus of this study was on the differences between research – extension linkages in developed countries like Australia, Israel and Taiwan with those of developing countries like Indonesia, Jamaica and Tanzania. Findings indicated that, linkage mechanisms between researchers and extensionists in both developed and developing countries were meetings, training, joint participation in trials, field days and demonstrations. However, developed countries had stronger extension systems and more direct personal contacts between researchers and

extension workers compared to developing countries. Therefore, linkage mechanisms were stronger in developed countries and weaker in developing countries. Some of the reasons for the strong linkages in developed countries were as follows:

- high education level of extension workers;
- extension services have input into determining research problems; and
- researchers and extension workers place great importance on joint activities like trials.

Likewise, the study pointed out some of the major reasons for the weak research – extension linkages in developing countries. These reasons were the negative attitude researchers and extension workers have about each other and great educational differences between them. The report concluded by recommending the following for improving linkages between researchers and extension workers in developing countries:

- researchers should perceive extension workers as competent;
- extension staff should get more training and incentives;
- research should emphasize farmers' problems in their research work;
- there should be more on farm research; and
- research should get more input from farmers and extension workers.

2.5.2 Linkage studies in Tanzania

Unfortunately, there is paucity of linkage studies in Tanzania. Nevertheless, linkage issues have been addressed at various Ministry of Agriculture fora such as workshops, meetings, surveys and task force review reports. Based on such ministerial reports (URT, 2000a and 2000b; Lema *et al.*, 2003), from pre colonial era to 1980s research - extension - farmer

linkages were limited and mostly informal. Both research and extension did not adequately involve farmers in their technology development and dissemination leading to low technology adoption rates. For instance, survey reports in the Western Zone found that less than 30 percent of farmers collaborating in on farm trials were involved in problem identification and research planning (Semgalawe *et al.*, 2002 and URT, 2004a).

From above, formal research -extension - farmer linkages, according to a Staff Appraisal Report for the NALERP, cited by the Task Force on Agricultural Extension Reform (URT/MAC, 2000) were initiated under NALERP in the early 1990s. According to URT (1995) the linkage, perceived to be interactive, was aimed at making the research process and products more relevant to farmers' needs. This aim was supported by the adoption of Farming Systems Approach (FSA) in agricultural research. Along this objective, senior research and extension managers held two successive meetings in 1992 (in Morogoro) and in 1993 (at Kibaha) and discussed on improvement of research – extension linkages.

The meeting in Morogoro produced a memorandum of understanding (MoU) between the Heads of Research and Extension Departments for improving research – extension linkages. Important elements of the MoU were provision of resources for linkages, formation of a National Technical Recommendation Committee (NTRC) and formalising collaboration at field level. Furthermore, the Kibaha meeting made recommendations for strengthening linkages which included conducting at least two national level coordination meetings per year. It was also recommended to hold discussions of linkage activities in the Zonal Technical Committee (ZTC) meetings and in the regional bi- monthly workshops. Other recommendations were on better coordination of NGOs and formation of Zonal Technical Recommendation Committees (URT, 1995).

Besides the above recommendations and memorandum of understanding, actual research – extension linkage mechanisms were as follows:

- At national level, linkages were through participation of the Assistant Commissioner for Extension Services in National Agricultural Research Council (NARC) meetings;
- at Zonal level, linkages were through participation of Regional Extension Officers in Zonal Technical Committees, Zonal Advisory Committees and zonal research priority setting meetings and participation of researchers and extensionists in agricultural shows;
- at regional level, linkages were through participation of researchers in bi – monthly workshops; and
- at field level, linkages were through involvement of Village Extension Officers (VEOs) in research activities like diagnostic surveys, on - farm trials and field days.

The above linkage mechanisms basically continued under NAEP II though with some modifications. Thus, Quarterly workshops replaced bi- monthly workshops and Internal Programme Review (IPR) and Zonal Executive Committee were introduced which involved research, extension, farmers and NGOs and, stakeholders' meetings. Another significant initiative for strengthening linkages was the appointment of Zonal Research Extension Liaison Officers to coordinate linkage activities and technology dissemination (URT, 1995; 2002b; Lema *et al.*, 2003).

Despite all the initiatives to strengthen research – extension – farmer linkages the country still experienced weak linkages, because not all planned linkage activities were fully implemented. The first National Workshop on Linkages identified two main reasons for

weak linkages namely inadequate funds and insufficient time for partners to communicate with each other (URT, 1995). In addition, Mbilinyi and Nyoni (2000) identified two other reasons for weak research – extension – farmer linkages. The first reason was inadequate involvement of farmers and other stakeholders in the process of technology development, evaluation and dissemination while the second reason was external financial dependency for implementation of most Tanzanian development projects. Consequently, there has been failure of farmers to internalise and own the research process. Another failure has been lack of control of the required resources hence the sporadic nature of implementation which leads to lack of sustainability upon end of donor support.

Potential alternatives to improve the linkage situation could be the following:

- Increased farmers' voice in the research process, this could be through formation and strengthening of farmers' organisations which influence demand for and own research and extension services;
- change of attitude among researchers and extensionists to be listening and responsive to what farmers communicate through formal and informal linkages (Swanson, 1996);
- decreased dependency on external funding and increased internal funding of linkage activities (Mbilinyi and Nyoni, 2000; URT, 2002b);
- promotion of informal linkages between researchers and extension workers with farmers which are less costly, along with formal linkages (FAO, 1997; Seegers and Kaimowitz, 1989);
- institutionalisation of the IPR at zonal level and more involvement of key stakeholders like NGOs, extension, development partners and farmer organisations in the planning process (URT, 1995); and

- strengthening of linkage between research and policy support systems by providing field level data to help planners in the design of appropriate policy support systems (URT, 1995).

Currently, some of the existing linkage mechanisms have been reformed in line with the Agricultural Sector Development Programme (ASDP) as follows:

- Zonal Steering Committee (ZSC) has replaced Zonal Executive Committee (ZEC). ZSC is responsible for the management of Zonal Agricultural Research and Development Fund (ZARDEF);
- ZARDEF Technical Committee (ZaTC) has replaced Zonal Technical Committee (ZTC) and is responsible for research priority setting and technical review; and
- Zonal Information and Extension Liaison Unit (ZIELU) has replaced Zonal Research Extension Liaison Unit (ZRELU). ZIELU is responsible for assembly, assimilation and dissemination of relevant agricultural knowledge and information and for linking with LGAs, farmers, ASLMs and other institutions (URT, 2006a).

It appears changes made in linkages are not based on sound research. It is just a question of trial and error and being dependent on source of funding. In future, changes in linkages should be informed by scientific research.

2.6 Factors Influencing Research – Extension – Farmer Linkages

Research – extension – farmer linkages are influenced by two types of factors namely positive and negative factors which enhance and inhibit linkages respectively. These factors are identified and explained in the ensuing sub sections.

2.6.1 Positive factors

Literature on research – extension – farmer linkages has identified several positive factors which enhance research – extension - farmer linkages as follows:

- Decentralization of both authority and resources: Decentralisation of authority and resources concerning research and extension was found to bring about strong linkages in Japan. In this decentralisation, decision making and implementation of all linkage activities are made by representatives of all partners (researchers, extensionists and farmers). In Tanzania, decentralisation of research and extension were implemented in 1989 and 1999 respectively. However, the Tanzanian decentralisation did not lead to stronger linkages because research and extension had inadequate managerial and organisational capacity building (Lema *et al.*, 2003; ZDRD/WZ, 2006);
- Institutionalization of participatory approaches: In Senegal and Zimbabwe, institutionalisation of On Farm Client Oriented Research (OFCOR) or Farming Systems Research (FSR) promoted research -extension -farmer linkages (FAO, 1997). In the case of Tanzania, Farming Systems Approach (FSA) was instituted in research in 1996. FSA led to increased involvement of farmers and extension workers in the process of technology development and dissemination (Lema *et al.*, 2003; URT, 2004b). Thus, adoption of participatory approaches in research allows involvement of farmers, extensionists and NGOs in collaborative activities like problem diagnosis, planning, implementation and evaluation of linkage activities. Stakeholders' involvement facilitates adaptation of technologies to local conditions and strengthens linkages.
- Strong farmer organisations: When strong farmer organisations effectively participate in linkage activities they make research responsive to farmers' needs

and improve linkages among partners. For instance, in Mexico farmers' organisations make final decisions on research needs for projects they finance or undertake jointly with government research stations. As a result, these farmer organisations have contributed to strong research – extension – farmer linkages (Agbamu, 2000). However, it is reported that farmer organisations in Tanzania are still faced with weak managerial skills, limited financial resources and poor leadership. In addition, farmer empowerment through groups, networks and fora under ASDP is still lagging behind due to weak farmer organisations (Rutatora *et al.*, 2008; URT, 2008b);

- Informal linkages: Informal linkages are direct person-to-person contacts like direct conversation or through telephone. These contacts happen during linkage activities like PRAs, field days or meetings. During such events, farmers articulate their technological constraints and concerns to researchers and extension workers. Studies conducted in Australia, Israel and Taiwan reported by Seegers and Kaimowitz (1989) found that personal contacts strengthened linkages between researchers and extension workers. In the case of Tanzania, survey findings indicate that there were informal farmer – farmer contacts which enabled sharing of research results between collaborating farmers with their neighbours. This contributed to dissemination of technologies to non collaborating farmers (URT, 2004a).

2.6.2 Negative factors

These are factors which constrain linkages and are responsible for weak research – extension – farmer linkages. Factors inhibiting linkages have been identified in different linkage studies and reports. In this study these factors are as follows:

- Lack of strong and sustainable coordination between research and extension: There has been weak coordination between the Department of Research and Development (DRD) and the Extension Service sub – department of the Department of Crop Development (DCD) of the Ministry of Agriculture Food Security and Cooperatives (MAFC). Linkages between the two departments have been characterised with discrete activities instead of interactive and sustainable coordination. At the same time, there has been weak coordination marked by unclear roles and relationships among the Agriculture Sector Lead Ministries (ASLMs). Ineffective coordination within MAFC and among ASLMs has been caused by lack of change of attitudes and mindsets towards working as an integrated team. Another reason has been the big number of ASLMs and the location of research, extension and other agricultural services in different ministries. This weak and ineffective coordination has slowed down implementation of linkage activities under ASDP and resulted into weak research - extension – farmer linkages at national and LGA levels (Rutatora *et al.*, 2008; URT, 2000a; 2003);
- Inadequate funding of research and extension activities: There has been inadequate funding of research and extension activities in Tanzania. For instance, the ASDP (URT, 2006a) reported that expenditure on research was 0.3% of agricultural GDP and was one of the reasons for weak linkages. Furthermore, URT (1995; 2000a) reported that inadequate funding coupled with donor dependency was the cause of lack of sustainability of agricultural programmes and strong linkages. This finding is further supported by studies conducted in Zambia by FAO (1997) and in Tanzania reported by Lema *et al.* (2003). Inadequate and irregular funding for research and extension causes delay in and unsustainable implementation of

linkage activities like coordination meetings and on farm trials. Such negative trends finally bring about loss of farmers' trust and reduced morale for research and extension activities and weak linkages;

- Local Government Authorities' (LGAs) low priority to agriculture: LGAs accord low priority and low budgets to agriculture besides most of them deriving much of their internal revenues from the sector. LGAs' low investment in agriculture has been cited by several reports like the Task Force on Extension Reforms (URT, 2000a) and the Third Joint Implementation Review of ASDP (Rutatora *et al.*, 2008). Small budgets for agricultural sector means less resources hence inadequate transport facilities, reduced supervision and low implementation rate of planned linkage activities. In combination, these factors result into less coverage of farmers by extension services and subsequent weak research – extension – farmer linkages;
- Weak extension services: It is estimated that about 60 to 75 percent of farm households in Tanzania are out of contact with extension and research services. Inadequate extension coverage is caused by high ratio of extension staff to farm household. According to URT (2006b), the current extension staff to farm household ratio is estimated at 1: 2000 against the agricultural policy objective of 1: 600, about one extension staff per village. Inadequate numbers of extension staff leads to extensive work areas for the existing few extensionists who also lack transport facilities. Findings by URT (2000a; 2006a) disclosed that few numbers of extension staffs was caused by retrenchment of some extension staff and freezing of employment in the public service for almost a decade. Failure of extension workers to effectively reach majority of farmers with linkage activities like FFSs limits technology dissemination and is one of the causes of weak linkages;

- Low wages and lack of incentives: Both extension workers and researchers have low wages and have no elaborate incentive package to motivate them. Low wages and lack of incentives demoralise agricultural staff therefore resort to other income generating activities like private farming and petty business to make ends meet. Such tendencies reduce researchers' and extensionists' time for linkage activities like on farm trials and visiting farmers. As a result, linkage activities reach few farmers leading to weak research – extension – farmer linkages Lema *et al.* (2003);
- Lack of participatory communication skills among extension staff: Lack of participatory communication skills limits competence of extension workers in their service delivery. This incompetence makes extension workers apply top -down approaches instead of participatory approaches thus hamper linkages (Agbamu 2000; Doamekpor 2006). Top- down approaches, like T & V extension method are technology or supply – driven rather than demand driven. Studies by ADB (2004) and URT (2000b) conducted in Tanzania found that top –down approaches focused mainly on transfer of technologies and not on empowerment of farmers. These approaches apply one way communication from the extension staff to the farmer. Therefore, there was little interaction among extensionists, researchers and farmers which caused inadequate involvement of farmers in research and extension activities and subsequent weak linkages;
- Failure of extension officers to change their mindsets: Extension workers consider researchers as working under privileged conditions with better facilities and remuneration. On the other hand, researchers think that they are better educated than extensionists hence tend to remain aloof. Isolation of extension and research staff from each other denies mutual trust and equal partnership which are necessary in participatory technology development and for strong linkages. Furthermore, lack

of change of mindsets among researchers has been one of the causes of low involvement of extension workers and farmers in linkage activities. Failure of change of mindsets among researchers and extensionists was reported as one of the causes of weak linkages in Tanzania and Cameroon (Seegers and Kaimowitz 1989; Kirway *et al.*, 2003);

- Lack of collaboration with other agricultural development partners: There has been lack of collaboration between researchers and extensionists with other agricultural stakeholders such as NGOs. Past efforts to collaborate with other agricultural development partners through District Extension Steering Committee (DESC) did not bring much impact (URT, 2000b). Frequent changes of government structure and decentralisation masked the attempt. Furthermore, recent findings by Rutatora *et al.* (2008) still indicate absence of strategic mechanisms for engaging the private sector in extension service delivery through the Public Private Partnership (PPP). Lack of collaboration between research and extension with other agricultural development partners leads to disjointed technical messages, farmers' confusion and weak linkages;
- Lack of support services: Adequate and efficient support services like credit and input supply are necessary to majority of Tanzanian farmers who are poor to enable them to access recommended technologies like seeds and fertilisers for increased production (URT, 2005). Farmers' access to support services like credit and input supply has been difficult in Tanzania since 1980s when the government adopted Structural Adjustment Programme (SAP) and removed input subsidies (Mbilinyi and Nyoni, 2000). Consequently, there has been decreased farmers' demand for technologies, lowered aspiration for participation in technology development and dissemination and weak linkages. In response to this situation,

the government reintroduced input subsidies in recent years for selected regions including Tabora. Nevertheless, observations show that subsidised fertilisers do not reach most resource poor farmers in villages while expensive transport cost obscure the subsidy for rural based farmers;

- Weak Monitoring and Evaluation (M and E) systems: Weak M and E results into failure of correcting implementation mistakes during the process of technology development and dissemination. These failures cause loss of farmers' interest in participating in linkage activities like on farm trials and weak research – extension farmer linkages. Weak M and E was reported in the Third Joint Implementation Review of ASDP and in the Research Medium Term Plan (Rutatora *et al.*, 2008; URT, 2003);
- Limited scale of production: Limited scale of production is caused by lack of mechanisation and small capital investment in farming. Farmers' small scale of production leads to low production and low income. It therefore perpetuates farmers' poverty and lowers their demand for technologies because of failure to afford the accompanied input cost. Low income also lowers farmers' aspiration to participate in linkage activities like trials and results into weak research – extension – farmer linkages (Lema *et al.*, 2003; URT 2006a); and
- Weak farmers' organisations and cooperatives: Weak farmer organisations decrease farmers' collective bargaining power for demanding services like; extension, research, credit facilities and market information. Basically, weak farmer organisations reduce farmers' participation and influence in planning and implementation of linkage activities (Kirway *et al.*, 2003; URT, 2000b). Following weak farmer organisations, farmers fail to communicate their problems to researchers which lead to development of less relevant technologies to farmer

conditions. Another shortcoming of weak farmer organisations is failure to communicate to research and extension regarding results of technology use, hence weak linkages (Peterson *et al.*, 2001).

In brief, the second chapter has reviewed literature on linkages including concept and importance of linkages, linkage mechanisms and positive and negative factors towards linkages. Among negative factors affecting linkages were inadequate funds, weak extension services, and inadequate support services for farmers like credits and input supply.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Overview

The methodology chapter provides description of the study area, research design, study population, sampling procedures, data collection methods and data analysis.

3.2 Description of the Study Area

This study was conducted in the Western Agricultural Research Zone of Tanzania, which covers Tabora and Kigoma regions. The Western zone is one of the seven agricultural research zones under the Department of Research and Development (DRD) of the Ministry of Agriculture, Food Security and Cooperatives. Other agricultural research zones are namely Central, Eastern, Lake, Northern, Southern and Southern Highlands. The Western zone is located in the miombo ecological system in the upland plateau. The zone borders with Kagera and Shinyanga regions in the North and North East respectively, Singida in the East, Mbeya and Rukwa in the South and South West respectively, Lake Tanganyika in the West and Burundi in the North West (Appendix 6).

The Western Zone has a total area of 113 160 km² which is about 13% of the national land area. Major soil types in the zone range from sandy to sandy loams in Tabora Region and from clay loam to heavy clay in Kigoma Region. There are ten districts in the zone, six in Tabora Region namely Igunga, Nzega, Sikonge, Tabora, Urambo and Uyui while four districts are in Kigoma Region namely Kasulu, Kibondo Kigoma Rural and Kigoma Urban. According to Tabora and Kigoma Regional Administrative Secretaries' offices, current estimates of population are 2 258 668 for Tabora Region and 1 740 111 for Kigoma Region. The Western Zone falls in the monomodal rainfall pattern, with an annual rainfall of 700 -800 mm in Tabora Region and 800 -1 000 mm in Kigoma Region which falls between November and April. Altitude ranges from 700 to 2 300 metres above sea level.

Agriculture is the main economic activity in the zone and is undertaken by smallholder farmers. Main food crops in Tabora Region include maize, sorghum, rice, cassava and

sweet potatoes while cash crops include tobacco, cotton, groundnuts and sunflower. In Kigoma Region main food crops include maize, beans, rice, cassava, bananas and sweet potatoes while major cash crops are coffee and oil palm. Livestock keeping is also an important economic activity in the zone and animals kept include cattle, goats, sheep and poultry. Livestock populations for Tabora Region are 2 099 265 cattle, 944 162 goats, 310 339 sheep and 3 215 505 poultry while for Kigoma Region are 111 419 cattle, 275 975 goats, 38 291 sheep, and 917 622 poultry. Furthermore, fishery is another important economic activity, along Lake Tanganyika and River Malagarasi in Kigoma Region (URT, 2004).

The Western Zone has one research centre namely the Agricultural Research Institute (ARI Tumbi) and one Ministry of Agriculture Training Institute (MATI Tumbi). Both institutes are located at Tumbi about 15 km west of Tabora Municipality. ARI Tumbi also hosts the headquarters of the Tobacco Research Institute of Tanzania (TORITA), a parastatal organisation for tobacco research. Thus, ARI Tumbi is the zonal headquarters and is headed by a Zonal Director for Research and Development (ZDRD) assisted by a Zonal Research Coordinator (ZRC). Researchers are organised into three research programmes, namely Crops, Natural Resource Management and Social – economics. There was also a Zonal Research Extension Liaison Unit (ZRELU) from 2001 to 2007 when it was replaced by the Zonal Information and Extension Liaison Unit (ZIELU). The unit is responsible for coordination of technology dissemination and linkages with other stakeholders within and outside the zone.

The Western Zone Agricultural Research Institute has the mandate of developing appropriate technologies and providing solutions to farmers' problems for increasing crop

and livestock productivity and production in Tabora and Kigoma regions. Research activities in the zone follow crop and livestock research priorities which were set by stakeholders in 1995 and were reviewed in 2008. Priority I research crops are maize, rice, banana, cassava, coffee, beans, tobacco and groundnuts while priority II crops are sorghum, sweet potatoes, cotton, oil palm and sunflower. Priority III crops are horticultural crops like avocado, pineapples and mangoes. Research themes for crops are; soil fertility improvement, use of improved seeds, crop management, crop protection, crop processing, improvement of extension services and crop marketing systems. Research priorities for livestock are as follows indigenous cattle, goats and sheep for production of meat, milk, hides and skins and manure and, poultry and pigs for production of eggs and meat respectively. Livestock research themes are production of indigenous breeds, ethno botanical medicines, disease treatment and improvement of marketing systems.

During implementation of the ASDP, the Zonal Information and Extension Liaison Unit (ZIELU) was established in the zone in 2007 after the appointment of the Zonal Information and Extension Liaison Officer (ZIELO) and two other members. However, two more members (crop and livestock researchers) are yet to be appointed. Key functions of the unit include assembly, assimilation and dissemination of relevant agricultural knowledge and information. Other ZIELU functions are linking downwards with LGAs, farmer groups and networks and linking upwards with national level organisations and institutions (URT, 2006a).

Other establishments under ASDP in the zone were the Zonal Steering Committee (ZSC) and the Zonal Agricultural Research and Development Fund (ZARDEF) Technical Committee (ZaTC) in 2007. Besides these developments, CORDEMA, ZARDEF and

ZIELU were not yet fully operational in the zone. Main reasons for slow implementation of ASDP were delay of release of funds and frequent changes of government ministries. Other reasons were reorganisation of MAFC departments and lack of a shared vision and effective coordination among ASLMs (Rutatora *et al.*, 2008).

In building linkages with districts, researchers in the Western Zone had been participating in preparation of District Agricultural Development Plans (DADPs) in three districts namely Uyui, Sikonge and Urambo in Tabora Region. The three districts were implementing the Participatory Agricultural Development and Empowerment Project (PADEP). These districts incorporated researchers in their District Facilitation Teams (DFTs) during implementation of PADEP thus facilitated more linkages. Therefore, researchers participated in the following linkage activities: PRAs, preparation of village project documents, farmers' training, technology demonstrations and field days. The remaining seven districts in the zone which were not implementing PADEP were not involving researchers in preparation of their DADPs due to lack of facilitation.

The Western Zone was selected for this study because it is one of the seven agricultural research zones in the country and research – extension – farmer linkage studies have not been conducted in the zone. Moreover, weak linkages had been cited as among the reasons for the apparent poor adoption of technologies (Simon, 2006). Thus, this study was an attempt to fill the knowledge gap.

3.3 Research Design

This study employed a cross sectional research design. This design allows collection of data from a representative sample of the population at a single point in time (Babbie,

1994; Bailey, 1994). The design is fast and efficient thus offers greater degree of accuracy and cost effectiveness (Kothari, 2004). This design was therefore preferred for this study based on study objectives and its efficiency.

3.4 Study Population

The study population consisted of all farmers and extension workers from Uyui, Urambo, Kigoma Rural and Kasulu districts and all ARI Tumbi researchers who had been involved in collaborative research for a minimum of three years prior to this study. In addition, researchers and extension officers were required to have awareness on research – extension – farmer linkages and the ASDP. These criteria were important to ensure that respondents had the required input for the study.

3.5 Sampling Procedures

Two types of sampling methods namely simple random sampling and purposive sampling were used for selecting respondents for this study. Sampling frame for districts consisted of eight districts in the zone which had ongoing research activities, four districts were from Kigoma Region and four districts were from Tabora Region. Two districts were randomly selected from each region giving a total of four districts for the study. With regard to villages two villages with ongoing research trials were purposively selected from each district giving a total of eight villages. Due to discontinuation of over 50% of on farm trials in the zone after conclusion of TARP II in 2004 few farmers fulfilled the criterion of involvement with research for at least three years prior the study. This affected the sampling frame and sample size of farmers. At district headquarters level, the sampling frame was also affected by the fact that there are designated SMSs who deal with researchers who include DALDO, DEO and two or three other SMSs.

In farmer selection, a sampling frame with 120 farmers from the selected eight villages was prepared and five farmers were randomly selected from each village giving a total of 40 respondents. However, one farmer failed to turn up for interview therefore 39 respondents remained. For selection of extension workers, a sampling frame with a total of 20 extension workers was prepared from district offices and four extension workers were randomly selected from each district giving a total of 16 respondents. On the other hand, eight village extension workers serving the selected villages were purposively selected (one was not interviewed because of accident). Thus, there were a total of 23 respondents from extension. At ARI Tumbi 11 researchers who qualified for the study were all selected. In summary, the study had a sample of 39 farmers, 23 extension workers and 11 researchers that is, 73 respondents.

In addition, five officials from four NGOs which had been collaborating with ARI Tumbi for more than three years, through linkage activities like on farm trials and research committee meetings were interviewed. These NGOs were TACARE and CARE from Kigoma Region and TDFT and AFRICARE from Tabora Region.

3.6 Data Collection Methods and Tools

The study collected primary and secondary data, based on the study objectives. Data collection tools used by the study included interview schedules, check lists and interview guides. Interview schedules were developed and used for personal interviews with farmers, extension officers and researchers. Interview schedules consisted of closed-ended questions for collecting factual data and open – ended questions for obtaining respondents' opinions on linkage issues. The interview schedules were used to collect

primary data like socio demographic characteristics of respondents and existing linkages, while checklists were used during focused group discussions with extension officers and researchers. On the other hand, interview guides were used for interviews with MAFC officials for obtaining data such as initiatives made to strengthen linkages in the past and strategies used currently for strengthening linkages. Interview guides were also used for interviews with NGO officials for collecting data like existing linkages, factors influencing linkages and strategies for strengthening linkages.

Data collection tools were prepared by the researcher and were verified by academic staff from the Department of Agricultural Education and Extension of Sokoine University of Agriculture (SUA). Appendices 1 to 5 indicate the different tools which were used in data collection namely interview schedules, interview guide and checklist.

Besides primary data, the study collected secondary data like historical perspectives of linkages and linkage experiences. Other secondary data were on linkage mechanisms and factors influencing linkages. Secondary data like history and performance of linkages in Tanzania were collected from Western Zonal reports and from reports of the Ministry of Agriculture Food Security and Cooperatives. Other sources of secondary data were books, reports and journals from the Sokoine National Agricultural Library (SNAL) and the internet.

Before the actual data collection exercise, the interview schedules were pretested using representative samples of respondents, to determine clarity, relevancy and adequacy. After pretesting, the interview schedules were revised to incorporate corrections.

3.7 Data Analysis

Primary data collected through closed – ended questions were verified, coded and entered into a computer. Quantitative data such as existing linkages, innovative linkages and negative factors inhibiting linkages were analysed using the Statistical Package for Social Sciences (SPSSs) computer programme version 12.0. Quantitative data analysis involved descriptive statistics specifically frequencies and percentages. Data were also organised in tables for presentation. On the other hand, primary data collected through open -ended questions and from group discussions and informal interviews were organised based on subject similarities for analysis. Qualitative data such as respondents' explanations on views on linkages and suggestions for strengthening linkages were analysed by the narrative content analysis.

Chapter three has presented the study methodology. This included description of the study area – the Western Agricultural Research Zone which includes Tabora and Kigoma regions and research design which was cross sectional. Other methodology sub sections were sampling procedures, data collection methods and tools and data analysis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter is divided into five sections namely socio- demographic characteristics of respondents, existing research – extension – farmer linkage mechanisms, innovative research – extension –farmer linkage mechanisms, factors influencing research- extension - farmer linkages and strategies for strengthening research – extension – farmer linkages.

4.1 Socio - Demographic Characteristics of Respondents

This section describes the socio –demographic characteristics of respondents. These respondents were extension workers and farmers from Kasulu, Kigoma Rural, Urambo and Uyui districts. Other respondents were researchers from the Agricultural Research Institute Tumbi (ARI – Tumbi). Aspects covered for extension workers and researchers are sex, age, highest level of training, number of years in service and number of years at current work station. Farmers’ aspects were sex, age, marital status, education, number of years in collaboration with research and sources of income. Tables 1 and 2 show socio-demographic characteristics of respondents.

Table 1 shows results on socio – demographic characteristics of extension workers and researchers. Results on sex show that majority of extension workers interviewed (83 percent) were males while 82 percent of researchers were also males. Results on age show that majority of extension workers interviewed (61 percent) were between 41 and 50 years whereas the minority of farmers (four percent) were between 31 and 40 years. Other results on age indicate that researchers interviewed belong to two age groups, between 41 and 50 years (64 percent) and between 51 and 60 years (36 percent).

With regard to training majority of extension workers (66 percent) had diplomas while majority of researchers (64 percent) had MSc degrees. Results on level of training indicate a marked difference between extension workers and researchers with researchers having generally higher level of training than extension workers. Differences in level of training between researchers and extension workers contribute to low level of involvement of extension workers in linkages which lead to weak linkages (Table 11). Similar results of

low level of training of extension workers were also reported by Agbamu (2000) as among reasons for weak research – extension linkages in Tanzania.

With respect to number of years in service results show that 86 percent of extension workers had been in extension service for a period of 11 to 30 years while 14 percent of them had been in service for 1 to 10 years. Same results indicate that 82 percent of researchers have been involved in research activities for a period of 11 to 30 years while 18 percent of them had been in research for 1 to 10 years. Results on duration of stay at current work station show that 52 percent of extension workers had been at their present station for 11 to 30 years while 55 percent of researchers had also been at their present work station for the same period. Long stay at one work station for both extension workers and researchers could be expected to result into establishment of more formal and informal linkages between them. However, results indicate the contrary because of stronger negative factors like lack of funds, weak extension services and low wages (Table 15).

Table 1: Distribution of Extension Workers and Researchers According to Socio – Demographic Characteristics

Category	Extension workers (N =23)		Researchers (N =11)	
	Frequency	%	Frequency	%
Sex				
Female	4	17	2	18
Male	19	83	9	82
Total	23	100	11	100
Age in years				
31 – 40	1	4	-	-
41 -50	14	61	7	64

51 -60	8	35	4	36
Total	23	100	11	100
Highest level of training				
Certificate	1	4	-	-
Diploma	15	66	3	27
BSc degree	3	17	1	9
MSc degree	4	13	7	64
Total	23	100	11	100
Number of years in service				
1 – 10	3	14	2	18
11 -30	16	69	9	82
31 -40	4	17	-	-
Total	23	100	11	100
Number of years at current station				
1 -10	11	48	5	45
11-20	7	30	5	46
11-30	5	22	1	9
Total	23	100	11	100

Table 2 shows results on farmers' socio – demographic characteristics. Majority of farmers were male (59 percent) aged between 25 and 50 years. In the case of marital status 90 percent of farmers who were interviewed were married. Majority of farmers (87percent) had attained standard seven primary education and 49% of them had collaborated with researchers for more than six years. Regarding sources of household income, majority of farmers (79 percent) depended on crop farming and livestock husbandry. Main crops grown by farmers were maize, rice, beans, cassava and tobacco whereas main livestock kept included cattle, goats and poultry.

Table 2: Distribution of Farmers According to Socio – Demographic Characteristics**(N = 39)**

Category	Values	Frequency	%
Sex	Female	16	41
	Male	23	59
Total		39	100
Age (years)	25 -40	16	41
	41 -50	10	26
	51 -60	5	13
	Over 60	8	20
Total		39	100
Marital status	Married	35	90
	Single	4	10
Total		39	100
Level of education	None	3	8
	Standard 7	34	87
	Form 4	2	5
Total		39	100
Duration of collaboration	3 -4 years	16	41
	5 -6 years	4	10
	Over 6 years	19	49
Total		39	100
Sources of income	Crops	8	21
	Crops and livestock	31	79
Total		39	100

4.2 Existing Research – Extension – Farmer Linkages in the Western Zone

This section describes existing linkages and their usefulness in technology uptake (Tables 3 to 5).

Table 3: Research - Extension - Farmer Linkages in the Western Zone Identified by Extension Workers and Researchers

Linkage mechanism	Extension workers (N =23)		Researchers (N =11)	
	Frequency	%	Frequency	%
Joint on farm trials	17	74	9	82
Demonstrations and FFS plots	17	74	9	82
Joint PRA and other surveys	9	39	9	82
Field days and agricultural shows	7	30	10	91
Training workshops and seminars	9	39	6	55
Personal contacts	7	30	4	36
Committee meetings (ZEC, IPR)	3	13	4	36

Table 3 shows that majority of extension workers (74 percent) indicated that existing linkages were on farm trials, demonstrations and Farmer Field Schools. With respect to researchers, the majority (91 and 82 percent) mentioned field days and agricultural shows as well as joint on farm trials, demonstrations and joint PRA and other surveys as the existing linkages. Basically, results show that extension workers and researchers indicated that important existing linkages in the Western Zone were on farm trials, demonstrations and FFSs. According to discussions with extension workers and researchers these linkages featured high among respondents because they were the most commonly utilised. These were the common mechanisms which linked researchers, extensionists and farmers in technology development and dissemination. Results show a difference between extension workers and researchers on field days and agricultural shows because most of these linkage activities are organised by ARI Tumbi. For this reason, western zone researchers (who are all located at ARI Tumbi) have more opportunity to participate in these linkage activities than extension workers who are located in different villages and districts. Results

from studies conducted in other developing countries also report similar findings. For instance, studies conducted in 18 different countries including Tanzania found that common linkage mechanisms between researchers and extension workers were on farm trials, field days and demonstrations and meetings (Seegers and Kaimowitz, 1989). Similarly, another study which was conducted in Kenya (Kimenye, 2006) reported that important linkages between researchers, extension workers and farmers were on farm trials, field days, demonstrations, PRAs and FFSs.

Other linkages mentioned by respondents included field days and agricultural show and PRAs. Informal linkages particularly personal contacts were lowly ranked by both extension workers and researchers with least responses (30 and 36 percent respectively). Another study in the Western Zone (URT, 2004a) reported that collaborating farmers were sharing research results with their neighbours through informal farmer - farmer contacts. However, literature does not indicate much presence of informal researcher – farmer contacts in the zone implying that they are not given much importance. Although informal linkages are not given much weight, according to literature they have potential to improve linkages as they are less costly and arise based on felt needs (FAO, 1997, Munyua *et al.*, 2002). For this reason, Swanson (1996) concluded that in order for research and extension to become demand driven research and extension personnel should listen to what farmers communicate through both informal and formal linkage mechanisms.

Table 4: Research – Extension - Farmer Linkages Identified by Farmers (N=39)

Linkage mechanism	Frequency	%
On farm trials	39	100
Demonstrations, Farmer Field School	27	69
MAFC Monitoring and evaluation exercises	9	23
Field days	8	21
Farmers' seminars	7	18

Farmers as one of the key linkage partners also identified existing linkages between themselves and researchers and extension workers. Results from Table 5 show that all 39 farmers (100 percent) mentioned on farm trials as the most important linkages. Ensuing discussions with farmers revealed that on farm trials offered the basic link between researchers and farmers. On farm trials are used by researchers for technology development and dissemination. Further discussions with farmers revealed that farmers participated in on farm trials through their Farmers' Research Groups (FRGs). One of such FRGs was Lukundo at Kalenge in Uyui district which was involved with maize and beans variety trials. About two thirds of farmers participating in on farm trials testified that they had adopted some of the technologies learnt in trials. In particular they had adopted new crop varieties like *Situca* and *Lishe* maize varieties and TXD 320 and TXD 88 rice varieties which had increased their productivity by about fivefold. The new varieties were preferred due to their early maturity, high yield and tolerance to drought and diseases compared to local varieties. These new varieties enabled farmers to get production even under conditions of stresses like drought.

Besides the above formal research – extension – farmer linkages, through probing farmers confirmed that there were informal farmer to farmer linkages among them. In villages with on farm trials or FFSs, informal farmer to farmer communication was the most important source of information. New technologies like crop varieties spread through farmers' mutual visits and visiting trial plots. Informal farmer to farmer contacts were also reported

to be the primary sources of information by FAO (1994). Other linkage mechanisms mentioned by farmers were annual monitoring and evaluation (M and E) exercises which were conducted by MAFC in collaboration with zonal researchers before end of Western Zone cropping season (May/June) (Semgalawe *et al.*, 2002; URT, 2004a).

A comparison between the existing linkages mentioned by extension workers and researchers and those from farmers, indicates a difference between the two lists. While extensionists and researchers identified ten linkages, farmers mentioned only five linkages which were conducted in their localities. Among these were the three most common linkages namely on farm trials, demonstrations and Farmer Field Schools which also received high responses from extension workers and researchers.

Other existing linkages like research committee meetings and agricultural shows received low responses (36 percent and below) from extension workers and farmers (Tables 3 and 4). Such linkage activities got low responses because they involved few farmers, were not conducted in farmers' localities and were less known among most farmers and extension workers.

Besides identifying existing linkages respondents mentioned institutions which initiated those linkages and results are presented in Table 6. With regard to farmers, majority of respondents (90 percent) indicated that District Agricultural and Livestock Development Offices (DALDOs) were the initiators of linkages in the Western Zone. Similarly, results from extension workers showed that majority (91 percent) mentioned DALDOs as key initiators of linkages. Most farmers and extensionists accorded DALDOs with initiation of linkages because most linkages like FFSs were organised by extensionists. In contrast,

results from researchers showed that all respondents (100 percent) claimed that ARI Tumbi was the initiator of existing linkages. This response was based on the ZIELO's explanation that most linkages like on farm trials and field days in the zone were initiated by ARI Tumbi.

Based on these results, important institutions which initiated existing linkages in the Western Zone are ARI Tumbi and DALDO. Most linkages were initiated during the first phase of extension and research projects (NALERP and NALRP) through coordination mechanisms like Zonal Executive Committees (ZEC) and IPR meetings. Since these projects applied non participatory approaches like T & V extension system the linkages were imposed on farmers.

Table 5: Institutions which Initiated the Existing Linkages

Institution	Farmers (N=39)		Extension workers (N=23)		Researchers (N=11)	
	Frequency	%	Frequency	%	Frequency	%
ARI TUMBI	31	80	20	87	11	100
DALDO	35	90	21	91	3	27
NGOs	17	44	10	43	5	45
Farmers	25	64	5	22	-	-

4.2.1 Strengths of existing linkages

Through interviews and focussed group discussions with respondents on existing linkages, the following strengths were identified:

- Direct contacts among partners: Linkage activities like on farm trials, enhance direct contacts between researchers, extension workers and farmers. These linkages thus facilitate experience sharing and mutual learning among partners. Through this process researchers learn farmers' indigenous technologies, extension workers learn new technologies and farmers learn and adopt new technologies. For instance, during interview and group discussion at Ilolangulu in Uyui district farmers mentioned technologies learnt. Among those technologies were *Situca* M1 and *Lishe* maize varieties and improved fallows using *Mucuna* and *Gliricidia* spp.;
- Enhance coverage: On farm trials and demonstrations are conducted in most villages which are involved in research and extension activities. As such, these linkage activities reach many farmers directly and indirectly through farmer to farmer information exchange. For instance, during interview the ZIELO testified that more than 1 913 farmers were reached through on farm trials, demonstrations and field days between 2004 and 2008 in the zone (Table 6). Linkages were therefore cost effective means for technology dissemination as they allow reaching many farmers at one time;

Table 6: Number of Farmers Reached Through Linkage Activities between 2004 and 2008 in the Western Zone

Linkage activity/year	2004	2005	2006	2007	2008	Total
On farm trials/ demonstrations	86	120	62	92	365	725
Field days	-	123	415	298	352	1 188
Total	86	243	477	390	717	1 913

Source: Western Zonal reports 2005 -2008

- Cost sharing with farmers: Linkage activities are conducted under farmer field conditions and management involving cost sharing. This enhances ownership and makes farmers to assume greater responsibility. During interviews farmers testified that they freely offered their land and performed all field operations related to on farm trials, demonstrations and FFSs; and
- Reinforcement of learning: One on farm trial is usually conducted for three consecutive years. This brings repetition of technical messages and enhancement of the learning process for farmers. For instance, farmers at Kalenge village in Kigoma Rural district testified that they decided to adopt new maize varieties (*Kilima*) after participating in trials for two consecutive years only.

4.2.2 Weaknesses of existing linkages

Discussions with extension workers, researchers and farmers identified the following weaknesses:

- Little involvement of farmers at planning: There is little involvement of farmers at planning stage mostly due to lack of funds to support participation of all stakeholders in all research stages. However, through probing it was found that besides shortage of funds some researchers still held the belief that farmers could

not contribute at planning stage due to their low level of education. The low level of farmers' involvement at planning stage therefore reduces farmers' influence and ownership of research agenda. It also reduces their ability to exert demand on research;

- Irregular implementation of linkage activities: About two thirds of farmers participating in trials mentioned the problem of irregularity and premature ending of linkage activities in which they were involved. These farmers reported that between 2005 and 2008, their on farm trials were conducted for two years instead of the planned three consecutive years. According to researchers, the irregularity in implementation was caused by irregular disbursement of research funds, which was beyond their control. The irregularity of implementation of linkage activities reduced farmers' morale in research;
- Poor follow up of trials: Farmers reported that there was poor follow up of trials by researchers and extensionists and poor communication between ARI Tumbi and DALDOs. Through separate discussions with individual researchers and extension workers two main reasons were identified for this situation. First, there was lack of funds for researchers and secondly low morale and lack of commitment for extension workers. Consequently, extension workers from district offices and from villages (hosting trials) rarely visited on farm trials in the absence of researchers. In fact, they demanded allowances from researchers for making follow ups claiming that they were lowly paid and had no other incentives;
- Lack of availability of improved seeds: Farmers complained that improved crop seeds involved in trials, demonstrations and FFSs were not available from stockists. Upon further probing on the issue, researchers and extensionists attributed the unavailability of the improved seeds to poor functioning of seed

multiplication and distribution system in the zone. As a result, farmers were limited in their bid for adopting new technologies experienced from their participation in linkage activities; and

- Lack of sustainability of adopted technologies: Farmers failed to adopt technologies acquired from linkages sustainably due to poverty and lack of support services like credit, markets and rural roads. For instance during interview, Kasungu farmers in Urambo district explained that they failed to access better markets outside their district due to poor roads. Therefore, they sold their maize to middlemen at low prices. As a result, it was difficult for them to afford expensive inputs like seeds and fertilisers for sustaining technology adoption.

4.2.3 Useful aspects of existing research – extension – farmer linkages in the Western Zone

Discussions with respondents exposed the ways in which existing linkages have been useful to their regular extension and research activities in dealing with farmers' problems. Table 7 shows various aspects in which existing linkages like on farm trials, demonstrations Farmer Field Schools and field days have been useful to extension workers and researchers in their work.

Table 7: Useful Aspects of Linkages to Extension Workers and Researchers

Useful aspect	Extension workers (N =23)		Researchers (N =11)	
	Frequency	%	Frequency	%
Technology dissemination Knowledge improvement & integration of ITK	12	52	8	73
Technology adoption	13	57	4	36
Collaboration & communication	3	13	6	55

Key: ITK: Indigenous Technical Knowledge

4.2.3.1 Usefulness of on farm trials

Based on informal interviews with researchers, on farm trials were initiated by ARI Tumbi researchers in response to farmers' problems. On farm trials are conducted for three consecutive years in villages with problems intended to be solved by the trials. Trial locations are determined jointly by researchers, extension workers and farmers. According to researchers on farm trials are jointly managed by Farmer Research Groups (FRGs) and researchers and serve the following purposes:

- Sources of new technologies: Trials have been sources of new technologies to extension workers and farmers. Results in Table 7 show that 52 percent of extension workers indicated that linkages helped them to improve their technical knowledge. Linkages thus made them become self confident as they had something to offer to farmers like new crop varieties and soil fertility improvement technologies. Likewise, discussions with farmers revealed that they acquired new crop varieties through on farm trials. Some of these varieties were *Lyamungo* and *Jesca* beans varieties, *Kilima* maize variety and TXD 88 and *Jaribu* rice varieties which were better than local varieties. The new crop varieties have helped farmers to increase productivity for instance, from 4 bags to 27 bags of maize (of 90 kg each) per acre as testified by Mzee Mlewa, a farmer from Kasungu village in Urambo district. Farmers further testified that their involvement in on farm trials had improved their understanding on relevant technologies. After several years of participating in on farm trials, they gained confidence about new varieties' better performance compared to local varieties. Among performance criteria of new crop varieties which attracted farmers were high yield, drought and disease tolerance. Therefore, unlike in the past when farmers had to be pushed to accept new varieties, now they demand for the varieties; and

- Integration of indigenous technologies (ITK) in research: On farm trials have been helpful in integration of local knowledge in research work. Results in Table 7 indicate that 55 percent of researchers showed that linkage activities like on farm trials help them to understand and integrate indigenous technologies (ITK) in research. Further probing during interview with researchers revealed that indigenous fruit processing was the most common indigenous technology which had been integrated in research in the Western Zone. This technology had been improved and disseminated to over 3 000 farmers and was one of the most demanded technologies by farmers. Integration of farmers' indigenous knowledge with modern science in agricultural knowledge and information system was also stressed by Van Crowder and Anderson (1996). ITK allows researchers to draw from existing potential knowledge for solving farmers' technological problems.

4.2.3.2 Usefulness of demonstrations, Farmer Field Schools and field days

In- depth discussions with extension workers indicated that extension workers initiated demonstrations and FFSs based on farmers' needs as part of District Agricultural Development Plans (DADPs). Demonstrations and FFSs are usually conducted under farmer conditions and are managed by farmer groups, assisted by extension workers and researchers. Basically, demonstrations and FFSs contribute to the following:

- Technology dissemination: From Table 7, seventy three percent of researchers and 52 percent of extension workers reported that participation of farmers in linkage activities simplified technology dissemination. Farmers who participate in demonstrations or FFSs learn new technologies practically by doing. They thus observe the new varieties from planting to harvesting and they compare superiority of these varieties with other local varieties. Therefore, these farmers gain

confidence about superiority of new technologies and finally take the technologies to their own fields. Out of 39 interviewed farmers 23 had transferred learning to their individual plots;

- Increased adoption of technologies: Table 7 shows that 57 percent of extension workers interviewed indicated that linkages increased technology adoption among farmers. These results were confirmed by farmers who were interviewed who said that their participation in these linkage activities had increased their adoption of technologies. Fifty nine percent of participating farmers reported that they had adopted technologies such maize, rice and beans varieties in their farms. In addition, the ZIELO explained that more than 4 500 farmers adopted new technologies through on farm trials and demonstrations between 2004 and 2007. Among the adopted technologies included the following: (i) maize varieties for example *Kilima ST SR* and *Lishe* (ii) rice varieties like TXD 306 and *Jaribu 220* (iii) groundnut varieties like *Pendo* and *Sawia*; and (iv) improved fallows using *Mucuna* and *Gliricidia* spp.;
- Collaboration and communication among partners: Results in Table 7 show that 55 five percent of researchers indicated that implementation of linkage activities allowed easy collaboration and communication among partners. Discussions with the ZIELO revealed that farmers, extensionists, agribusinesses and NGOs meet during research coordination committee meetings like ZSC, ZaTC and IPR. Besides meetings, ARI Tumbi researchers collaborate with NGOs in on farm trials, field days and training workshops. For instance, between 2005 and 2007 researchers collaborated with REDES0 in conducting on farm trials and field days at Kasanda village in Kibondo district. Other organisations which have been collaborating with ARI Tumbi through linkages include TACARE and CARE in

Kigoma Region and ICRAF and TDFT in Tabora Region. Therefore, working together in linkage activities involving partners facilitates more collaboration and communication among them; and

- Mutual information sharing: Table 7 shows that 52 percent of interviewed extension workers and 55 percent of researchers reported that linkages improved their technical knowledge through mutual information sharing. In addition, farmers and NGOs through discussions admitted that during field days there was mutual sharing of information on agricultural technologies. One example of such information sharing was explained by the ZIELO during in depth interviews. He explained that, during a field day at Kasanda in Kibondo which was organised in collaboration with REDESO in 2007 researchers learned a new technology for preparing liquid fertilisers. Later, ZIELU staff went back and prepared a video training episode of this technology in collaboration with REDESO.

4.2.4 Implementation level of planned linkage activities

Interviews and discussions with ARI Tumbe researchers, extension workers and farmers provided the implementation level of linkage activities like on farm trials, quarterly training workshops and research coordination meetings like IPR and ZEC.

- Implementation level of on farm trials: Interview results from respondents indicated that on farm trials were the most common linkage mechanisms (Tables 3 & 4). However, results in Table 8 show that all farmers interviewed reported low implementation level of on farm trials due to irregularity, late trial setting and discontinuations. In addition, about two thirds of interviewed farmers confirmed that their on farm trials were not implemented in 2006/07 season. In follow up discussions with the ZRC it was also confirmed that between year 2000 and 2008

about 80 percent of on farm trials were conducted late and about half of the trials were discontinued. Results in Table 9 show that 78 percent and 64 percent of extension and research respondents respectively mentioned late and inadequate funds as major reasons for the low implementation level of on farm trials.

Table 8: Challenges Encountered by Farmers in their Collaboration with Researchers in On Farm Trials (N=39)

Challenge	Frequency	%
Late and irregular implementation	39	100
Poor follow up by researchers and extensionists	18	46
Poor communication with researchers	8	21

- **Implementation of Quarterly Training Workshops:** According to discussions with the ZIELO planned quarterly training workshops were four separate sessions for Tabora and Kigoma Regions thus eight workshops per year. However, based on Western Zonal records 20 percent of training workshops were conducted during TARP II (between 2000 and 2003). Implementation of quarterly training workshops went down to six percent after conclusion of TARP II (between 2004 and 2008). Results from extension workers and researchers in Table 9 further identify irregular funding as the major constraint for adequate implementation of quarterly workshops in the zone;
- **Implementation of research coordination meetings (IPR and ZEC):** The ZIELO reported that IPR and ZEC meetings involved researchers, extension, farmers, agribusiness and NGOs. These meetings were each scheduled once per year for review of ongoing projects and for approval of new research projects. Further discussions with the ZIELO revealed that implementation of IPR and ZEC meetings was according to plan during TARP II – research project (between 2000

and 2003). However, implementation of IPR and ZEC meetings stopped between 2004 and 2007 after conclusion of the TARP II project. Results in Table 9 show that 78 percent of extension workers and 64 percent of researchers indicated lack of funds as the major constraint for implementation of planned research coordination meetings.

Table 9: Reasons for Low Level of Implementation of Linkages

Reason	Extension workers (N = 23)		Researchers (N = 11)	
	Frequency	%	Frequency	%
Inadequate and delay of funds	18	78	7	64
Weak M & E systems	16	70	5	45
Poor communication between research and extension	8	21	3	27

4.2.5 Level of collaboration and involvement of partners in linkages

Respondents were asked about their views on the level of collaboration among linkage partners as well as on the level of their involvement in linkage activities. Results of respondents' views are presented in Tables 10 to 12.

- Level of farmers' involvement: Table 10 shows that 91percent of extension workers indicated low farmers' involvement in linkage activities. Through probing extension workers explained that farmers' involvement in planning was minimal due to funding problems and low education level. Table 10 also shows that 45 percent of researchers indicated average involvement of farmers in linkages. Researchers explained that farmers were involved in linkage planning through PRAs and IPR meetings and in implementation of on farm trials, demonstrations and field days. Farmers' low involvement in linkage activities was also observed in Nigeria by Oladimeji *et al.* (2005). In their study on research – extension – farmer

linkage system they found that farmers were least involved in linkages compared to extensionists and researchers mainly because of their low level of education;

Table 10: Level of Farmers' Involvement in Linkages

Level of involvement	Extension workers (N=23)		Researchers (N =11)	
	Frequency	%	Frequency	%
High	-	-	2	18
Average	2	9	5	46
Low	21	91	4	36
Total	23	100	11	100

- Collaboration level of extension workers: Results from extension and research on respondents are presented in Table 11. Results show that majority of extension workers (57 percent) indicated low collaboration level in linkages. Extension workers argued that they were inadequately involved during planning of linkage activities and that they were only invited to participate during implementation. On the other hand, 55 percent of researchers reported average collaboration level of extension workers in linkages. Through probing, some researchers attributed the low level of involvement of extension staff to their low level of training compared to researchers (Table 2). Similar observations were also made by Agbamu (2000) who confirmed that low level of training for extension workers was one of the causes of weak linkages in Tanzania. However, researchers suggested that it was important to increase involvement of extension staffs in planning linkage activities.

Table 11: Level of Involvement of Extension Workers in Linkages

Involvement level	Extension workers (N=23)		Researchers (N =11)	
	Frequency	%	Frequency	%
High	3	13	3	27
Average	7	39	6	55

Low	13	47	2	18
Total	23	100	11	100

- Collaboration level of NGOs: Table 12 presents results on collaboration between extension workers and researchers. Seventy four percent of extension workers indicated high level of NGO collaboration in linkages. Similarly, majority of researchers (64 percent) also reported that there was high collaboration with NGOs in linkages. This view was also shared by farmers and the four NGOs contacted for the study (TACARE, CARE, TDFT and Africare) who confirmed high level of collaboration in linkage activities. Collaboration between public agricultural service providers and NGOs for promotion of linkages and farmer empowerment was also emphasised by Kimenye (2006). Important linkage activities in which NGOs collaborated with public extension workers and ARI Tumbi researchers included coordination meetings, farmers' training, quarterly training workshops and field days. Collaboration level with NGOs was high because of the following reasons: (i) most NGOs had similar objectives like research and extension of attaining farmers' food security, poverty reduction and environmental conservation (ii) most NGOs lacked enough technical personnel thus used researchers and LGAs' extension workers in their programmes, and (iii) NGOs were members in ZEC and ZTC research committees.

Table 12: Level of Collaboration of NGOs in Linkages

Collaboration level	Extension workers (N=23)		Researchers (N =11)	
	Frequency	%	Frequency	%
High	17	74	7	64
Average	4	17	3	27
Low	2	9	1	9
Total	23	100	11	100

From the results the level of collaboration and involvement of farmers and extension workers in linkages ranged from low to average. Discussions with extension workers and researchers identified the following reasons for this situation:

- (i) Lack of funds for supporting involvement of partners: There was lack of funds to facilitate involvement of farmers and extensionists in the whole process of technology development and dissemination. This problem was experienced during NALERP, NAEP II and TARP II due to donor dependency and it became worse after these projects. In relation to this situation, the ZIELO reported that during TARP II and NAEP II the actual funds disbursed to the zone were about 20 percent of the approved budget. Inadequate funds caused delay and non implementation of linkage activities like coordination meetings (IPR, ZEC, and ZTC), quarterly training workshops and trials.
- (ii) Low interest of LGAs in agricultural activities: LGAs did not allocate enough funds to cover linkage activities thus all the cost was left to the research institution which had inadequate and irregular flow of funds. For example, the ZIELO reported that between 2002 and 2006 LGAs contributed 17% of their pledges to Zonal Agricultural Research Fund (ZARF). This fund was expected to support linkage activities and improve stakeholder involvement in linkages.

- (iv) Lack of change of mindsets: Through probing it was realised that researchers revealed that they still believed that they were more educated than extension workers and farmers (Table 1). Therefore, they thought that involvement of extension workers and farmers at planning stage could not contribute significantly.
- (v) Low income of farmers: During interviews with farmer respondents it was observed that low income was among major hindrances for technology adoption. These farmers further clarified that most of them could not afford inputs required for adoption of technologies learnt from on farm trials. As a result, farmers had low interest in participating in research activities.

4.3 Innovative Research –Extension – Farmer Linkages in the Western Zone

In this study respondents were asked to identify innovative linkages they use in technology development and dissemination. Results from extension workers and researchers with respect to this issue are presented in Table 13.

Table 13: Innovative Linkages Identified by Extension Workers and Researchers

Innovative linkage	Extension workers (N = 23)		Researchers (N = 11)	
	Frequency	%	Frequency	%
Cell phones	23	100	11	100
Internet	1	4	10	91
Monthly meetings	6	26	5	45

During interviews extension workers and researchers explained that they used cell phones for two reasons. Firstly, cell phones were quick means of communication for facilitating timely implementation of planned linkage activities like IPR meetings. Secondly, cell phones were cost effective as they allowed researchers and extensionists to send and receive information without travelling. Due to this importance of cell phones the study found that ARI Tumbi management had one cell phone for official use by researchers.

This cell phone was at the Zonal Director's office. However, both researchers and extension workers admitted that despite potential of improving linkages through cell phones they were limited by operational cost. Management at ARI Tumbi as well as the DALDOs had not yet devised means of facilitating their staff in using private cell phones for linkages.

Table 13 also shows that 91percent of researchers who were interviewed identified internet as another innovative linkage. Fortunately, ARI Tumbi had internet connectivity which was paid for by the Ministry of Agriculture Food Security and Cooperatives (MAFC). The ZRC explained that internet communication was used because it was fast and cost effective. Through discussions researchers explained that they extensively used internet for sending meeting or workshop invitations to DALDOs and NGOs, exchanging research reports for peer review and sending progress reports to MAFC headquarters. However, internet use was low among DALDOs as most of them did not have direct internet connectivity thus accessed the service through other offices.

Finally, results in Table 13 indicate that 45 percent of researchers interviewed mentioned agriculture monthly meetings in Tabora Region as other innovative linkages. The ZIELO explained that these meetings were initiated by Tabora Regional Agriculture and Livestock Advisors (RAA and RLA). These meetings brought together DALDOs, ARI Tumbi and other public agricultural institutions in the region and facilitated linkages between extension and research. According to ZIELO, ARI Tumbi participated in 18 Tabora regional monthly meetings during their existence. At one of these meetings in 2005 participants from Nzega DALDO's office presented a problem from tomato farmers which was taken to ARI Tumbi researchers and resolved. However, despite their

significance Tabora Regional monthly meetings were short lived as they only existed between 2003 and 2005 when the initiators retired. The ZIELO informed the study that the meetings ceased due to lack of commitment from DALDOs, lack of MoU among participants and lack of institutionalisation of the meetings.

Innovative linkages explained above were initiated based on felt needs of linkage partners. Therefore, these linkages have great potential of improving research – extension –farmer linkages and speeding up technology development, dissemination and utilisation. For this reason linkage partners need to revive, adapt and institutionalise innovative linkages in both Tabora and Kigoma regions. However, linkage partners in each region should meet and agree in a participatory manner on the need to revive the meetings, participants, agenda, frequency of the meetings and venues.

4.4 Factors Influencing Research – Extension – Farmer Linkages in the Western Zone

Factors influencing research – extension – farmer linkages are the central theme of this study. Results from extension workers and researchers on this subject are categorised into positive and negative factors. Positive factors facilitate and enhance linkages whereas negative factors inhibit linkages and make them weak.

4.4.1 Positive factors

Table 14 shows the factors enhancing the linkages among researchers, extensionists and farmers. Results in Table 14 show that 91 percent of researchers interviewed identified innovative mechanisms particularly information communication technologies (ICTs) as factors enhancing linkages, while 57 percent of extension workers also cited the same.

Through probing ARI Tumbi researchers testified that ICTs like internet and cell phones allowed fast communication with partners like DALDOs, NGOs, fellow researchers and MAFC headquarters. Thus, innovative communications facilitated exchange of information regarding implementation of linkage activities like research coordination meetings and field days. Unfortunately, most DALDOs in the zone still lacked direct internet connectivity. In the case of farmers, through probing it was found that they were using FFSs as self help groups for cultivation of individual plots which enhanced farmer – linkages.

Table 14: Positive Factors Enhancing Linkages in the Western Zone

Factor	Extension workers (N=23)		Researchers (N=11)	
	Frequency	%	Frequency	%
Innovative mechanisms	17	57	10	91
Government policies	13	56	6	55
Informal contacts	10	43	4	36

Results in Table 14 also show that 56 of extension workers indicated government policies as other positive factors to linkages while 55 percent of researchers had the same opinion. Among government policy initiatives were the NAEP II and TARP II extension and research projects respectively (of the 1990s and early 2000s), Agricultural Sector Development Programme (ASDP) and the National Agricultural Policy of 2008. These policy initiatives required adoption of participatory approaches for involvement of target groups and other development partners in the whole process of programme implementation. Finally, 43 percent of extension workers also indicated traditional communications among farmers and between farmers and researchers as other positive factors to linkages. Informal contacts like farmer to farmer contacts included mutual farmer visits while farmer to researcher contacts occurred during implementation of

formal linkage activities like field days. Such contacts increased technology dissemination and strengthened linkages.

4.4.2 Negative factors

Interview with respondents also identified negative factors which work against research – extension – farmer linkages. Results on these factors are presented in Table 15.

Results in Table 15 indicate that 91 percent of researchers reported that inadequate funds for linkage activities was the major factor inhibiting linkages, while 87 percent of extension workers also reported the same. Discussions with the Zonal Research Coordinator revealed that during NALERP and NAEP II and NALRP and TARP II funding for linkage activities was inadequate and irregular. For example, during TARP II (1999 -2004) research received TZS 374 million out of TZS 708 million, about 53 percent of approved budget. Similarly, during the same period the Liaison Unit (ZRELU) received from NAEP II about TZS 20 million out of TZS 70 million (about 28% of approved budget) for linkage activities.

Consequently, implementation of linkage activities like on farm trials and quarterly training workshops was reduced. After conclusion of TARP II (from 2004 to 2007) funding level went further down, thus coordination meetings and workshops were stopped and about half of on farm trials were also discontinued. Funding issue in linkages was also reported from studies conducted in Ghana by Doamekpor (2006), in Nigeria and Tanzania by Agbamu (2000) and in Uganda by Rivera *et al.* (2005). In all these study reports funding problem featured high among factors causing weak linkages.

Table 15: Negative Factors Inhibiting Linkages Identified by Extension Workers and Researchers

Factor	Extension workers (N = 23)		Researchers (N=11)	
	Frequency	%	Frequency	%
Inadequate funds for linkages	20	87	10	91
Low income of farmers	18	78	9	82
Poor support services (credit, inputs)	16	69	9	82
Weak extension service	16	69	8	73
Low education level of farmers	15	65	7	64
Improper diagnosis of farmer problems	15	65	9	82
Poor coordination	12	52	8	73
Weak farmer organisations	13	57	6	55
Weak M & E system	16	69	5	45
Low wages of extension staff	11	48	7	64

According to the Assistant Director for Extension Services (AD Extension), the problem of inadequate and late disbursement of funds was caused by dependency on foreign donors. There were delays in release of funds for local expenditure which led to late implementation of activities. However, according to the ADB (2004) NALERP Performance Evaluation Report the delay in fund disbursements was caused by the following: (i) MAFC late report submissions to donors, (ii) expansion of project coverage from 12 to 16 regions, (iii) rising prices of project equipment due to lengthy tendering processes, (iv) slow implementation of project activities and (v) failure of the Government of Tanzania to fully contribute its committed project budget share.

The issue of inadequate and irregular funding for linkage activities could be addressed by the government by allocating enough funds from own sources. This should include timely disbursements that follow zonal crop calendars. Linkage activities could also be made less costly by DALDOs (LGAs) organising linkage activities like field days and agricultural shows at ward and district level to widen technology dissemination.

Table 15 also indicates that 82 percent of researchers mentioned low income of farmers as another negative factor to linkage strengthening while 78 percent of extension workers reported the same. Low income of farmers and high price of inputs were also identified by majority of farmers (87 percent) as the main factors inhibiting linkages. According to URT (2005) low income (poverty) is more widespread in rural areas where 87% of the national poor population live. This implies that majority of farmers are poor with limited ability to participate in linkage activities and to adopt technologies. For instance, farmers from Magiri in Uyui district confirmed that despite several years of participating in on farm trials most of them failed to adopt the technologies because they could not afford the seeds and fertilisers involved. In addition, 82 percent of researchers mentioned poor support services for farmers like credit, input supply and rural infrastructure (like roads) as negative factors affecting linkages. Poor support services were also identified by 69 percent of extension workers as negative factors. With poor support services farmers fail to access farm inputs (such as seeds and fertilisers) and better markets. Therefore, farmers' ability to adopt technologies diminishes.

4.5 Strategies for Strengthening Research - Extension – Farmer Linkages

In this study respondents suggested strategies for addressing shortcomings in research – extension –farmer linkages with regard to study objectives. Strategies for strengthening linkages are presented in two sub sections.

4.5.1 Strategies for strengthening existing linkages

During interview and discussions, extension workers, researchers, farmers and NGOs suggested strategies aimed at addressing weaknesses within linkages and negative factors

inhibiting linkages. Weaknesses identified were as follows: little involvement of farmers in planning of linkage activities, irregular implementation and poor follow up of linkage activities and lack of availability of improved seeds. Meanwhile, negative factors included inadequate funding, low income of farmers, poor support services, weak extension services, poor coordination, low wages, and weak farmer organisations. The strategies identified were as follows:

- Increased funding for linkage activities from internal sources: Respondents suggested increased funding of linkage activities and reduction of external donor dependency as it was unreliable and unsustainable. Adequate funding was needed to support increased involvement of partners and to ensure regular implementation and follow up of linkage activities. In order to increase funding for linkages the central government and LGAs should make agriculture a priority. In moving towards this direction, the government announced the *Kilimo Kwanza* resolve which was an intention of making agriculture a national priority;
- Training in low cost input technologies and in value addition: Researchers and NGOs suggested training farmers in locally available low cost inputs like farm yard and compost manures and Agroforestry technologies. Other farmers' training should be in entrepreneurship and in simple processing technologies for value addition of their products like cassava, sweet potatoes, fruits and vegetables. Entrepreneurship and agro processing are important for improved marketing and increased incomes;
- Seed multiplication and distribution in the zone: Researchers and extension workers suggested LGAs in the Zone in collaboration with the MAFC to contract seed multiplication to public and private organisations. Potential organisations like prisons and the National Service (JKT) could be contracted for seed multiplication

to ensure availability of research recommended seeds in the zone. Through probing the study found that LGAs in Kigoma Region were already collaborating with prisons in seed multiplication of cassava varieties tolerant to Cassava Mosaic Virus. Therefore, collaboration with these and other prisons could be expanded to include seed multiplication of other crops like maize;

- Training and employment of extension staff and their facilitation: Respondents suggested MAFC and LGAs to collaborate and prepare training and employment programmes for extension. However, the Assistant Director for Extension confirmed that MAFC through ASDP was already implementing a four year strategy aimed at improving extension services and strengthening linkages. Objectives of the strategy included increasing field extension officers from 3 379 to 15 082 by 2010/11 and establishing Ward Agricultural Resource Centres (WARCs). WARCs would be centres for agricultural information and dissemination and would be equipped with transport, computer and internet facilities, library and farmer training facilities. The Assistant Director added that MAFC in collaboration with ASLMs was also in final stages of preparing extension guidelines for extension staff. According to the President's speech to the parliament on 16 July 2010, the government had employed an additional 3 302 extension workers by 2009;
- Change of mindsets among researchers towards extension workers and farmers: Respondents suggested researchers to change their mindsets about extension workers' and farmers' low level of education which caused their little involvement in linkage activities particularly at planning. Extensionists and farmers who participate in implementation of linkage activities should be involved at the planning phase through PRAs and Internal Programme Reviews. In increasing

farmers' involvement in linkages, under ASDP farmers compose half of members of Zonal Steering Committee and 43 percent of members of Zonal Technical Committee. These committees are responsible for planning and coordination of linkage activities. However, respondents commented that members representing farmers in these committees should be seasoned farmers and not retired research and extension officers;

- Sustainable MAFC structure and elevation of the Extension Unit: Respondents suggested for the government to establish a sustainable structure for the Ministry of Agriculture Food Security and Cooperatives for smooth continuity of development programmes. They also suggested the elevation of the Extension Unit of MAFC into a full department to be at the same level with the Department of Research and Development. This would also put the Extension Unit at the same level with the Department of Research, Training and Extension of the Ministry of Livestock and Fisheries to facilitate horizontal coordination;
- Improved coordination at all levels: Respondents suggested on improved coordination between extension and research units of the MAFC and with other Agriculture Sector Lead Ministries (ASLMs). Improved coordination could be through regular coordination meetings at ministerial level and at LGA level in order to speed up implementation of joint programme activities. In addition, extension and research (of MAFC) and other ASLMs should promote teamwork, commitment and doing business unusual in implementation of joint programmes like ASDP aimed at transforming subsistence agriculture into commercial;
- Establishment and institutionalisation of liaison units at national and LGA levels: Respondents pointed the importance of establishing and institutionalisation of liaison units at national and district levels to link up with the zonal unit (ZIELU).

The national unit would fill the linkage vacuum at Ministry level and improve coordination between research and extension;

- Increased wages and incentives for researchers and extension staff: Researchers and extension workers suggested increased wages and performance based incentive system. Similarly, a study conducted in Ghana by Doamekpor (2006) recommended an incentive system that rewards collaboration for research and extension staff in order to strengthen research – extension – farmer linkages. Among the performance criteria could be development of relevant technologies, dissemination, adoption and impact made on farmers’ productivity and incomes; and
- Form and strengthen farmer organisations: Respondents suggested the establishment and strengthening of farmer organisations like cooperatives and SACCOS. They acknowledged the central importance of farmers in the linkage continuum as technology innovators, disseminators and users. Strong farmer organisations are important for increased farmers’ participation in linkages through articulating farmer needs from research and for increased influence and ownership over research agenda.

4.5.2 Strategies for strengthening innovative linkages

Suggestions for strategies for strengthening innovative linkages aim at three problems identified in these linkages. These problems are absence of internet connectivity at DALDO offices, lack of support for using private cell phones for linkages and cessation of regional agricultural monthly meetings. The strategies are as follows:

- Linking DALDOs to internet connectivity: DALDOs should budget for acquiring internet services in their offices in order to benefit from quick communication with

other linkage partners. Internet communication with partners like researchers would facilitate exchange of information and implementation of linkage activities;

- Support to staff for using cell phones for linkages: Researchers and extension workers suggested for management at ARI Tumbi and DALDOs to establish financial support system for using their cell phones for linkage purposes. Cell phones are also potential communication means for informal linkages among linkage partners; and
- Reviving and institutionalising regional agriculture meetings: Researchers and extensionists advised that regional agricultural monthly meetings in Tabora and Kigoma Regions to be revived and institutionalised. However, they added that the regions could adapt the meetings into quarterly meetings and involve other linkage partners like NGOs and CBOs.

The fourth chapter presented existing linkage mechanisms which included on farm trials, demonstrations and Farmer Field Schools while innovative linkages included internet and cell phones. Other findings were positive and negative factors to linkages and strategies for strengthening linkages which included increased funding, strong coordination and seed multiplication in the zone.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

This chapter gives a summary of major findings and recommendations based on study findings.

5.1 Conclusion

The objectives of the study were to: describe existing linkages, identify innovative linkages, identify and describe factors enhancing and/or affecting linkages and to determine ecologically sound strategies for strengthening research- extension – farmer linkages sustainably.

According to study findings conclusions are summarised as follows:

1. Existing linkages in the western zone: The study identified the following linkages; on farm trials, demonstrations, Farmer Field Schools (FFSs), Participatory Rural Appraisals (PRAs), field days, quarterly training workshops, agricultural shows, coordination meetings, seminars, and personal contacts. Out of these, the most beneficial linkages were on farm trials, demonstrations, Farmer Field Schools and field days. The least effective were coordination meetings, seminars and personal contacts.
2. Innovative linkages: With respect to innovative linkages the study identified three linkages in the zone namely cell phones, internet and regional agriculture monthly meetings. Out of these linkages the most beneficial were cell phones and internet which were still under use by researchers, extension workers and NGOs. On the other hand, the least effective ones were regional monthly meetings which had stopped.

3. Factors enhancing and/or affecting linkages: Study findings identified positive factors that enhance and negative factors that inhibit linkages.

(i) Positive factors were as follows: Innovative mechanisms like cell phones and internet, government policies like ASDP and National Agricultural Policy of 2008 and informal contacts like farmer to farmer contacts. Innovative mechanisms were the most beneficial factors while informal contacts were the least effective.

(ii) Negative factors were as follows: inadequate funds, poor coordination within MAFC and among ASLMs, weak extension services, poor support services, low income of farmers, low wages of extension staff and weak farmer organisations. The most critical factors were inadequate funds, low income of farmers, poor support services, weak extension services and poor coordination while the least critical factors were low wages and farmer organisations.

4. Strategies for strengthening research – extension – farmer linkages: In view of the aforementioned negative factors the study identified the following strategies for strengthening linkages:

- Increased funding for linkage activities from internal sources and reduction of external donor dependency as it was unreliable and unsustainable;
- training farmers in low cost input technologies like farm yard manure and Agroforestry and in simple agro -processing technologies for value addition;
- seed multiplication in the zone through contracting organisations like prisons;
- training and employing adequate extension staff and providing transport facilities and incentives;

- strong coordination between research and extension by establishing liaison units at national and LGA levels to team up with zonal liaison units, and among Agriculture Sector Lead Ministries by promoting team work, commitment and doing business unusual; and
- stable and sustainable MAFC structure for smooth continuity of programmes.

From above, the most beneficial strategies are as follows: increased funding, training in low cost input and value addition technologies, seed multiplication in the zone, employing adequate extension staffs and facilitation and strong coordination.

5.2 Recommendations

On the basis of proposals advanced by researchers, extension workers, farmers and NGOs the following are recommended:

1. With respect to existing linkages, findings identified over ten linkages in the zone, however, only three linkages namely on farm trials, demonstrations and Farmer Field Schools were most beneficial. Findings further indicated little involvement of extension workers and farmers in linkage planning activities and low adoption of technologies. It is therefore recommended that:
 - researchers in collaboration with partners should increase use of other linkage mechanisms like field days, exchange visits, video shows, personal contacts and radio programmes in order to increase coverage and technology dissemination;
 - informal linkages between researchers and extensionists with farmers should be encouraged along with formal linkages in order to increase technology adoption and diffusion; and

- researchers should change their mindsets and consider extension staff and farmers as partners and people of crucial importance in as far as agricultural development is concerned. Hence, there is a need to involve them in all stages of technology development, dissemination and utilisation.
2. Study findings identified three innovative linkages in the zone however, only two of them namely cell phones and internet were still used while the third, regional agriculture monthly meetings had stopped. In addition, findings indicated lack of support of extension staff and researchers in using cell phones for linkages while most DALDO offices had no internet connectivity. It is therefore recommended to support financially extension staff and researchers in using their cell phones for linkages, installation of internet services at DALDO offices and revival and institutionalisation of the regional monthly meetings in Tabora and Kigoma regions.
3. Study findings identified positive and negative factors which influenced linkages in the zone. The five most critical negative issues identified together with strategies for strengthening linkages are presented as follows:
- inadequate funding of linkage activities could be addressed through increased funding based on internal sources and decreasing donor dependency for implementation of development programmes;
 - low income of farmers could be addressed through training in low cost input technologies like farm yard manure and Agroforestry, in agro processing and in entrepreneurship;

- poor support services particularly unavailability of recommended crop seeds could be addressed through seed multiplication and distribution in the zone by contracting public and private organisations;
- weak extension services could be addressed through training and employing adequate extension staff and providing them with transport facilities and performance based incentives; and
- poor coordination between research and extension units of MAFC could be addressed through establishment and institutionalisation of liaison units at national and Local Government Authority levels to team up with the zonal liaison units. In addition, coordination among ASLMs could be strengthened by promoting team work, commitment and doing business unusual.

REFERENCES

- ADB (2004). Tanzania: National Agricultural and Livestock Extension Rehabilitation Project (NALERP). Project Performance Evaluation Report (PPER). African Development Bank Group. Operations Evaluation Department. 19th July 2004
[<http://www.afdb.org/fileadmin/uploads/afdb/Documents/Evaluation.pdf>] site visited on 4/08/2009.
- Agbamu, J.U. (2000) Agricultural Research–Extension Linkage Systems: An International Perspective. Agricultural Research and Extension Network Paper No. 106a. London: ODI. [<http://www.rimisp.cl/agren03/documentos/agren106.pdf>] visited on 28/05/2008.
- Babbie, E.R. (1994) *Research Methods 2nd Edition*. Wadsworth Publishing Company Inc. Belmont, California. 395pp.
- Bailey, K.D. (1994). *Methods of Social Research. Fourth Edition*. The Free Press. A Division of Macmillan, Inc. New York. 345pp.
- CIESIN (1993). A framework for incorporating indigenous knowledge systems into agricultural research, extension and NGO for sustainable agricultural development
[<http://www.ciesin.org/docs/004-201/004-201.htm>.] site visited on 6/04/2009.

COD (2001). Concise Oxford English Dictionary. 10th Edition. On CD – ROM 2001.

Version 1.1. Oxford University Press 1999, 2001. Uk.

Doamekpor, P. K. (2005). Effectiveness of Extension – Research linkages in Volta Region of Ghana. AIAEE 21st Annual Conference, San Antonio, TX.

[<http://www.aiaee.org/2005/Accepted/023.pdf>] site visited on 12/08/2008.

Doamekpor, P.K. (2006). The Research – Extension – Farmer Interface in the Cassava Industry in the Volta Region: The Communication Link. AIAEE 22nd Annual Conference Proceedings, Clearwater Beach, Florida. Pages 183 -193

[<http://www.aiaee.org/2006/Accepted/183.pdf>] site visited on 9/05/2009.

FAO (1996). Report on the Expert Consultation on Small - Scale Rural Aquaculture.

Appendix5.Research-DevelopmentLinkages.

[<http://www.fao.org/docrep/X5821E/x5821e00.HTM>] site visited on 26/03/2009.

FAO (1997). Management of Agricultural Research. A Training Manual. Module 8. Research Extension Linkage.

[<http://www.fao.org/docrep/w7508e/w7508e.HTM>] site visited on 6/04/2009.

Kimenye, L. (2006). Research – Extension – Farmer Linkages for Market Orientation

[<http://www.asareca.org/tuusi/index2.php?>

option=com_docman&task=docviw&gid=44Itemid=44] site visited on 12/05/2009.

- Kirway, T.N., Lema, N.M., Lyimo, S.D., Kileo, R.O., Kapange, B.W., Schouten, C. and Schrader, T. (Editors) (2003). *Farming Systems Approaches Training Manual*. Volume I. Ministry of Agriculture and Food Security. Division of Research and Development. Client Oriented Research Programme. KIT. 213pp.
- Kothari, C.R. (2004). *Research Methodology. Methods & Techniques*. New Age International (P) Ltd, Publishers. Second Revised Edition, Delhi. 401pp.
- Lema, N. M., Schouten, C. and Schrader, T. (Editors) (2003). Managing Research for Agricultural Development. *In Proceedings of the National Workshop on Client Oriented Research 27 -28 May 2003, Moshi, Tanzania*. Ministry of Agriculture and Food Security & KIT. Inter Press of Tanzania Ltd, Dar es Salaam. 206pp.
- Mattee, A.Z. (1989). Accessibility of Agricultural Extension Services to Small Farmers in Tanzania. *In Communication Methods for Effective Agricultural Technology Transfer in Tanzania* (Edited by Mattee, A.Z., Lupanga, I.J., Mvena, Z.S.K.). *Proceedings of a National Workshop held at Sokoine University of Agriculture, Morogoro, Tanzania 28 November - 1 December 1988: pp 66 -72.*
- Mbilinyi, M. and Nyoni, T. (2000). Rural Food Security Policy and Development Group (RFS). Institute Of Development Studies. Agricultural and Livestock Policy, 1997. Revised on The Basis of Feedback Workshop on Policy Review Process of The Rural Food Security Policy and Development Group. Tanzania Episcopal Conference (TEC), 2-3 May, 2000.

[<http://www.tzonline.org/pdf/agriculture.pdf>] site visited on 23/04/2009.

Mensah, C.E. (1999). Information Support for Agricultural Research in Ghana. The Ghana Agricultural Information Network System (GAINS).

[<http://www.uneca.org/adf99/worddocs/gains.doc>] site visited on 6/04/2009.

Mlozi, M.R.S. (2004). Factors Constraining the Development of the Agricultural Education and Extension Profession in Tanzania. *Paper Presented at the Tanzania Society of Agricultural Education and Extension (TSAEE) Annual Conference* held in November at Ukiriguru, Mwanza, Tanzania. 10pp.

Munyua, C. N., Phyllis, F. A and Joan, T. (2002). Designing Effective Linkages for Sustainable Agricultural Extension Information Systems Among Developing Countries in Sub-Saharan Africa. AIAEE 2002. Proceedings of the 18th Annual Conference Durban, South Africa. [<http://www.aiaee.org/2002/munyua301-307.pdf>] site visited on 26/05/2009.

Oladimeji, I. O., Jun-Ichi S., and Kazunobu, T. (2006). Research–Extension–Farmer Linkage System in Southwestern Nigeria. WFL Publisher. *Journal of Food, Agriculture & Environment*, Vol.4 (1), January 2006
[<http://www.world-food.net/scientificjournal/2006/issue1/pdf/agriculture/a14.pdf>] site visited on 26/05/2009.

Peterson, W., Galleno, V., Thomas E., Wuyts-Fivawo A., and Wilks, M. (2001). Methods for Planning Effective Linkages. ISNAR Briefing Paper No.45

[<http://www.isnar.cgiar.org/publications/briefing/Bp45.htm>] site visited on 8/03/2008.

Rivera, W .M. , Qamar, M. K. and Henry, K. M. (2005). Enhancing Coordination Among AKIS/RD Actors. An Analytical and Comparative Review of Country Studies on Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD). Research and Technology Development Service Research, Extension and Training Division. Sustainable Development Department. FAO, Rome, 2005

[<http://www.laolink.org/Literature/FAO%20akis.pdf>] site visited on 12/05/2009.

Rutatora, D.F., Busindi, I.M., Rwenyagira, B.W., Kajugusi, A. and Makonta, A. (2008). *An Assessment of the Agricultural Services (Research and Extension) Delivery Under ASDP* (Final Report). Agricultural Sector Development Programme (ASDP). Third Joint Implementation Review. Ministry of Agriculture Food Security and Cooperatives. United Republic of Tanzania. 80pp.

Semgalawe, Z.M., Ahmed, A., Rwezaula, D., Ngahulira, T., Banzi, J., Ulotu, H., Lema, N., Ngereza, A. and Chamila, B. (2002). *Survey Report of Farmers Participating in On –Farm Research (Draft)*. Ministry of Agriculture and Food Security. Department of Research and Development. Tanzania Agricultural Research Project – Phase II (TARP II). 250pp.

Shumba, E.M., Waddington, S.R. and Navarro, L.A. (Editors) (1990). Research and Extension Linkages for Small Holder Agriculture in Zimbabwe. Proceedings of a Workshop on Assessing the Performance of the Committee for On-Farm Research and Extension (COFRE) Kadoma, Zimbabwe. 7-9 May, 1990 .

[<https://idl-bnc.idrc.ca/dspace/bitstream/123456789/11421/3/a-89701.pdf>]

site visited on 12/05/2009.

Simon, M.M.S. (2006). Adoption of Rotational Woodlot Technology in Semi –Arid Areas of Tanzania. The Case of Study of Tabora Region. Dissertation for Award of PhD at Sokoine University of Agriculture, Morogoro, Tanzania, 249 pp.

Seegers, S. and Kaimowitz, D. (1989). *Relations Between Agricultural Researchers and Extension Workers: The Survey Evidence*. ISNAR Staff Notes. The Hague, Netherlands, 22 pp.

Swanson, B.E. (editor) (1996). Improving Agricultural Extension. Chapter 19 In Strengthening Research-Extension-Farmer Linkages.FAO, Rome. [<http://www.fao.org/docrep/W5805E/w583e0l.htm>] site visited on 13/05/2008.

URT/MOA and ISNAR (1992). “*Ways and Means of Fostering the Institutionalisation of Research/Extension Linkages*” Morogoro: Ministry of Agriculture. 29pp.

URT/ISNAR (1995). *First National Workshop on Linkages Between Agricultural Reserach and Technology Users. In Proceedings of a Tanzania Workshop*. Arusha International Conference Centre. April 5 – 7, 1995. Department of Research and Training. Ministry of Agriculture. The United Republic of Tanzania. ISNAR. 61pp.

URT/MAC (1997). Ministry of Agriculture and Livestock Developmet. National Agriculture and Livestock Policy.

[[http://www.agriculture.go.tz/Publications/Agriculture and Livestock policy of 1997.htm](http://www.agriculture.go.tz/Publications/Agriculture%20and%20Livestock%20policy%20of%201997.htm)] site visited on 3/06/2008.

URT (1999). Tanzania Development Vision 2025. Dar es Salaam, 1999

[<http://www.tzonline.org/policies.htm>] site visited on 11/06/2009.

URT (2000). Poverty Reduction Strategy Paper (PRSP), Government Printer, Dar es Salaam. [<http://www.tzonline.org/policies.htm>] site visited on 11/06/2009.

URT/MAC (2000a). *The Need for Agricultural Extension Reform*. Vol. I. Review of Literature. Task Force on Agricultural Extension Reform. MAC –EFU, Dar es Salaam, July 2000. 106pp.

URT/MAC (2000b). *Agricultural Extension Reform in Tanzania. A Vision and Strategy Outline to Year 2010*. Main Report. Prepared by the Task Force on Agricultural Extension Reform. DRAFT. Ministry of Agriculture and Cooperatives. Extension Facilitation Unit, Dar es Salaam November 2000. 31pp.

URT (United Republic of Tanzania) (2001a). Agricultural Sector Development Strategy (ASDS). [<http://www.tzonline.org/policies.htm>] site visited on 12/08/2008.

URT (United Republic of Tanzania) (2001b). Rural Development Strategy (RDS). The Main Report. The Prime Minister's Office, Dar es Salaam. [<http://www.tzonline.org/policies.htm>] site visited on 12/08/2008.

URT (United Republic of Tanzania) (2002a). Cooperative Development Policy. The Main Report. The PMO, Dar es Salaam. [<http://www.tzonline.org/policies.htm>] site visited on 12/08/2008.

URT (2002b). *Workshop Proceedings on Future of Research and Extension in Tanzania*. Part I. Held at Sea Cliff Hotel from May 16 to 17, 2002. Ministry of Agriculture and Food Security. 40pp.

URT/MAFS (2003). *Medium Term Plan (MTP) (2004/5 – 2008/9). National Agricultural Research System (NARS)*. First Draft. Ministry of Agriculture and Food Security. 73pp.

URT/MAFS (2004a). *Survey Report of Farmers Participating in on- Farm Research*. First Draft. Ministry of Agriculture and Food Security. Department of Research and Development, Dar es Salaam. 233pp.

URT (2004b). *Agricultural Sector Development Programme. Agricultural Service Support Programme Document and IFAD Appraisal Report. Volume I: Main Report*, Mainland. 54pp.

URT (2005). National Strategy for Growth and Reduction of Poverty (NSGRP/MKUKUTA). [<http://www.tanzania.go.tz/nsgrp.html>] site visited on 28/04/2008.

URT/MAFC (2006a). Agricultural Sector Development Programme. (ASDP). Support through Basket Fund. Government Programme Document. [<http://www.tzonline.org/policies.htm>] site visited on 12/08/2008.

URT/ MAFC (2006b). *Agricultural Extension Policy*. First Draft. Ministry of Agriculture Food and Cooperatives, Dar es Salaam, November, 2006. 37pp.

URT/BOT (2008a). BOT Economic Bulletin for quarter ending March 2008. [<http://www.bot-tz.org>] site visited on 12/08/2008.

URT/MAFC (2008b). *National Agricultural Policy*. Ministry of Agriculture Food Security and Cooperatives, Dar es Salaam, December 2008. 40pp.

URT/PMO - RALG, 2008c). Local Government Reform Programme. [<http://www.poralg.go.tz/index.php>.] site visited on 18/04/2008.

Van Crowder, L. and Anderson, J. (1996). *Integrating Agricultural Research, Education and Extension in Developing Countries*. FAO Research, Extension and Training Division. [<http://www.fao.org/SD/SDR/SDRE/AKIS.pdf>] site visited on 9/05/2009.

Zonal Director for Research and Development/WZ (2001 - 2007). Zonal Reports.

APPENDICES

**Appendix 1: Self Administered Questionnaire for Local Government Extension
Workers**

Name -----

Job Station----- District-----

Region----- Date of the interview -----

Socio- demographic information

1. What is your sex? 1. Female 2. Male
2. What is your age? -----years
3. What is your highest level of agricultural training? (Circle one response)
 1. Certificate
 2. Diploma
 3. First degree
 4. Second degree
4. How many years have you been working as an extension worker? ----- years.
5. How many years have been working at your current work station? ----- years.

Research – extension – farmer linkage mechanisms

6. What are the existing linkages in the western zone? (You can circle more than one response)

- 1. Planning and coordination meetings (e.g. IPR, ZEC)
- 2. Training workshops/seminars
- 3. Field days
- 4. On - farm trials/Demonstrations/FFS plots
- 5. PRA /survey
- 6. Informal direct personal contacts
- 7. Agricultural shows
- 8. Mass media (radio, TV)
- 9. Others (mention)

7. Which institutions initiated the existing linkages mentioned above?

- 1. ARI Tumbi
- 2. DALDO
- 3. NGOs
- 4. Farmers
- 5. Others (mention)

8. What are the strengths of existing linkages?

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

9. What are the weaknesses of existing linkages?

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

10. In what aspects are research – extension – farmer linkages useful to your work? (You can circle more than one response)

1. Knowledge improvement among linkage partners
2. Technology dissemination
3. Technology adoption
4. Collaboration and communication among partners
5. Others (mention)

11. What is the implementation level of the following linkages?

Coordination meetings (IPR, ZEC) -----

On farm trials-----

Quarterly training workshops-----

12. What are your reasons for the above implementation level of linkages?

1. -----

2. -----

3. -----

13. What NGOs do you collaborate with?

14. What linkage activities do you collaborate with the above NGOs?

15. What is the level of collaboration between researchers and farmers? (Circle one response)

1. High

2. Average

3. Low

16. Give reasons for the above answer

17. What is the level of collaboration between researchers and extension workers? (Circle one response)

1. High

2. Average

3. Low

18. Give reasons for the above answer

19. What is the level of collaboration between researchers, extension staffs and NGOs? (Circle one response)

1. High

2. Average

3. Low

20. Give reasons for the above answer

Innovative research – extension – farmer linkages

21. What are the existing innovative linkages? (You can circle more than one response)

1. Cell phones

2. Internet

3. Meetings

Others (mention)

22. Reasons for using the above innovative linkages:

1. -----

2. -----

3. -----

4. -----

Factors Influencing Research – Extension – Farmer Linkages

23. What are positive factors which enhance linkages?

1. -----

2. -----

3. -----

4. -----

24. What are negative factors which inhibit linkages? (You can circle more than one answer)

1. Low education level of farmers

2. Low income of farmers

3. Absence of or weak farmers' organisations

4. Low knowledge in participatory approaches among extension workers

5. Low wages and lack of incentives for extension workers

6. Weak extension services

7. Improper diagnosis of farmers' problems

8. Inadequate funds for linkage activities

9. Poor coordination between research and extension at all levels

- 10. Limited involvement of extension and farmers in technology development
- 11. Weak M & E system of transferred technologies
- 12. Poor support services (input supply, credits markets and rural infrastructure like roads
- 13. Others (specify) -----

Strategies for strengthening research – extension – farmer linkages

25. What strategies do you recommend for strengthening linkages?

- (i) -----
- (ii) -----
- iii) -----
- (iv) -----

26. What strategies do you recommend for strengthening innovative linkages?

- (i) -----
- (ii) -----

27. What other opinions do you have concerning research – extension- farmer linkages?

THANK YOU FOR YOUR COOPERATION

Appendix 2: A Self Administered Questionnaire for ARI Tumbi Researchers

Name-----

Date -----

Socio- demographic information

1. What is your sex? 1. Female 2. Male
2. What is your age? -----years
3. What is your highest level of agricultural training? (Circle one response)
 1. Diploma
 2. First degree
 3. Second degree
 4. Doctor of philosophy (PhD)
4. For how many years have you been working as a researcher? -----years
5. For how many years have been working at your current work station? -----years

Research – extension – farmer linkage mechanisms

6. What are the existing linkages in the western zone? (You can circle more than one response)
 1. Planning and coordination meetings (e.g. IPR, ZEC)
 2. Training workshops/seminars
 3. Field days
 4. On - farm trials/Demonstrations/FFS plots
 5. PRA /survey
 6. Informal direct personal contacts
 7. Agricultural shows
 8. Mass media (radio, TV)
 9. Others (mention)
7. Which institutions initiated the existing linkages mentioned above?
 1. ARI Tumbi

- 2. DALDO
- 3. NGOs
- 4. Farmers
- 5. Others (mention)

8. What are the strengths of existing linkages?

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

9. What are the weaknesses of existing linkages?

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

10. In what aspects are research – extension – farmer linkages useful to your work? (Circle one response)

- 1. Knowledge improvement among linkage partners
- 2. Technology dissemination
- 3. Technology adoption
- 4. Collaboration and communication among partners
- 5. Others (mention)

11. What is the implementation level of the following linkages?

- Coordination meetings (IPR, ZEC) -----
- On farm trials-----
- Quarterly training workshops-----

12. What are your reasons for the above implementation level of linkages?

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

3. -----

4. -----

13. What NGOs do you collaborate with?

14. What linkage activities do you collaborate with the above NGOs?

15. What is the level of collaboration between researchers and farmers? (Circle one response)

1. High

2. Average

3. Low

16. Give reasons for the above answer

17. What is the level of collaboration between researchers and extension workers? (Circle one response)

1. High

2. Average

3. Low

18. Give reasons for the above answer

19. What is the level of collaboration between researchers, extension staffs and NGOs? (Circle one response)

1. High

2. Average

3. Low

20. Give reasons for the above answer

Innovative research – extension – farmer linkages

21. Existing innovative linkages (You can circle more than one response)

1. Cell phones

2. Internet

3. Meetings

Others (mention)

22. Reasons for using the above innovative linkages:

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

Factors Influencing Research – Extension – Farmer Linkages

23. What are the positive factors which enhance linkages?

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

24. What are negative factors which inhibit research- extension – farmer linkages? (You can circle more than one answer)

1. Low education level of farmers
2. Low income of farmers
3. Absence of or weak farmers' organisations
4. Low knowledge in participatory approaches among extension workers
5. Low wages and lack of incentives for extension workers
6. Weak extension services
7. Improper diagnosis of farmers' problems
8. Inadequate funds for linkage activities
9. Poor coordination between research and extension at all levels
10. Limited involvement of extension and farmers in technology development
11. Weak M & E system of transferred technologies
12. Poor support services (input supply, credits markets and rural infrastructure like roads
13. Others (specify) -----

Strategies for strengthening research – extension – farmer linkages

25. What strategies do you recommend for strengthening linkages?

(i) -----

(ii) -----

iii) -----

(iv) -----

26. What strategies do you recommend for strengthening innovative linkages?

(i) -----

(ii) -----

iii) -----

(iv) -----

27. What other opinions do you have concerning research – extension- farmer linkages?

THANK YOU FOR YOUR COOPERATION

Appendix 3: Interview Schedule for Farmers Collaborating with ARI Tumbi

Researchers

Name of Farmer -----

Village----- District-----

Region-----Date of the interview -----

Socio- demographic information

1. What is your sex? 1. Female 2. Male
2. What is your age? -----years
3. What is your marital status?
 1. Married
 2. Single
 3. Others (mention)
4. What is your education level?
 1. None
 2. Standard four
 3. Standard 7 or 8
 4. Form four
 5. Others (mention)
5. For how many years have you been collaborating with ARI Tumbi researchers? -----
6. What is your main source of income?
 1. Crop production only
 2. Livestock production only
 3. Crop and livestock production
 4. Others (mention)

Research – extension – farmer linkage mechanisms

8. What linkage activities have you been involved in with ARI Tumbi researchers?

1. On farm trials
2. Demonstrations/FFS
3. Field days
4. Monitoring and evaluation exercises
5. Seminars
6. Others (mention)

9. Which institutions initiated the above linkages?

1. ARI Tumbi
2. DALDO
3. NGOs
4. Farmers
5. Others (mention)

10. What has been the frequency of implementation of on farm trials in the last three years (2005 to 2007)?

1. Conducted every year in the three years
2. Conducted two years
3. Conducted one year only

11. Explain your answer above

14. Have you adopted any technologies from your participation in linkage activities?

1. Yes
2. No

15. Explain your response above

16. What lessons have you learned from your collaboration with researchers?

17. What challenges do you face in your collaboration with researchers?

1. Late commencement of trials and irregular implementation
3. Poor follow up by researchers and extension staffs
4. Poor communication with researchers

5. Others (mention)

18. Do you collaborate with any NGOs in agricultural extension activities?

1. Yes 2.No

19. If yes mention the NGOs

20. How important is your collaboration with NGOs?

Factors Influencing Linkages

21. What are the challenges in your collaboration with researchers?

22. What challenges do you get in adoption of new agricultural technologies and other agricultural activities?

Recommendations for Strengthening Research – Extension – Farmer Linkages

23. What recommendations do you suggest for strengthening research – extension – farmer linkages?

(i) -----

(ii) -----

iii) -----

(iv) -----

24. What other opinions do you have concerning research – extension- farmer linkages?

THANK YOU FOR YOUR COOPERATION

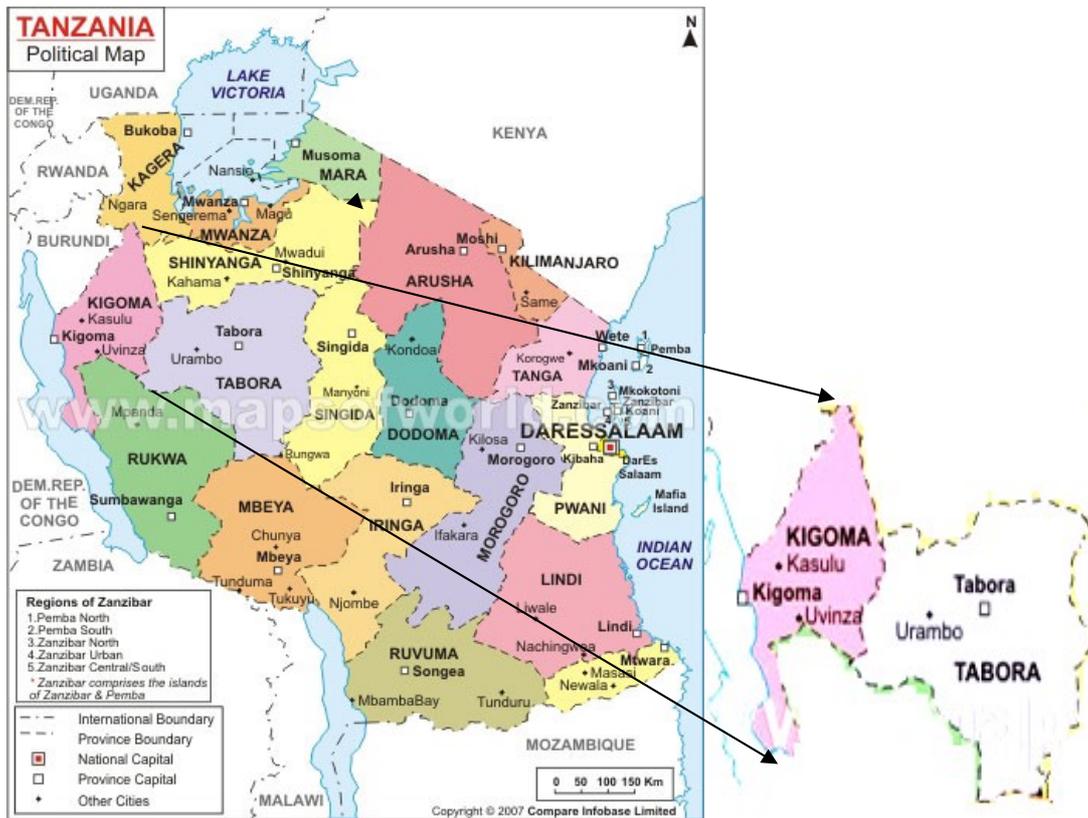
**Appendix 4: An Interview Guide for Key Officials of the Ministry of Agriculture,
Food Security and Cooperatives.**

1. Major initiatives made by the ministry to strengthen research – extension – farmer linkages in the past
2. Which initiatives worked and which did not?
3. Factors which enhanced linkage performance in questions 2 above
4. Reasons which caused poor performance of linkages in question 2 above
5. Current performance of research – extension – farmer linkages, at zonal and national levels
6. Current reasons for strong/weak linkages
7. Involvement of NGOs, farmer organisations and the private sector in linkages, nationally
8. Coordination and collaboration mechanisms between DCD (extension) and DRD and with other ASLMs (like DRTE or MLF)
9. Performance of ASDP in the first three years of operation in relation to linkages.
10. Strategies for strengthening linkages, sustainably, at all levels
11. Other relevant information about research extension farmer linkages

Appendix 5: A Checklist for Discussions with NGOs

1. Main agricultural activities of your organisation
2. Area (districts) coverage under your mandate
3. Duration the NGO has been working in the area
4. Target group(s) for your service
5. Achievements and constraints
6. Strategies used in dealing with the above constraints
7. Linkage activities with the LGA extension service of the area
8. Linkage activities with ARI Tumbi
9. Duration of collaboration with ARI Tumbi
10. Existence of MoUs to guide with research, LGA extension
11. Importance of linkage activities with ARI Tumbi and LGA extension service (DALDO)
12. Performance of linkages with DALDO and ARI Tumbi
13. Factors enhancing linkage activities with ARI Tumbi and LGA's extension service
14. Factors inhibiting linkage activities with ARI Tumbi and LGA's extension service
15. Suggestions for strengthening the above linkages
16. Other opinions on research – extension – farmer linkages

Appendix 6: Map of Tanzania Showing Location of Study Area the Western Agricultural Research Zone - Kigoma and Tabora Regions



Source: www.mapsofworld.com