



UNIVERSITÄT  
HOHENHEIM

Institute of Social Sciences in Agriculture  
Department of Rural Sociology

Farmers' perceptions and opinions of the implementation process of food securing  
innovations in Tanzania

Master thesis in the faculty of Agricultural Sciences

By Diana Naikoba

Matr. Nr 646833

First Examiner: Prof. Dr. Andrea Knierim

Second Examiner: Dr Frieder Graef

Submitted

April, 2018

Funded by  **HORTINLEA**  
DIVERSIFYING FOOD SYSTEMS

 **Trans-SEC**  
Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

## **Acknowledgement**

I would like to extend my sincere gratitude to my principal supervisor Prof. Dr. Andrea Knierim for the constant guidance and unwavering support which have enabled me to write this thesis to completion. Special thanks to Dr. Frieder Graef, my second supervisor, Dr. Barbara Schröter and Dr. Emil Gevorgyan of the Trans-SEC and HORTINLEA projects for giving me a chance to write this thesis with these projects. Thank you for the supervision, material and financial support rendered. I am grateful to the team at the Department of Rural Sociology at the Institute of Social Sciences in Agriculture (430a) especially Ms Birke, Ms. Herrera, Ms Gölz and Dr Gerster-Bentaya for all inputs towards this thesis. Your timely insights at the various stages of this thesis made a difference.

I also would like to extend my gratitude to Trans-SEC's staff and the Soil Water team at SUA for the supporting me while in the field. I am eternally grateful to the German Academic Exchange Services (DAAD) for enabling me pursue this master's program. I would like to extend my heartfelt gratitude to Mrs Katrin Winker, the program coordinator for MSc Agricultural Economics for the encouragement, love and support throughout this entire academic journey.

I would also like to extend my utmost gratitude to my family for encouraging me and believing in me. Special thanks to Aunt Irene for mentoring, supporting and cheering me on to the end. And finally, my sincere gratitude to my classmates and friends especially Narcisse, Alex, Bezawit, Ianna, Marwa, Severin, Theresa, Juan and Kayode, thanks for the wonderful company.

## **Abstract**

Although Tanzania has experienced economic growth in the recent past, poverty and food insecurity are still high especially in rural areas where majority of the people are smallholder farmers. These mostly practice low yielding subsistence agriculture. The low productivity increases vulnerability of smallholder households to food insecurity and poverty. To address challenges in the rural food value chain in this country, the Trans-SEC project, developed ten food securing innovations by collaborating with farmers in a Participatory Action Research. A few farmers tried out these innovations to assess whether they could spur growth in food and income. This thesis is part of the ongoing monitoring of the innovations in the Trans-SEC project. It focused on three innovations; the Kitchen Gardens, Tied Ridges and the Poultry Crop Integration.

The study objective was to explain the implementation process by exploring the perceived facilitating and hindering factors and how these may contribute to the differences in the performance of the innovations hence gaining insights into the degrees of implementation. This was facilitated by asking interviewees to describe the implementation process, to explain the factors influencing farmers' decisions to implement the innovations, the perceived benefits from being part of the process and farmers' opinions about integrating African Indigenous Vegetable in the Kitchen Garden innovation. The farmers were assumed to be logical decision makers who decided to implement to achieve their varying goals. The Theory of Planned Behaviour and Diffusion of Innovations' theory were used to explain farmers' behaviour as they implemented.

A case study research approach was used to obtain qualitative data from farmers and experts in Dodoma and Morogoro regions. A Net-Map tool, the "process Net-Map" and an interview guide were the main tools used during data collection. The results were analysed using a mixed approach. The implementation processes were mapped, visualizing the implementation paths of the innovations per village from farmers' and experts' perspectives. Points of entry of challenges faced along the paths were highlighted. The different facilitating and hindering factors perceived to be influencing the extent to which farmers were using the innovations were explored. It was noted that farmers gained a lot of knowledge which when applied consistently under conducive circumstances will have a positive impact on their food and income situation.

**Keyword:** African Indigenous Vegetables, process Net-Map, innovation, implementation

# Contents

Acknowledgement	ii
Abstract	iii
Abbreviations and/ acronyms	viii
1. Introduction	1
1.1 Context and social significance of the topic.	3
1.2 Problem description	4
1.3 Objective of the study	4
1.4 Research question	5
1.5 Overview of method and Scope of the study	5
1.6 Content overview	6
2. Literature Review	7
2.1 Poverty and food insecurity interlinkages.	7
2.1.1 Poverty and food insecurity in Tanzania	8
2.1.2 Action Research as a source of change in rural Tanzania	8
2.1.3 Behaviour change in the innovation adoption-implementation processes.	13
2.2 The implementation process.	13
2.2.1 Factors influencing the implementation process.	14
2.3 Theoretical framework	17
2.4 Conceptual framework	18
2.5 Perceptions and opinions of actors about the implementation process	19
3. The Study	21
3.1 The regions	21
3.2 The study villages	22
4. Methodology	24
4.1 Research design and approaches	24
4.2 Data collection methods used in the study	25
4.3 Research tools	27
4.3.1 The process Net-Map	27
4.3.2 The Guiding questions	28
4.3.3 Interpreter usage	28
4.3.4 Pilot testing the guiding questions and Process-Net Map	28
4.4. Sample selection methods and criteria	28
	iv

4.5 Data collection in the two case study sites	30
4.6 Data analysis	33
4.6.1 The narratives analysis for themes	33
4.6.2 The implementation process analysis: The aggregated process Net-Maps	34
4.6.3 Statistical analysis of the rating of the implementation process.	34
4.7 Ethical consideration	35
4.8 Strengths and limitations of the methodological approach	36
5. Findings	37
5.1 Farmers' characteristics.	37
5.2 The implementation processes of the three innovations.	37
5.2.1 The Implementation steps, actors and their roles.	38
5.2.2 The aggregated process Net-Map	40
5.3 Which actors influenced the implementation process most?	51
5.4 Which factors facilitated the implementation process?	53
5.4.1 Implementation goals as facilitating factors	53
5.4.2 Gains from the implementation process as influencing factors	54
5.4.3 Support, monitoring and supervision of the innovations.	59
5.4.4 Group registration and group support	59
5.4.5 Compatibility of innovation with needs, experience and innovation fit	59
5.4.6 Observability of results and comparative advantage	60
5.4.7 Perceived ease of use	60
5.4.8 Communication/information flows in the implementation social systems	60
5.4.9 Fairness and trust in the implementation process	61
5.5 Which factors are hindering the implementation process?	62
5.5.1 Failure to observe results from implementation efforts.	62
5.5.2 Perceived difficulty to install or use the innovations.	63
5.5.3 High costs incurred	64
5.5.4 Low knowledge and incomplete information	64
5.5.5 Marketing constraints	65
5.6 Degree of implementation (extent of innovation use) of the innovations.	65
5.7 Opinions on growing African Indigenous Vegetables (AIVs)	67
6. Discussion	69
6.1 The steps and actors in the implementation of the three innovations	69
6.2 Who were the influential actors the implementation process?	70

6.3 The benefits from the implementation process: Which actors gain most?	70
6.3.1 The gain in the Kitchen Gardens:	71
6.3.2 The gains in the Tied Ridges' implementation	71
6.3.3 The gains in the Poultry Crop Integration implementation	72
6.4 The factors facilitating the implementation process	72
6.4.1 Innovation attributes and their influence on the implementation processes	72
6.4.2 Training as a facilitating factor	74
6.4.3 Trust as a facilitating factor	74
6.4.4 Availability and development of the market near the farmers.	74
6.4.5 Support and monitoring as drivers in the process	75
6.5 Growing the AIVs as farmers implement the innovations	75
6.6 Conclusion	75
6.7 Methodological limitations	76
6.8 The recommendations	77
7. References	79
8. Annexe	92
Declaration	116

**Table of figures**

Figure 1: The Kitchen Garden..... 10

Figure 2: The Tied Ridges..... 11

Figure 3: The Poultry Crop Integration ..... 12

Figure 4: The Conceptual framework..... 19

Figure 5: The Map of Tanzania showing the regions..... 23

Figure 6: The main implementation steps ..... 38

Figure 7: Experts' aggregated process Net-Map for KG in Idifu ..... 41

Figure 8: Experts' aggregated process Net-Maps for KG in Changarawe ..... 42

Figure 9: Idifu KG farmers' aggregated process Net-Map..... 43

Figure 10: Farmers' aggregated process Net-Map for the KG in Changarawe ..... 44

Figure 11: Experts' aggregated process Net-Map for TR implementation in Idifu ..... 45

Figure 12: Experts' aggregated process Net-Map for TR in Changarawe ..... 46

Figure 13: Idifu TR farmers' aggregated process Net-Map..... 47

Figure 14: Changarawe TR farmers' aggregated process Net-Map..... 48

Figure 15: PCI experts' aggregated process Net-Map..... 49

Figure 16: PCI Farmers' aggregated process Net-Map ..... 50

Figure 17: Level of (degree) of implementation of the innovations..... 66

Figure 18: An example of process Net-Map ..... 92

Figure 19: The online Mann Whitney U test calculator used..... 92

## Abbreviations and/ acronyms

ACT	Agriculture Council Tanzania
ADA	Austrian Development Cooperation
AIVs	African Indigenous Vegetables
ARI	Agricultural Research Institute
CSS	Case Study Site
ERCC	Education, Research & Consultancy Centre (Lithuania)
EU	European Union
FA	Field Assistant
FAO	Food and Agricultural Organization
HORTINLEA	Horticultural Innovation and Learning for Improved Livelihood and Nutrition in East Africa (HORTINLEA)
ILO	International Labour Organization
KG	Kitchen Garden
Mo., AFC	Ministry of Agriculture, Food Security and Cooperatives of Tanzania
MoH	Ministry of Health and Social Welfare Tanzania
MVIWATA	<i>Mtandao wa Vikundi vya wakulima</i> Tanzania
NAP	National Agricultural Policy of Tanzania
NBS	National Bureau of Statistics
PAR	Participatory Action Research
PAI	Population Action International
PCI	Poultry Crop Integration
RCC	Research & Consultancy Institute (Cyprus)
SLE	Seminar für Ländliche Entwicklung



SOFI	State Of Food Insecurity in the world
SUA	Sokoine University of Agriculture
SVL	Sub-Village Leader
TAFSIP	Tanzania Food Security Investment Plan
TR	Tied Ridges
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change.
UPS	Upgrading Strategy
URT	United Republic of Tanzania
VEO	Village Extension Officer (extension officer for crop)
VLE	Village livestock expert (the extension officer for livestock)
WFP	World Food Programme
ZALF	Leibniz-Zentrum für Agrarlandschaftsforschung

# 1. Introduction

Sub-Saharan Africa (SSA) hosts 80% of Africa's rural poor most of whom depend on agriculture for their livelihood (SARRIS ET AL. 2006; FAO 2015). Tanzania is no exception. Most of its population live in rural areas depending on rain-fed subsistence agriculture (MARO ET AL. 2011; WORLD BANK 2015). The farmers not only use poor technologies but are also reluctant to take up new ones. Soil fertility has declined in the recent past due to continuous cultivation, soil erosion and other factors. These constraints coupled with erratic climatic conditions contribute to the high rural poverty and food insecurity (MoAFC 2006; SARRIS ET AL. 2006; MNENWA & MALITI 2010) in some regions such as Dodoma. High rates of food insecurity especially in Chamwino district of Dodoma region have led to the high malnutrition rates among children below five years of age (MUTABAZI 2016).

Several pathways have been proposed to address food insecurity which include: Improving crop productivity to enable farmers obtain surpluses that could be sold to reduce income poverty, identification of measure to address socio-economic constraints in production, strengthening rural food systems, promoting research and extension in rural areas (RIVERA 2003; KABISAMA ET AL. 2007; PAUW & THURLOW 2011; BODNÁR ET AL. 2011; FAO 2014B). One of the ways to make the food systems sustainable involves addressing the challenges along the rural food value chain. This was pursued by Trans-SEC, a Participatory Action Research (PAR) project (GRAEF ET AL. 2014). PAR is a form of action research in which actors from academia and workplace (MCTAGGART 1994) team up with affected communities (beneficiaries) to solve societal problems in a project format (KAGAN ET AL. 2006).

The Trans-SEC project is working towards reducing challenges along the entire rural food value chain (GRAEF ET AL. 2014). In this project, interventions or Upgrading Strategies (UPS) with potential for enhancing food security in several parts of the country were developed (SCHINDLER ET AL. 2016; REINHARDT & HERRMANN 2017) through collaboration between farmers and experts. The strategies were tried out by farmers, individually on own farms from August 2014 onwards (GRAEF, ET AL 2016). Trying out Upgrading Strategies by farmers may necessitate changing some aspects of farm production processes. The changes may be slight or radical (WEST 2002). The transition from commonly done practices or processes to slightly different or totally new ones in agriculture is equivalent to innovating hence the use of the term innovations hereafter.

An innovation is defined by OECD (2013) as; “*the implementation of a new or significantly improved product or service, a process, a new marketing method, or a new organisational method in business practices, workplace or external relations*”(OECD 2013: 124). Innovations are usually adopted to improve efficiency in any activity (SMITH 2005; OECD 2013). Innovating is the deliberate effort “*to bring about benefits from new changes*” (WEST 2002: 3). Implementation of an innovation is the putting to use of new ideas, the use of new or slightly improved products or putting into practice a new way of doing something (WEST 2002).

Farmers who adopt and implement innovations are assumed to be logical decision makers motivated by the need to maximize own utilities (WEJNERT 2002; DERESSA ET AL. 2011). Their decisions to implement new technologies are often driven by several goals such as the need to achieve economic benefits (profits), higher productivity of enterprises and higher levels of satisfaction (WEST 2002; SCOTT ET AL. 2008; DERESSA ET AL. 2011). The goals and expectations of farmers as they embark on implementation processes are believed to be influenced by how they perceive the attributes of innovations (innovations’ characteristics). These attributes include the perceived ease of use (complexity) of the innovations, compatibility (with needs, values and experience of the users), observability of results, relative advantage, trialability (MRICA ET AL. 1995; ROGERS 1995; DIEDEREN ET AL. 2003; PERKINS 2011). Farmers as consumers (users) of innovations are unique with diverse socio-economic and psychographic characteristics. These characteristics contribute to the varying motivations to use the new technologies (AMSALU & DE GRAAFF 2007; BO ET AL. 2013). In addition, factors within the innovation’s social system (such as environmental factors) have potential to influence how the innovation performs once put to use. The interaction of the innovations with other factors influences the attitudes and beliefs users develop towards an innovation which subsequently influences the decision to use or reject the innovation (TEY ET AL. 2011).

This study examined perceptions and opinions. The opinions were considered to be synonymous with attitudes (BERGMAN 1998). The perceptions were considered to be mechanisms in which individuals obtain information from their surroundings and convert it into mental consciousness (HOFFMANN ET AL. 2009). The implementation process in this context encompasses all the activities between making adoption commitment to when the promoted intervention become routines. This consists of several activities performed by individuals or groups of actors in organised settings (TORNATZKY ET AL. 1990; ROTHMAN 2006; AMSALU & DE GRAAFF 2007; MAY & FINCH 2009).

## **1.1 Context and social significance of the topic.**

The implementation processes of the Kitchen Gardens, Tied Ridges and Poultry Crop Integration in both regions were focused upon. The Kitchen Gardens (KG) involved growing leafy vegetables on special bags with an aim of increasing vegetable availability among adopters which would lead to increased vegetable consumption. The Tied Ridges (TR) involved growing crops on special ridges that captured rainwater in situ to improve soil conditions, hence increasing crop yields. The Poultry Crop Integration (PCI) involved keeping improved breeds of chicken using an improved poultry keeping system to make this enterprise economically viable, hence increase incomes among adopters. These innovations are periodically assessed on several criteria including their potential to improve farmers' income and food security situation (MAKOKO ET AL. 2017; URASSA ET AL. 2017).

This thesis is part of an ongoing monitoring for the three innovations and the implementation processes were focused on because they had not yet been studied. Studying these processes is advocated for in innovation studies because many challenges crop up at this point (KLEIN ET AL. 2016) hence vital for identifying these emerging challenges. It also facilitates obtaining information on the project's progress towards achieving their set goals and reveals any deviations from the desired goals (PONNIAH ET AL. 2008). Studying the process can also lead to generation of insight into how the intervention could be improved (HULSCHER ET AL. 2003). Monitoring the processes is thus essential for the routinization of promoted ideas (innovation) (ROGERS 1995; FAO 2014; KLEIN ET AL. 2016).

This study focused on perceptions and opinions especially of farmers on several pre-determined criteria such as: (a) the perceived influence of several actors on the implementation process (b) the perceived gains in terms of income, food and knowledge (c) trust and fairness of the process (d) the factors influencing the implementation process. Monitoring the implementation process necessitated retracing the process step by step (HULSCHER ET AL. 2003) from the initial to the latest step using a process Net-Map. The process Net-Map is a participatory tool used by researchers to map processes thus visualizing networks in the implementation process. This tool also facilitates gaining insights into facilitating and hindering factors in the processes (ILUKOR ET AL. 2015; POKU ET AL. 2018).

The farmers who tried out the innovations (active farmers) were focused on as primary sources of information during the study. These were assumed to be well informed and knowledgeable due to their experiences from using the innovations. Their involvement is often perceived to be

critical in making the implementation of change sustainable (DEARING 2010) hence their opinions and perceptions obtained. Experts' perceptions and opinions were also obtained and used in this thesis to provide more insights especially on aspects that may have been too technical for farmers to explain. Experts' perceptions were also used for verifying some aspects mentioned by farmers.

The information generated is feedback to the HORTINLEA and Trans-SEC project who financed the data collection phase of this study. Using the information could contribute to making the innovations suitable to their implementation contexts (KLEIN ET AL. 2016). The Trans-SEC project could learn about what worked and hindered the process which could be of use to the project if they decide to promote these innovations to other areas but in similar settings. HORTINLEA started also carrying out research on Tied Ridges and Fertiliser Micro dosing and promotion of AIVs in Tanzania in 2017, hence highly interested in learning from the results. The projects' partners in research and development and any other development agents interested in carrying similar work in a similar setting could also learn something from this information. This learning could contribute to a more sustainable implementation of similar innovations in future in similar settings.

## **1.2 Problem description**

Farmers adopted and implemented the different innovations, hoping to improve their food security (HERNANDEZ ET AL. 2016). However, the implementation speed of the innovations varied (MAKOKO ET AL. 2017). In addition, a few of the innovations were not adopted and their groups closed (Hernandez 2016). The existence of variations in adoption and level of use of the innovations could be attributed to several facilitating and hindering factors. This study assessed the implementation process of the Kitchen Gardens, Tied Ridges and Poultry Crop Integration by exploring the opinions and perceptions of interviewees about several aspects of the processes especially the facilitating and hindering factors.

## **1.3 Objective of the study**

The main objective of this study is: *“To explain the process of implementation of the garden, Poultry crop integration, Tied Ridges of Trans-SEC by exploring farmers' perceived facilitating and hindering factors, how these may contribute to the differences in the performance of the innovations hence gain insights into the degrees of implementation.*

The minor objectives are:

1. To describe the process of implementation by retracing the implementation steps of the Kitchen Garden, Poultry Crop Integration and Tied Ridges in the two case study sites
2. To explore the facilitating and hindering factors contributing to the variation in implementation of the three innovations in Idifu village of Chamwino district in Dodoma region and Changarawe village of Kilosa district in Morogoro region.
3. To assess the actors' perceived benefits from participating or facilitating the implementation process of the three innovations.
4. Identify opinions and attitudes of actors towards incorporating African Indigenous vegetables in their innovative practices.

#### **1.4 Research question**

The guiding research questions in the study are as follows;

- What are the specific steps through which the innovations were implemented from 2014 to date? Were there any variations in the two regions?
- Which actors influenced the process of the implementation of the Kitchen Garden, Tied Ridges and Poultry-Crop Integration? Why were these actors perceived to be influential?
- What are the benefits actors perceive to be gaining from participating in the implementation processes of the three innovations? Which actors are perceived to have gained most from the implementation processes of the different innovations?
- What are the hindering and facilitating factors in the implementation process of the three innovations in the two case study sites? Could these be influencing the difference in the degree of implementation of the different innovations the two regions
- What are farmers' opinions and attitudes towards incorporating African Indigenous vegetables in the Kitchen Gardens?

#### **1.5 Overview of method and Scope of the study**

A qualitative research approach was used to study the implementation process. The field research instrument used for the study were interviews; both unstructured and semi-structured interviews. The anticipated responses were not predefined necessitating the use of a qualitative research design (PUNCH 2005). Due to time constraints, the study was limited to the implementation process from August 2014 to April 30<sup>th</sup>, 2017.

## **1.6 Content overview**

The thesis starts with an introduction and study contexts presenting the study problem and objectives and research questions. This is followed by the literature review chapter in which concepts and theories used in this study are explained. In the third chapter, the study area is explained. This is followed by the methodology chapter in which data collection and analysis approaches used in this study are made clear. The fifth chapter is the presentation of study findings which are discussed in the sixth chapter. This chapter also consists of the limitations to the study, the conclusions and recommendations.

## **2. Literature Review**

This chapter introduces the different concepts used in the thesis. It explores food insecurity and poverty linkages, literature related to innovations and the implementation process. The innovations whose processes are studied are briefly explained in this chapter.

### **2.1 Poverty and food insecurity interlinkages.**

Poverty occurs when people have limited access to incomes and other resources. This makes them face difficulties in accessing good diets and social amenities, thus limiting their abilities to playing their roles in the society (CHAMBERS 2006). Poverty is mainly defined in terms of income poverty (basic needs poverty and food poverty), with consumption used as an indicator for defining poor people. The extent of poverty in an area is established by obtaining an estimate of how far below the poverty line people are (*IBID*). The effectiveness of this indicator has however been contested in the recent past. Food security can be defined in terms of people's ability to acquire and consume adequate amounts of foods of their choice at all times so that they lead a healthy and active life (FAO 1996). Food availability refers to food supply from own production or in the market (MAHADEVAN & HOANG 2016). Access to food (and utilization) by households depends on their capacity to lay claims over food within their vicinity. Limited access to food leads to hunger which is manifested as micro and macronutrient deficiencies (WHEELER & VON BRAUN 2013).

Poverty and food insecurity are interrelated (MAHARJAN & JOSHI 2009). People with limited access to incomes tend to be food insecure (MISSELHORN 2005; VORSTER & KRUGER 2007) and are prone to periodic food insecurity. During times when availability and access to food is limited, such households are pressed with the need to smoothen consumption to survive through that phase. Such households liquidate own assets to buy food which reduces their asset base, they reduce intake of protein dense foods that are replaced with energy-dense carbohydrates, feeding frequency during hard times also reduces and at times food redistribution in households occurs. Changing consumption patterns predisposes vulnerable members of such households such as women and children to malnutrition which when not addressed can have dire consequences (CHANG 2009; SWAI ET AL. 2012; PANGARIBOWO ET AL. 2013). The effects of chronic food insecurity tend to be more pronounced among the children below five years. The children in food-insecure households tend to be stunted, underweight or wasted. Later on, these children perform poorly in schools, at times dropping out and taking up less economically



rewarding jobs as adults. This keeps their households in a form of the poverty trap (FAO 2015; CHANG 2009; SWAI ET AL. 2012; PANGARIBOWO ET AL. 2013). Poverty, therefore, creates more poverty and is a key driver of food insecurity (BERRY ET AL. 2015) in any country. This makes addressing poverty and food insecurity a major policy issue in many countries (FAO 2015).

### **2.1.1 Poverty and food insecurity in Tanzania**

Tanzania has high incidences of food insecurity and poverty (MARO ET AL. 2011; SCHNEIDER 2014). Income poverty is high especially in rural areas where (SEMBOJA ET AL. 2006) 70% of the population live. Most of these (80%) are farmers (SEMBOJA ET AL. 2006; MELOROSE ET AL. 2015; WORLD BANK 2015; SEMBOJA ET AL. 2006). The sector is predominantly low yielding subsistence agriculture where soil fertility is low due to poor management practices over the years and low fertilizer use (SENKORO ET AL. 2017). Declining soil fertility leads reduction in agricultural output. Farmers in addition sell their produce immediately after harvesting to get income to so that they can purchase other basic needs. This not only leads to lower profits but also subsequently reduces households' food stocks which are much needed later during the dry season, when the farms are empty. This makes such households vulnerable to periodic food insecurity and also stuck in vicious cycles of poverty, some of Tanzania's main challenges (UNDP, 2014).

There is a strong positive correlation between increased agricultural productivity and poverty reduction (KUYIAH ET AL. 2015) in Tanzania, hence a key sector in addressing the country's poverty and food insecurity (SCHINDLER ET AL. 2014; SENKORO ET AL. 2017). As stated in the previous chapter several pathways have been suggested and pursued to address these challenges by different actors (including Trans-SEC and HORTINLEA) in the country. The Trans-SEC project driven by the goal of making the rural food systems sustainable conducted Action Research in some parts of Tanzania (GRAEF ET AL. 2014).

### **2.1.2 Action Research as a source of change in rural Tanzania**

Action Research is pursued in rural development to bring about behaviour change among individuals or groups. It aims at solving problems associated with a practice and learning more from the intervention to transform or improve own practices (TRIPP 2005; MCNIFF & WHITEHEAD 2010; MATHEWS & CHRISTOPHER 2016). In Trans-SEC's Action Research, farmers worked with experts to solve some of the challenges in the rural food value chain through knowledge exchange (SIEBER & GRAEF N.D.). This led to the development of ten innovations:

(1) Tied Ridges and fertilizer micro dosing, (2) pyrolizer for charcoal making, (3) maize Sheller and millet threshing machines, (4) Improved wood supply and tree planting, (5) Improved Cooking Stove, (6) sunflower oil pressing, (7) Optimised Market-oriented Storage, (8) household nutrition education and Kitchen Gardens, (9) Poultry Crop Integration, (10) mobile integrated market access system (m-IMAS). These innovations were adopted and tried out by farmers (MAKOKO ET AL. 2017). This study focused on three innovations, namely: the Poultry crop integration, Tied Ridges and Fertilizer micro dosing and Household nutrition education and kitchen garden

### **The Kitchen Gardens: Promotion of vegetable growing by HORTINLEA and Tran-SEC**

The Kitchen Garden was designed to mitigate the high malnutrition rates attributed to poor diet diversity. High consumption of carbohydrates, low protein and vegetable intake among rural households were perceived to be contributing to high incidences of hidden hunger (micronutrient deficiency). This led to high occurrence of hidden hunger-related diseases like anaemia among children and pregnant women especially in Dodoma region (MBWANA ET AL. 2015; MUTABAZI 2016). This innovation was promoted to increase production of green leafy vegetables. This would increase vegetable availability among implementing households. The Kitchen Garden was combined with nutritional education. It was intended to address the limited nutritional knowledge and the stereotypes people have towards vegetable consumption. All these would subsequently lead to higher consumption of green leafy vegetables among rural households (MBWANA ET AL. 2015; MAKOKO ET AL. 2017).

The Kitchen Gardens have been promoted and practised in varying contexts in developing countries with rural farmers to address malnutrition and income poverty (GALHENA ET AL. 2013). Vegetables are usually grown in and around the house for household consumption (MISRA ET AL. 2008; MOHSIN ET AL. 2017). Trans-SEC promoted the pocket bags type of KG made by filling special bags with soil and other planting materials. Green leafy vegetables like collards and Chinese cabbages were grown on the bags. This type of KG was promoted because the bags were deemed cheaper and required less water to irrigate unlike when growing vegetables directly on the ground. This would make the innovations functional even in water semi-arid Dodoma (MBWANA ET AL. 2015). A study by URASSA ET AL. (2017) highlighted that experts in the project anticipated farmers to eventually abandon growing the promoted 'modern' vegetables in future due to the perceived high cost of seeds. The study further revealed that KG farmers were anticipated to eventually switch to growing the traditional vegetables.

Traditional vegetables or African Indigenous Vegetables (AIVs) are leafy vegetables native to Sub Saharan Africa (SSA) hence part of the food system in this region (TALANI ET AL. 2012). These vegetables were underutilised in the past. People's consumption trends of these vegetables have changed in the recent decades due to studies which continuously highlight the potential of AIVs in curbing hidden hunger. There is scientific evidence revealing that some of these vegetables have superior micronutrient density in comparison to modern vegetables. The AIVs have further been identified as having potential to reduce income poverty in rural areas if farmers grow and sell them (TALANI ET AL. 2012; GEVORGYAN ET AL. 2013). HORTINLEA, a sister project to Trans-SEC, which has promoted growth and consumption of AIVs in Kenya is currently expanding its activities to Tanzania. This project has keen interest in learning about farmers' opinions and perceptions towards these AIVs. This study explored farmers' opinions on growing, consuming and selling the AIVs as probing information for HORTINLEA.



**Figure 1: The Kitchen Garden**

### **The Tied Ridges and Fertilizer Micro-Dosing**

Soil infertility, soil degradation and low moisture content particularly in semi-arid Dodoma (KAHIMBA ET AL. 2015) contribute to low crop yields. This increases the vulnerability of households to food shortages (MONGI ET AL. 2010). Tied Ridges were designed to reduce erosion and conserving soil moisture to improve crop productivity (MAKOKO ET AL. 2017) hence reducing food insecurity. Tied Ridging is a form of cultivation where furrows are created between soils by ridging. The ridges are closed at regular intervals creating micro-catchment basins in the gardens. When the rains fall, water is retained in situ for longer periods compared to conventional cultivation. This facilitates water infiltration and reduces surface runoff. These ridges have in the past been promoted in research partnerships in several countries like Ethiopia,

Tanzania, Burkina Faso and Zimbabwe to reduce moisture stress and increase food crop yield (KABANZA & RWEHUMBIZA 2007; PALE ET AL. 2009; B. SHIFERAW ET AL. 2009; BIAZIN & STROOSNIJDER 2012; NYAMADZAWO ET AL. 2013). In these studies, crops like sorghum, maize and pulses were grown on trial basis and impact assessments revealed that crops grown on Tied Ridges gave higher yields than those grown on flat cultivation (PALE ET AL. 2009; NYAMADZAWO ET AL. 2013).

In the Trans-SEC project, this innovation was promoted in conjunction with Fertilizer Micro-dosing. Fertilizer micro dose refers to the addition of small quantities of fertilizers to crops growing on the ridges at sowing stage instead of using the common practice of fertilizer broadcasting. This method of fertilizer usage would improve fertilizer efficiency (due to its lower fertilizer usage per hectare) making the venture less costly hence more appealing to farmers to use fertilizers. These efforts would result into higher productivity of farms in Dodoma and Morogoro hence increased food availability for households using this innovation (MAKOKO ET AL. 2017).



**Figure 2: The Tied Ridges**

### **The Poultry Crop Integration system**

Several societies have for centuries kept poultry such as chickens alongside crop production (WONG ET AL. 2016) due its potential to improve economic situations of households. Poultry is commonly integrated with other farming activities to alleviate poverty. It is a renewable resource suitable for poor smallholder farmers, especially the women (MENSAH-BONSU ET AL. 2009B) and the landless. This is because it is relatively cheaper to manage compared to other

livestock such as cattle if locally available resources are used (AWUNI 2002; MACK ET AL. 2013). It is a ready source of income and food (animal protein for households in form of eggs and meat) (WONG ET AL. 2016). Most African farmers raise local chicken breeds in their backyards where they scavenge in free-range poultry system. In this system, feed input from the farmers is minimal and they hardly use any veterinary services. The poultry share dwellings with the farmers and the sector is characterised by a high rate of mortality (MENSAH-BONSU ET AL. 2009A).

Trans-SEC introduced this innovation as an upgrade from the traditionally kept low yielding indigenous chicken to better yielding improved breeds that would be kept under improved conditions. The chicken were to be kept alongside crop production and adopters would be trained thus becoming more efficient entrepreneurs. Manure from chicken houses would be applied to the crop fields and refuse from cropping units would feed the chickens. It was anticipated that this new system would result in higher incomes among implementing households thus improving nutrition security (KAHIMBA ET AL. 2015; MAKOKO ET AL. 2017) and food access (MUTABAZI 2016). Poultry would be easily liquidated assets in lean periods hence sources of revenue for purchasing household needs such as food. This would reduce their vulnerability to periodic food insecurity. Farmers received chicks on credit, raised them and sold the mature chicken on the local and regional market (KAHIMBA ET AL. 2015). A similar intervention was implemented in Bangladesh in which poultry was given to rural farmers as a tool to reduce poverty. This intervention led to an increase in incomes among households that were part of the project (RIISE ET AL. 2005).



**Figure 3: The Poultry Crop Integration**

### **2.1.3 Behaviour change in the innovation adoption-implementation processes.**

An innovation is a concept that is believed to be new to a group of people (MANNAN & NORDIN 2014). When innovations are introduced to communities, potential adopters become aware of them and adopt them. The adopters implement innovations to improve own circumstances (OCED 2012). Putting a new activity into use (implementation) is a behaviour change (TEY ET AL. 2011). The promoted behaviour change in Trans-SEC was the adoption and implementation of the innovations by farmers to address the different challenges along the food value chain (GRAEF ET AL. 2014). In innovation-implementation literature, the use patterns of the adopted practices or routines are measured by establishing the incidence of the new behaviour in the community. It is also referred to as the degree of implementation which is the extent to which the promoted behaviour is used by those who decided to take it up (TORNATZKY & KLEIN 1982; MICHIE ET AL. 2011).

## **2.2 The implementation process.**

Implementation is a *“specified set of activities designed to put into practice an activity or a program”* (FIXSEN ET AL. 2005: 5). It consists of processes undergone to install and use the new practice to a point when an innovation gets assimilated into daily routines (WANG 2009). The process has an impact on the expected outcomes (MEYERS ET AL. 2012). The implementation process is a purposeful phenomenon which when described reveals key steps embedded in it (FIXSEN ET AL. 2005). These activities include: Mobilization of resources and fit assessment, recruiting of staff, pre-innovation training, setting up suitable implementation structures and the designing of the implementation plan, installation of the innovations, supporting and monitoring the process as innovations are put to use, evaluation and feedback collection, and finally adapting the process (innovations) to make them suitable in the future replications (FIXSEN ET AL. 2005; MEYERS ET AL. 2012). This thesis explained the process from introduction of the project through adoption to current use of the innovations. This has been done in the past by allowing research participants to narrate their experiences about how the processes unfolded hence revealing impacts of the intervention on their lives. Sharing of experiences reveals a lot of information and gives insights into what needs to be done to effectively attain the desired behaviour change (HULSCHER ET AL. 2003).

Installing and using the innovation necessitates making adjustments in the entire set of a practice (FIXSEN ET AL. 2005). This can be in terms of levels of skills or in organizational structure. Switching from the usual practices to new practices tends to cause anxiety in the

adopters psychological field. Being aware of the probable positive impacts of using the innovations reduces the uncertainty adopters may harbour towards innovations (SAHIN 2006). Awareness about other innovations' attributes also contributes to reducing the uncertainty associated with adopting and using the innovations. These and other factors in one way or another influence the implementation processes (ROGERS 1995; SAHIN 2006; SCOTT ET AL. 2008; PERKINS 2011; ZHANG ET AL. 2015). These factors have been explained in details below.

### **2.2.1 Factors influencing the implementation process.**

#### **Innovations' attributes**

Innovations' attributes are deemed to be a matter of interest for actors engaged in the innovation implementation process to make the process a success (JOHNSON 2001). This is because as people adopt and gradually implement innovations, they observe their characteristics (attributes) leading to the development of either positive or negative attitudes towards it. Positive attitudes lead to successful routinization of new ideas into practice while negative attitudes lead to cessation of the implementation. The attributes influencing the process of implementation are; relative advantage, compatibility, complexity, trialability and observability of results (POPA ET AL. 1996; ROGERS 1995).

Relative advantage reflects the extent to which implementers perceive the new practice as being more advantageous in comparison to the old practice. Implementers often assess which situation is better in terms of costs, benefits, prestige, convenience, satisfaction and effort saving. Compatibility is the extent to which the new practice is perceived to be in harmony with farmers' values, beliefs, needs and previous experiences. Innovations that are compatible tend to be adopted and implemented more readily than those perceived otherwise. The ability of adopters to try out an innovation on a small scale and observe results for themselves influences their decisions to subsequently use it or reject it. Trying out an innovation provides adopters with evidence on whether it is suitable to their contexts and has potential to bring about the fulfilment of farmers' implementation goals or not. It also equips adopters with knowledge and confidence, making it easier for them to use the innovation. The perceived ease of use (complexity) is also sometimes referred to as usability of the innovation. New ideas that are perceived to be easier to understand or use are easily implemented. Complicated practices or those perceived to be difficult to use are hardly implemented. The extent to which results from implementing a practice are observed by members in an innovation's social system influences the extent to which an innovation is adopted and implemented. Gains should be observed after

a relatively shorter duration because the earlier the individuals observe gains from implementing an innovation, the more readily it will be implemented by more members in the community (ROGERS 1995; POPA ET AL. 1996; JOHNSON 2001; SAHIN 2006; KREIN ET AL. 2006; PERKINS 2011; GHANE ET AL. 2011; MEYERS ET AL. 2012; CHOR ET AL. 2015; ZHANG ET AL. 2015).

**The influence of communication on the implementation process.**

The communication of ideas, experiences, opinions and perception in the process of implementing is the backbone of an innovation (CRONQUIST ET AL. 2006). This is because it links scientists to consumers (users) of an innovation. Communication fosters knowledge exchange and learning which are important especially in PAR as a source of useful feedbacks. It informs the change agents if the promoted practices are succeeding in terms of contributing towards achieving positive results (implementation goals). Communication occurs during the actor-actor interactions. As the interactions take place, experiences about the adopted innovations are shared (CRONQUIST ET AL. 2006; KNICKEL ET AL. 2009; CHOR ET AL. 2015). The hindering and facilitating factors are revealed leading to the creation of new knowledge. It also facilitates mutual understanding among the actors (BECKETT & HYLAND 2009) hence having an impact on the way people behave (DERO & DEROIAN 2002).

**Social networks and actor influence.**

Actors in Participatory Action Research settings interact. The interactions lead to development of networks in actors' social and cultural milieu (HOFFMANN ET AL. 2009) as innovations are developed, disseminated and utilised (GEELS 2004). The networks have an impact not only on the ability of actors to access information but also on the information's quality (COWAN & JONARD 2004). That is, they influence who is in position to share their communication space hence their knowledge with whom. Being in contact with other actors in one's social networks exposes an individual to a diversity of ideas. The exposure influences the attitudes and perceptions developed by these actors especially the implementers (farmers) towards the innovations thus influencing the innovation-implementation processes (PATTERSON ET AL. 2009; MEIJER ET AL. 2015).

Social networks have been extensively studied in sociology to explain human behaviour in organisational settings in terms of which actors have influence and power over resources or activities in these settings (LU ET AL. 2005). The influence of actors over activities stems from the roles they play in the in the implementation process. The level of influence is not uniform. Some actors may have opinions and values that other members in their societies consider



important. Those with power are referred to as opinion leaders and these actors have potential to influence the adoption and implementation decisions. This is because some people may adopt innovations based encouragement of other people in their social networks (TALUKDER 2012). Support from influential actors reduces uncertainty and discomfort in the adopter's psychological field arising from their adoption decisions. It also shapes an individual's belief in their ability to install and use the innovation hence linking an individuals' perceived ease of use to social influence (LU ET AL. 2005). Social influence is a normative belief adopters have about the innovation adoption process, that is, the belief that implementing is the appropriate step to take (TALUKDER 2012). The degree of influence of actors is said to be linked to perceived trustworthiness of an actor (DERO & DEROIAN 2002).

### **Implementation goals**

Adopters have goals as they embark on the implementation of innovations. These goals are also referred to as motivations and can be for individuals or organisations. The goals are the initial drivers for adoption and implementation. Motivations are the benefits (rewards) actors anticipate to get from their efforts (MOLINA-AZORÍN ET AL. 2007). The achievement of actors' implementation goals (motivations for participating in process) renders an innovation implementation to be considered a success (KLEIN & SPEER 1996).

### **Trust among actors in the implementation process**

Trust is the *“willingness of a party to be vulnerable to the actions of another party based on the assumption that the other will perform a particular action important to the trustor irrespective of the ability to monitor or control that party”*(MAYER ET AL. 1995: 5). The ability of actors engaged in the implementation process to trust one another leads to successful implementation of innovations. This is because trust facilitates easier sharing of knowledge and ideas. The belief that the sources of the knowledge and ideas are trustworthy (Shazi 2014) facilitates cooperation in PAR. Trust is therefore important not only for social learning to take place in a participatory setting (HERMANS ET AL. 2015), but also for interdependence among working teams in order to achieve set goals (MAYER ET AL. 1995). Higher levels of trust in a population is associated with a greater level of cooperation (DASGUPTA & SERAGELDIN 2000). Trust encompasses fairness, that is, the belief that processes were executed in a fair manner. Fairness is a requirement for high levels of trust in the process to be attained (LEE 2008).

### **Implementation practices and policies established by change agents**

The policies and practices established by change promoting organisations influence innovation use and implementation success. These policies and practices have been identified by KLEIN ET

AL.(2016) as the quality and quantity of training available, implementation incentives and availability of support when needed. Implementation incentives promote the extent to which users are willing to try out an intervention, hence, the user behaviour of implementers (TALUKDER 2012). Unrealised gains in terms of incentives either from participating in the project or from using the innovation hinders innovation implementation (MARTIN & SHERINGTON 1997). People persist along the implementation path even when challenges arise if they are equipped with appropriate knowledge for handling issues that crop up in the innovation implementation. The existence of a strong support system in the implementation networks encourages adopters to persist along the implementation path (PATTERSON ET AL. 2009). Successful implementation also requires monitoring and evaluation of the processes (KLEIN ET AL. 2016).

### **Characteristics of adopters**

The individual characteristics of farmers such as such as age, education level, marital status, gender affect the willingness of adopters to change their behaviour. The psychological conditions (motivations, previous experiences, perceptions), socioeconomic characteristics (education, resources in their control, income) and self-confidence of implementers shape their knowledge, attitudes and perceptions towards an innovation and its usage (BARSKA 2014; MEIJER ET AL. 2015). The enjoyment derived from using the innovation influences attitudes that the individuals develop towards and innovation influences (TALUKDER 2012) the degree of innovation implementation.

### **Environmental factors and innovation implementation**

Innovations are implemented in the environment from where inputs and other resources for implementation are obtained (DAMANPOUR & SCHNEIDER 2006). Environmental factors refer all external and internal factors that affect a business or an established enterprise. Factors in the farmers' internal environment include their motivations, attitudes, skills (perceived behaviour control) and whether farmers have funds to execute the required implementation activities (AJZEN 1991; BUĆ & DIVJAK 2016). Factors in farmers' external environment consist of their proximity to markets, market structure and size, consumer behaviour (if products are marketed) and seller behaviour (BUĆ & DIVJAK 2016).

## **2.3 Theoretical framework**

This study is based mainly on two theories: The Diffusion of Innovation Theory (ROGERS 1995) and the Theory of Planned Behaviour (AJZEN 1991). The diffusion of Innovations theory

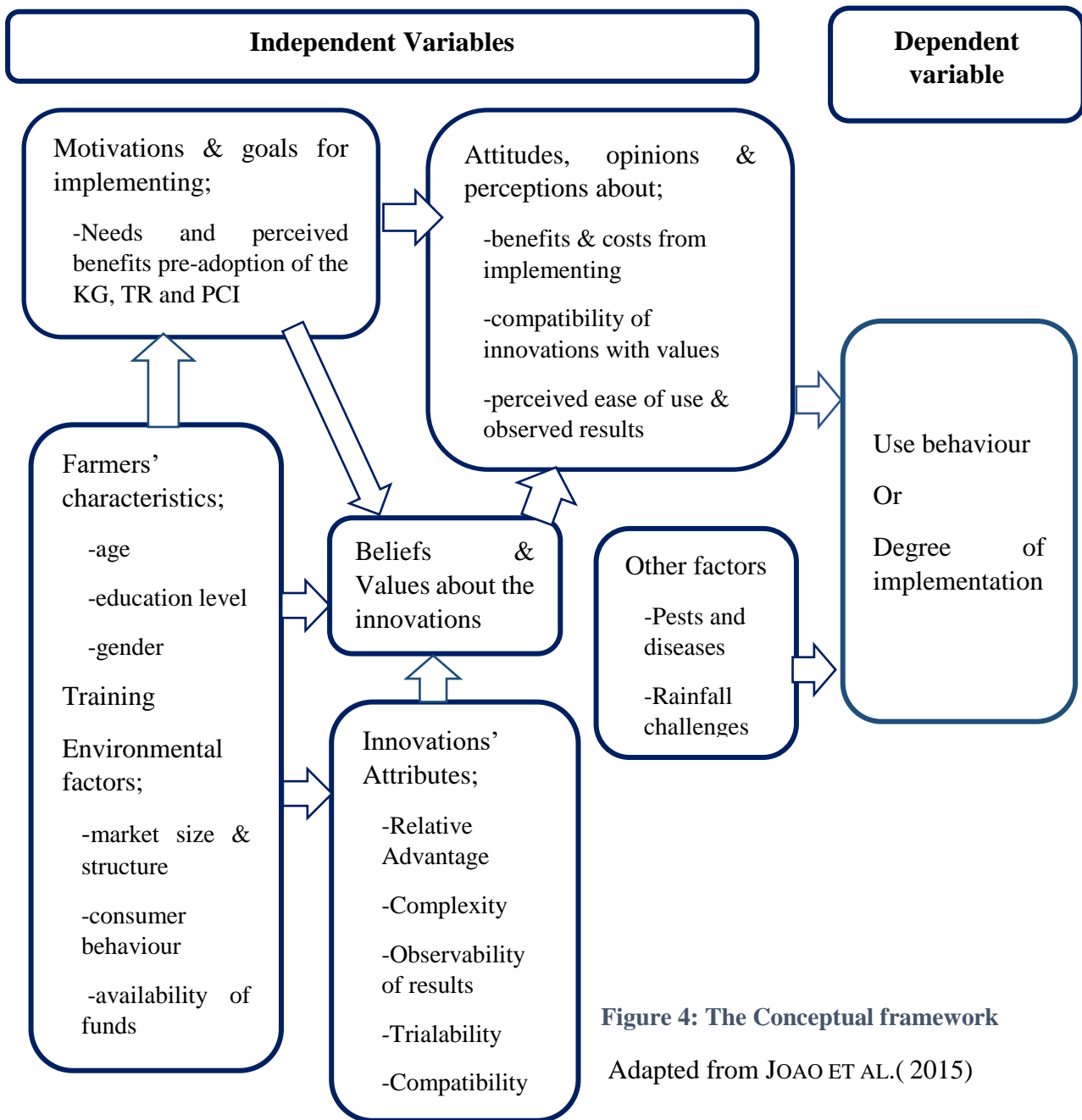
explains how new ideas are adopted (SCOTT ET AL. 2008) and implemented by focusing on the five attributes (NILSEN 2015) explained in section 2.2.1. Innovations' attributes have been used in several studies as factors facilitating or hindering achievement of the desired behaviour change (AMSALU & DE GRAAFF 2007; PERKINS 2011; BLAZY ET AL. 2011; ZHANG ET AL. 2015). This theory also highlights the significant role played by actors in their social networks in facilitating innovation use (NILSEN 2015). This theory, however, focuses on the innovations characteristics and ignores other factors in the innovations' system such as individual intrinsic factors and other factors that could somehow explain behaviour change (MOORE & BENBASAT 1991). To make up for the shortcomings in the theory, researchers occasionally use it in conjunction with the Theory of Planned Behaviour (SCOTT ET AL. 2008; WEIGEL ET AL. 2014).

The Theory of Planned Behaviour posits that people's attitudes, self-efficacy and perceived behaviour control influence their intentions to perform a physical activity and subsequently, the use of an innovation (AJZEN 1991). In this theory, people develop attitudes towards a behaviour and its expected outcome. This makes them to respond favourably or unfavourably to towards the behaviour (MORRIS ET AL. 2012). Behaviours that have positive consequences lead to farmers developing positive attitudes towards it (AJZEN 1991). Attitudes are influenced by implementers' beliefs and subjective norms (TEY ET AL. 2011). Beliefs are formed as adopters associate the new practices with certain characteristics or outcomes. This theory and its frameworks are widely used to predict and understand human behaviour (LU ET AL. 2005; TEY ET AL. 2011; TALUKDER 2012; MEIJER ET AL. 2015; JOAO ET AL. 2015). The concepts from these two theories were used in adapting the conceptual framework used in the study because the theories complement each (WEIGEL ET AL. 2014) (see Figure 4).

## **2.4 Conceptual framework**

In this framework, key variables analysed in the study are highlighted with a goal of deriving conclusions on how these interact to influence farmers' use behaviour (degree of implementation of innovations). Some of the factors influencing use or intention to use the innovations from both theories (see 2.3) are highlighted as independent variables. The explained behaviour (dependent variable) is the extent of farmers' level of innovation use which is also referred to as the degree of implementation.

## Variables influencing farmers' use of the innovations



**Figure 4: The Conceptual framework**

Adapted from JOAO ET AL.( 2015)

### 2.5 Perceptions and opinions of actors about the implementation process

The terms opinions and beliefs interchangeably used in some literature. Opinions show the extent to which individuals are aware of their surroundings as a result of the insights formed about an object or subject (KIM 2000). Opinions are formed from people's previous experiences, experimentations and research (LEEUIS 2004). In this thesis, farmers' opinions about the different aspects of implementation process are from their experiences with the

innovations (HULSCHER ET AL. 2003) The opinions reveal implementers' behaviour dispositions which are people's propensities to act in a specific way towards a process. Behaviour dispositions can also include actions like assessing a process (BERGMAN 1998). Assessment of innovations by individual actors depends not only on own experiences but also on experiences of their peers (DERO & DEROIAN 2002). Opinions tend to be used in qualitative research studies when establishing attitudes of participants and understanding implementation processes of interventions (HULSCHER ET AL. 2003; AHMED ET AL. 2013).

Experiences are formed by individuals as they gain information from their environment (become aware of their surroundings). The process by which individuals become aware of their surroundings through physical senses is known as perception. Perceptions are dependent on people's previous experiences, their attitudes, social-cultural backgrounds, needs, targets and expectations. Perceptions are subjective in nature (HOFFMANN ET AL. 2009; OTTO-BANASZAK ET AL. 2011). People's goals and decisions are influenced by their knowledge and perceptions (KIELEN 1996). Exploring perceptions leads to gaining understanding of how research participants talk about a subject (KIELEN 1996; NAIR ET AL. 2008; GHAZOUANI ET AL. 2009; TALENI ET AL. 2012; AHMED ET AL. 2013). The perceptions and opinions allow interviewees to evaluate implementation processes (AXTELL ET AL. 2000) as they narrate their experiences.

The interviewees in this thesis were the different groups of actors who were active participants in the implementation processes of Trans-SEC's innovations. These were deemed knowledgeable and capable of assessing the implementation process hence experts in their own right on matters related to the studied processes (TALENI ET AL. 2012; HARRIS & PATERSON 2016). Different groups were interviewed because they were assumed to have played different roles hence assumed to be having diverse opinions and perceptions (INGRAM ET AL. 2010).

### **3. The Study**

Tanzania is located in East Africa (FAO 2014a) south of the equator. It lies between latitudes 1° and 12°S, longitudes 21° and 41°E. It borders Kenya, Uganda, Rwanda, Burundi, Democratic Republic of Congo, Malawi, Mozambique, Zambia and the Indian Ocean (see Fig.2) (URT 2012: 9). It has approximately 45 million people (NBS 2013) and 63% of the working population is engaged in agricultural production (NBS 2014; NIKUSEKELA ET AL. 2016). Agriculture is a big contributor to the country's GDP (LEAVENS ET AL. 2011) and contributes to 32% of the foreign earnings. Farms are predominantly small in size but these supply 95% of the country's food demand. Poverty is high especially in arid and semi-arid regions (URASSA ET AL. 2017). The country is divided into 30 regions (NBS 2013). This study was conducted in two regions; that is, Dodoma and Morogoro where the Trans-SEC project currently operates. These two regions were predetermined by the project basing on ecological conditions. The regions are detailed explained below.

#### **3.1 The regions**

Dodoma region is located on the central plateau (MONGI ET AL. 2010) with a population of 2,083,588 (NBS 2013). The main economic activity is agropastoralism (NIKUSEKELA ET AL. 2016). Sorghum, millet, sesame are the main crops grown alongside livestock keeping. Animal-drawn implements and hand hoes are the main tools used by farmers for land preparation (URASSA ET AL. 2017). The region is semi-arid, receiving between 350mm and 500mm of rainfall per year (NBS 2013; MUTABAZI 2016; SENKORO ET AL. 2017). The rainfall patterns are unreliable. The soils are highly degraded. These factors lead to low crop yields in the region (REINHARDT & HERRMANN 2017). This is one of the poorest regions in Tanzania with low agricultural productivity, rising population density and high malnutrition. It is habited by mainly the Gogo tribe (NIKUSEKELA ET AL. 2016). It is divided into seven districts including Chamwino, where Trans-SECs villages in Dodoma are located. The average household size in the region is 4.5 people per household (NBS 2014).

Morogoro region in east-central Tanzania (KAHIMBA ET AL. 2015) with a population of 2,218,492, 65% of whom are engaged in agriculture. Maize, sorghum, rice sunflower and sesame are the main crops grown. Animal-drawn implements are used to prepare the fields (URASSA ET AL. 2017). The area is semi-humid ( MSANYA ET AL. 2004; MUTABAZI 2016) and receives two rainfall seasons ( MSANYA ET AL. 2004; MBWANA ET AL. 2015). Kilosa receives

between 1000mm to 1600mm of rainfall per year. The rain distribution is unreliable and the soil fertility is low. Farmers hardly use any fertilizers (MSANYA ET AL. 2004; KAHIMBA ET AL. 2015; ADAMU ET AL. 2015; MUTABAZI 2016) leading to low crop yield. The region also has seven districts including Kilosa where two of Trans-SECs regions are located. The average household size in the region is 4.6 people per household (NBS 2014).

### **3.2 The study villages**

Data was collected from Idifu village which is located in Idifu ward, Mvumi division of Chamwino district (KAHIMBA ET AL. 2015). The village lies between 990m and 1050m above sea level (REINHARDT & HERRMANN 2017) on 6000 hectares. Of these, only 2000 hectares are suitable for agriculture. On average, the farm size for each household is smaller than 5 acres. Most of the soils are sandy and prone to soil erosion. Pearl millet, watermelon, cowpeas, pumpkins, groundnuts and sunflower are the main crops grown. On average, 20% of the households keep cattle with an average herd of 10 animals per household. Indigenous Chicken is also kept. The vegetation cover is sparse, consisting of shrubs and Baobab. The shrinking vegetation is attributed to be arising out of clearing land to grow sesame, exposing the soils to erosion (KAHIMBA ET AL. 2015). This is one of the most food insecure villages in Dodoma (ASSENGA & KAYUNZE 2016).

Changarawe village is located in Masanze ward, Ulaya division of Kilosa district. The area is relatively flat covering 6000 hectares but the community has access to 2500 hectares which is perceived to be of low fertility. It has a population of 3000 people. Most farms are smaller than in Idifu with an average farm size of 2 acres per household. Maize is the main crop grown and it is intercropped with pigeon peas, cowpeas and sesame. The village has good vegetation cover (forest). Livestock especially cattle population is low. Households keep poultry mainly. Indigenous chickens and ducks are commonly kept by most household. The village has a better market access and it is relatively food secure (KAHIMBA ET AL. 2015).



Figure 5: The Map of Tanzania showing the regions

(Source: nations online)



## **4. Methodology**

This section describes how the data was acquired and analysed in this study. It describes the research approach and design used, the sample selection process, how the data collected was analysed and the ethical reflections of this study.

### **4.1 Research design and approaches**

The study sought to describe the implementation processes and explain farmers' use behaviour in two villages by retracing the steps through which the innovation passed as research ideas translated into practices. It aimed at identifying the facilitating and hindering factors in the implementation path to gain insights into the degree of implementation (the level of use of the innovations by farmers hence the use behaviour). It necessitated describing and explaining what transpired as the innovation were adopted and implemented. Describing the processes would give a picture of how the processes unfolded. Explaining the certain aspects would give insights (reasons) behind the observed situations. For this reason, an explanatory is a research design was chosen for this study because it allows both description and explanation to be done (PUNCH 2005). Data was collected at one point in time from farmers hence use of cross-sectional study. Cross section designs involve "one episode" of fieldwork (RITCHIE ET AL. 2003).

Since the study examined opinions and perceptions of interviewees of the implementation process, a flexible research approach was needed. The qualitative research, renowned for its flexibility was chosen to obtain in-depth information. This is because it would make it possible for research participants to give their opinions freely as they shared their experiences of the implementation process. In doing so, their feelings toward the entire process would be revealed, enabling the researchers to understand participants' perspectives. It enables researchers to understand how and why a certain behaviour happens (DAWSON. C 2008; ANDERSON 2010; SUTTON & AUSTIN 2015; HASHMI ET AL. 2016). The qualitative research approach is recommended when collecting data from people in their natural settings (Carr 1994; Creswell 2007). A quantitative approach would not be used because the data sought after in this study would not be generated using its instruments (structured questionnaires) (ANTWI & HAMZA 2015). Data in qualitative research is generated using ethnography, grounded theory, case studies, narrative-biography and phenomenology approaches (CRESWELL 2007).

The case study research approach is used to “*generate an in-depth, multi-faced understanding of a complex issue in real-life context. It is an established research design that is used extensively in a wide variety of disciplines, particularly in social sciences*” (CROWE ET AL. 2011: 1). A diversity of data can be collected when using this research approach, making it possible to draw conclusions about a phenomenon of interest (BAXTER & JACK 2008; YIN 2011; BIGGAM 2012). Case studies are commonly used in studies that assess performance of work (how it progresses) in development, to examine activities done by an actor and for identifying research participants’ desires, status quo or history (STARMAN 2013). Several cases can be studied at the same point in time in different contexts and settings to make comparisons. This makes it a suitable approach when comparing differences and similarities in perceptions of actors about a phenomenon occurring in different locations (BAXTER & JACK 2008). Since this study aimed at assessing implementation processes of three innovations in two regions, from farmers’ and experts’ points of view, a case study approach was believed to be most suitable hence its usage. Some concepts from phenomenology like conducting in-depth interviews to obtain in-depth data, which would be used to understand farmers’ opinions and perspectives on the different aspects of the implementation process, were applied. Theory generation was not the goal of this study and observation of people as they implemented was not done. Due to these facts, grounded theory and ethnography were unsuitable approaches hence not used for data collection. More than two participants were studied making narrative biography also unsuitable (MOUSTAKAS 1994; MASON 2002; CRESWELL 2007; STARKS & TRINIDAD 2007).

#### **4.2 Data collection methods used in the study**

Information in qualitative research can be collected using several methods such as observation, content analysis, interviews, content analysis and focused group discussions (MASON 2002; ERCC & RCI 2010; RITCHIE ET AL. 2013). Interviewing is a “*conversation with a purpose*” (BERG 2009, 101). It is a common data collection method used by researchers exploring perceptions of research participants (MOSS ET AL. 2012). It gives a researcher room to probe and pursue emerging storylines. Since interviewing is conducted as researchers and interviewees interact face to face, it encourages the development of rapport between them (KNUPFER & MCLELLAN 1996). It facilitates understanding a phenomenon from interviewees’ perspectives (RITCHIE ET AL. 2003) as researchers learn about how the participants talk about a researched subject. It also allows one to diagnose potential challenges in a new program or project, to understand other people’s behaviour (SEIDMAN 2006). It is a recommended data

generation method in studies where an event (such as the implementation process) is studied (BERG 2009). In this method, data can be collected from one person or several individuals at the same time, hence individual or group interviews. The individual interviews can be structured, unstructured (informal/conversational) and semi-structured interviews (MASON 2002; COHEN & CRABTREE 2006).

#### **Individual unstructured (conversational) and semi-structured interviews**

Unstructured interviews/ informal or conversational are interviews that are conducted without pre-determined questions. They are flexible. Semi-structured interviews are interviews that are guided by a set of predetermined questions. The questions are not fixed, more questions are asked as depending on the responses given by the interviewees (SWANSON ET AL. 2007). The ordering and wording may be adjusted as the stories unfold when semi-structured and unstructured interviews are used (WORLD BANK 2007; BERG 2009). The information from the rest of the experts and active farmers were conducted in a semi-structured way leading generation of 47 process Net-Map and for collecting of all the other information related to assessing the process.

Unstructured interviews (informal or conversational) were used in this study when generating data from: five former members of the farmer groups who had dropped out, three Village Extension Officers (VEO) from Idifu and Changarawe, and from three experts who were not fully conversant with the steps which the implementation of the three innovations had undergone. The ex-group members were assumed to have missed some phases of the implementation hence not fully aware of all the steps needed to draw a complete process Net-Map. The VEO were government employees and much as they were in the villages, they were assumed to be unable to know exactly how the events in the project unfolded. This interview format was used to be able to glean more information which would otherwise have been lost had the study limited itself to using only semi-structured interviews leading to obtaining the process Net-Maps. The main questions asked in the conversational interviews were derived from the interview guide used in semi-structured without mapping the process.

#### **Feedback interviews**

The feedback interviews with farmers were conducted after all the individual interviews had taken place in each village. They were organised as focused group discussions to give feedback and get more information which could have been missed out during the individual interviewing phase. They were also meant to be an avenue for making corrections where needed on the key actors and the sequence of steps in implementation. Altogether, five sessions were conducted

with farmers (one session per innovation in each village) who had been part of the individual interviews. One session was organised with experts at the University of Sokoine, where results from tentative data analysis were presented. The session with experts was also a source of more clarification on some aspects of the implementation process.

### **4.3 Research tools**

Several tools and research aids were used collect data on: how the implementation process progressed from the initial to the latest step in the implementation path of each innovation, to identify the most influential actors during implementation, the perceived benefits from implementing the innovations, the factors which hindered or facilitated the implementation process in each village, and the opinions about incorporating AIVs in the kitchen gardens. The tools used were: a list of questions, the Process Net-Map tool and an interpreter.

#### **4.3.1 The process Net-Map**

This was the main tool used in the study. It is a variant of the Net-Map tool that was designed for identifying bottlenecks during the implementation of development driven projects (ILUKOR ET AL. 2015). The process Net-Map is a mapping procedure which is participatory in nature. In-depth interviews and visualizations are used to generate data. The information is obtained from purposely selected research participants who are diverse in nature (POKU ET AL. 2018). The researcher asks interviewees to describe the process in a stepwise manner, that is, from the first to the latest step in the implementation of the intervention being assessed. All the steps in the implementation process are given and the actors engaged at every step in the implementation are highlighted (ILUKOR ET AL. 2015; POKU ET AL. 2018). This tool was used in this study to obtain the steps of implementation of the innovations of interest, identify influential actors, their level of influence, and to identify the point of entry of implementation challenges. It was also used to elicit opinions and perceptions of research participants about issues related to gains in income, food, knowledge and trust levels in the processes. It has been by researchers in the previous studies to identify influential actors, governance challenges and to highlight points of entry of challenges in the implementation processes. The information has been collected from a diversity of actors (ILUKOR ET AL. 2015; POKU ET AL. 2018) some of whom have similar characteristics and are in similar situations like research participants in this study, making it a suitable tool for this study.

### **4.3.2 The Guiding questions**

To describe the implementation process, a list of questions in the form of an interview guide were used (see interview guide in the annexe). These questions were used to probe participants' responses hence gaining insights into how the implementation had progressed to the latest step. As explained earlier, the order of asking questions was flexible and sometimes, questions that were not on the guide were asked to glean as much information as possible about the studied phenomenon. This was especially done to understand the extent to which farmers were using the innovations and why it was like that, so as to get insights into reasons behind the degrees of implementation in the two case study sights. Questions were asked in a sequential order at the beginning to facilitate recall as suggested by ILUKOR ET AL. (2015).

### **4.3.3 Interpreter usage**

The interviews with farmers were conducted with the assistance of an interpreter because the researcher could not speak Swahili the main language used in Tanzania. The questions were asked in English and translated into Swahili by the translator for the interviewee to understand. The responses were given in Swahili and translated back to English for the researcher.

### **4.3.4 Pilot testing the guiding questions and Process-Net Map**

Trying out an instrument on a small sample of participants is recommended so that a researcher can assess if the chosen method is adequate and can lead to achieving research objectives. It is usually done so that adjustments can be made (SEIDMAN 2006) to enable obtaining of suitable data. To ensure that sound instruments and method had been selected, the interview questions and process Net-Map were tested out with three participants. This was carried out in two phases. The first phase involved interviewing one expert in January. Later within the first week of arrival in the field, two farmers from Idifu were interviewed. Carrying out this activity guided the researcher in establishing the length of interviews. It was also a learning point for the researcher about the tentative issues that could crop up while interviewing using the process Net-Map. The interviews with the farmers led to adjustments being made in the interview guide to make it easier for the farmers to understand it. This was needed since the first farmer had perceived it as a sort of a reward to the scientists, hence the need to make it clear as a mere tool, not a rewarding session of sorts.

## **4.4. Sample selection methods and criteria**

Purposeful sampling has been used in the past by researchers to identify rich sources of information for analysis. Participants who are known to possess the desired variables are sought

after since they are thought to be more informative (MASON 2002; ANDERSON 2010). Pre-identified selection criteria guided the selection process. This was to facilitate the acquisition of knowledgeable interviewees in position to provide the specific information sought after (DAWSON. C 2008; DENZIN & LINCOLN 2008). The selection criteria were shared with the MVIWATA officers and the ARIs attached to Trans-SEC in each region before the commencement of the field phase. The ARIs gave the criteria to Field Assistants who together with MVIWATA officers contacted the interviewees (farmers and extension officers) in Idifu and Changarawe villages. The plan was to have 5- 10 research participants for each innovation in each village hence a minimum of 50 respondents. These were to include also five people who had been implementing but stopped (one for each innovation in each village). The gender aspects (by including men and women, young and old) when selecting farmers were to be considered because it was assumed that different genders have access to different spaces and resources hence may face different implementation challenges. The final sample interviewed is given in Table 1 below.

**Table 1: An overview of the sample selected for the study**

<b>Innovation</b>	<b>Village</b>	<b>stakeholders</b>	<b>Experts</b>
<b>Kitchen Garden</b>	Idifu Changarawe	8 farmers 7 farmers	2 Field assistants, 2 officers from MVIWATA, 2 ARIs, 2 SUA experts
<b>Tied Ridges</b>	Idifu Changarawe	8 farmers, 1 VEO 7 farmers, 1 VEO	2 Field assistants, 2 officers from MVIWATA,3 ARIs, 2 SUA experts
<b>Poultry Crop Integration</b>	Changarawe	8 farmers, 1 VLE	1 Field assistant, 2 officers from MVIWATA, 2 ARIs, 3 SUA experts
<b>Source: Own illustration</b>			

NB: The project has one Field Assistant one and MVIWATA officer per village hence these were part of the implementation of all the innovations in their village. Due to this, they were interviewed for each innovation. SUA facilitated the process on one innovation in both villages hence interviewed for an innovation twice. ARI gave perceptions on only one innovation per village. The VLE and VEO were interviewed because they were assumed to key actors in the villages due to their roles as the government's agents of change in agriculture. They were thus assumed to be interacting with farmers and knowledgeable about some factors influencing innovation use. All these actors were selected obtain information from varied sources and from different case study sites to promote internal validity.

#### **4.5 Data collection in the two case study sites**

A week before arriving at each location, the researcher sent e-mails containing the selection criteria and tentative research schedule to the ARI and MVIWATA officers in each district. The schedule indicated weeks, dates and proposed time when interviews would be conducted with the purposefully identified interviewees in each village. The Field Assistants and MVIWATA guided by the selection criteria identified farmers who were to be part of the set interviews. The appropriate dates and time when these would be available were agreed upon by the farmers. MVIWATA reimbursed the interview participants (the farmers and stakeholders) after they turned up for the interviews as an incentive for them to come and attend the individual interviews and feedback sessions. A week before arrival in each region, the experts (FA, SUA, ARI and MVIWATA) were requested via emails to participate as interviewees in the study. Attached to the emails, was a temporary timetable for experts' interviews for each region. The experts were requested to personally select suitable dates and time when they would be in position participate in the interviews.

Data was collected from 28<sup>th</sup> March 2017 to 09<sup>th</sup> May 2017. Information from farmers on Tied Ridges and Kitchen Garden obtained both villages that on the Poultry Crop Integration was obtainable only in Changarawe. This is because it's only here that farmers are implementing it. On average, two interviews (semi-structured interviews and informal interviews) were carried out per day. The duration of each interview varied depending on the innovation being assessed and research participant interviewed. Farmers' interviews lasted for 1-2hrs. Those with village extension staff and former members lasted for 30-45 minutes. Interviews with experts tended to be long, lasting from 1-3 hrs. MVIWATA and Field assistant's interviews in Changarawe were exceptionally long because they had to assess all the three innovations implemented here.

Before starting each interview, the objective of the study was explained and interviewee's consent to participate in the study sought verbally. The interviewees were then asked for permission to have the interview recorded. They were assured about the privacy and confidentiality of collected information by the researcher. Generally, interviewees were asked open-ended questions and given time to respond and elaborate on their answers. The given responses also led to subsequent questions some which had not been anticipated when designing the interview guide. These extra questions were pursued to glean as much information as possible on the issues being discussed. Notes were also taken during the interview sessions highlighting key words and catchy phrases used by interviewees. These notes and audio

recording of the interviews were referred to later when analysing data. The steps followed to collect the data using the process Net-Map are as follows;

**Step1: Description of the process of implementation of each innovation.**

The interviewees were asked if they remembered how the process of the implementation of the innovation started from 2014. They were then asked to describe the subsequent steps that followed leading to generation of steps from the initial to the last step in the implementation of each innovation. As the steps were being described, actors engaged at the different steps were mentioned and these actor(s) or groups of actors were written down on sticky paper creating actor cards. Actor cards from previous studies were shown to the interviewees and they were asked if they remembered any more actors from these cards. The selected actors were all noted and used in drawing the process Net-Map.

**Step 2: Drawing the process Net-Map**

The identified actors (actor cards) were arranged on a flip chart paper. Arrows were then drawn between actor cards by the interviewer, showing the different steps mentioned by research participants. The arrow originated from the doer of the activity pointing towards the actor who was on the receiving end of the first activity. This arrow was labelled with a number, 1. The second activity was added as an arrow originating from the doer to the receiver. The arrow is labelled number 2. Successive steps and actors were added as respondents remembered them until the entire process was mapped out. The number assigned to each arrow (legend) was explained in detail in the key section at on the flip chart. This led to the generation of the process Net-Map (see 8.1 Annexe of figures and tables in the annexe).

**Step 3: Tower construction**

After mapping out the process, research participants identified actors who influenced the implementation process of a particular innovation. One to five wooden chips (towers) were stacked one on top of the other, building towers of influence near the influential actor cards. While doing this, explanations were given as to why these actors were perceived to be influential. The towers acted as a visible Likert scale, giving perceptions of the interviewed actors. Actors with five wooden chips were perceived to be most influential while those with towers consisting of one chip were least influential. Those with zero chips were perceived to have played no significant role in the implementation process. This resulted in the visualization of the level of influence as indicated in the figure.18. The process was repeated, revealing which actors were perceived to be gaining most food, income and knowledge from participating in the



implementation process. It was also done to identify the actors perceived to be most trustworthy in the implementation process. The towers were recorded down to be used later for analysis. Actors' influence levels were of interest to the project to establish which actors had power over the different activities in the process. It would be of interest to know if where these actors were located were also where most of the implementation challenges cropped. This was done based on the assumption that, influential actors would to some extent determined the success or failure of the implementation process since their opinions mattered to some members of the social systems. Farmers and experts gave their perceptions and opinions on which actors gained most. This was anticipated to reveal the potential of the innovations to have an impact on their food, income and knowledge situations. This would be further backed up by storylines of interviewees as they rated the processes (as they talked of their statuses and statuses of others in terms of gains of food, income and knowledge from using the innovations). The potential of the innovations to have an impact on food and income situations was of interest because these innovations had been presented to the farmers as feasible means to improve these situations. Narratives revealing farmers' perceived gains in knowledge were of interest because this would give insights into whether the knowledge acquired would enable farmers to utilise the innovations even after the project exited the case study sites. The existence of trust in the implementation process was of interest because its existence would have an impact on actors' willingness to participate in the different implementation activities. This trust was explored further by asking farmers of if they thought that the implementation of innovations had been carried out in a fair way or not.

#### **Step 4 Implementation challenges and opinions on AIVs**

The perceived facilitating and hindering factors in the implementation of the three innovations were explored to assess if these were influencing the extent to which farmers were using the innovation. Points of entry of challenges faced were identified. The knowledge generated could be used in future by projects contributing to more sustainable implementation of similar innovations in similar contexts. Farmers' opinions on growing AIVs were explored as one of the ways to make Kitchen Garden more sustainable.

#### **Feedback to the interview participants**

After all individual interviews had been conducted per case study site, the interviewees from the individual interviews were invited to a group meeting. The invitations to farmers were oral while those to experts were sent by emails. The meetings with the farmers were held at the village authority office in Changarawe and at the Trans-SEC house in Idifu. Upon arrival, the

purpose of the meeting was explained, which was verifying the implementation steps and getting more information which could have been missed. The aggregated process Net-Map for each innovation was presented to the respective groups (see section 4.6. for more information on the aggregated process Net-Map). Also presented to them were the actors they had perceived to be influential, trustworthy or benefiting most from implementation. Each group was asked a couple of questions that had been organised prior to the meeting. They gave responses after discussing amongst themselves. These responses were recorded. Some of the questions asked were on verifying the impact on lives, verification of the given steps and ratings from the individual interviewed. Any information that could have been overlooked in individual interviews was also sought after. Each of these meetings lasted for 30-45 minutes.

## 4.6 Data analysis

The general approach towards data analysis was comparing opinions and perceptions of the different actor groups and subgroups given below.

### Interviewee groups whose perceptions were compared

Innovation	Farmer groups	Experts (in both villages)
KG	KG farmers in Changarawe	Experts facilitating KG
	KG farmers in Idifu	
TR	TR farmer in Changarawe	Experts facilitating TR
	TR farmers in Idifu	
PCI	PCI farmers in Changarawe	Experts facilitating PCI
<b>Source: Own Illustration</b>		

The data collected was both textual and numerical. This necessitated using a mixed approach towards data analysis. Due to this, narrative analysis, descriptive and basic inferential statistics were used in data analysis.

### 4.6.1 The narratives analysis for themes

The recorded interviews were transcribed into texts and together with field notes (also taken during the interviewing process) organised into codes. The codes were summarised into the major themes in the narratives given by research participants. Coding can be done manually or using computer software (POPE ET AL. 2000). In this study, manual coding was used because the narratives were not so long. Some of the interviews were transcribed and coded line per line to look for common themes to compare how the different interviewee groups talked about the innovations. Codes are *“identified issues, topics, similarities and differences revealed by*

*interviewee's narratives and interpreted by the researcher*"(SUTTON & AUSTIN 2015: 228). Codes that are similar are grouped together forming categories that contribute to the formation of major themes in available data (SALDAÑA 2009)

#### **4.6.2 The implementation process analysis: The aggregated process Net-Maps**

The steps of implementation given by all participants interviewed for each innovation, per actor group in each village, were aggregated and used to draw one general process Net-Map (the aggregated process Net-Map). This map would represent all the steps recollected and narrated by participants for this particular innovation. For example, all steps mentioned by Kitchen Garden farmers in Changarawe were aggregated from the first to the last step. All the actors perceived to be engaged at each step were also identified and one aggregated process Net-Map for Kitchen Garden farmers in Changarawe drawn as shown in the results section. Using the same procedure, all the aggregated process Net-Maps were generated from farmers' and experts' perspectives. The farmers' perspectives were then compared experts' perspectives.

#### **4.6.3 Statistical analysis of the rating of the implementation process.**

This part of data analysis was done by examining the similarities and differences in perception within and between actor groups. It was achieved by comparing mean ratings assigned to each actor, that is, each actor being rated was treated as a variable. For example, all the individual ratings (towers) assigned to the Field Assistant on their perceived gain in income by interviewed Kitchen Garden farmers in Idifu were summed up obtaining total sum of towers for this actor (N). The mean rating for this criterion was then calculated and compared to the mean ratings assigned to the same actor by KG farmers in Changarawe. This process was repeated for all the other actors on this criterion. This is the farmer-farmer ratings in the tables in the annexe section. The sum of all ratings assigned by each individual KG farmer to the FA in both villages were also calculated and the means obtained. These were compared to the sums (N) and means assigned to the same actor by all the interviewed KG experts generating the expert-farmer rating in the annexe section. The process was repeated obtaining mean farmer-farmer and expert farmer ratings for all the three innovations in both villages on all the five criteria. The standard deviations were calculated to show the spread of the ratings (perceptions) from the estimated mean. Both the means and standard deviations were calculated in Microsoft Excel. The bigger the mean and N values, the higher the perceived levels of influence, gains and trustworthy an actor is assumed to have from being part of the implementation process.

To see if there were significant differences in the way the two actor group assigned towers to an actor (variation in the distribution of the rating), a Wilcoxon-Mann-Whitney test was run for each actor being evaluated on a given criterion. The Mann-Whitney U test is also known as the Mann-Whitney-Wilcoxon, Wilcoxon rank-sum test or Wilcoxon-Mann-Whitney test. It is commonly used when comparing ordinal data (ratings/rankings) from two independent groups in statistical related studies. It is an alternative test to the independent t-test. The Mann-Whitney U test is used to analyse data very small samples of data ( $n < 20$ ). The data must not be normally distributed. It is run on the hypothesis that there is no statistically significant difference in the way the different interviewees in the groups rated an actor on a given criterion. For example, it assumes that the distribution of the ratings (towers) assigned to the FA by KG farmers in Changarawe and Idifu did not differ that much. If there is little or no variation in the distribution, then there would be no significant difference in the medians and the standard deviation of the ratings at 1%, 5% and 10% levels of significance (HART 2001). The test can be run using STATA, SPSS and other statistical software. It can also be carried out online using an online Mann-Whitney calculator. Extensive analysis of towers using STATA and SPSS did not seem necessary since the scores could be easily managed in Excel from where they were easily be fed into the online calculator.

The towers assigned to an actor by all research participant from the two groups being compared were manually fed into either side of the calculator shown in figure 19 in the annexe. A hypothesis of no significant difference in the mean was selected and the test run. A resultant p-Value was noted down at 1%, 5% and 10% levels of significance. If a significant difference existed in the ratings done by the interviewees in the two groups, the group whose ratings led to a bigger mean value was pointed out by attaching a subscript to it. The subscripts in this study were; a, b, c which indicated significance at  $< 1\%$ ,  $< 5\%$   $< 10\%$  level of significance respectively.

#### **4.7 Ethical consideration**

To be able to access the research participants, one needs to obtain permission from authorities and the participants themselves. Permission was sought from Dodoma and Morogoro regions prior to the commencement of the field phase. Research permits were granted by the district authorities allowing the study to be conducted in the two villages in a legal way. Much as the research participants had been invited by the FA and they had agreed to be part of the study, their consent to participate was obtained again before any data would be collected. The privacy

and confidentiality of the collected data was guaranteed. Consent was also sought on whether the interviews could be recorded or not and all of the interviewees agreed to participate and for their interviews to be recorded.

#### **4.8 Strengths and limitations of the methodological approach**

Data in various forms (audios, notes in research journals and some observations) from multiple case study sites and varying actor types (farmers, village extension officers, experts) was collected to obtain a diversity of perspectives on the implementation process. This was done to promote internal validity of the results obtained. The information was obtained in the farmers' natural settings making them at ease and free to express their opinions after being guaranteed of their privacy. Selecting of participants was non-random and the information obtained cannot therefore be used to make generalisations about the entire implementing population in the case study site. The project staff in the villages identified the farmers interviewed. This could have impaired their ability to freely give information on some aspects if they that they were betraying the project's staff. Some research participants were not comfortable using the process Net-Map tool and had reservations in giving perception on how other people were benefitting from the implementation.

## 5. Findings

This chapter presents results gained from both the farmers and experts. The characteristics of farmers were described first followed by the description of the implementation process. The influential actors were then identified followed by exploration of the facilitating and hindering factors in the processes. The chapter winds up by giving an overview of farmers' opinions on integrating AIVs into Kitchen Gardens.

### 5.1 Farmers' characteristics.

The characteristics of the 32 farmers who had tried out the innovations were as follows:

**Table 2 Farmers' characteristics**

Innovation	village	Number of farmers per education level			Average Age (in years)	Household size
		No formal education	Primary	Secondary & Tertiary		
KG	Changarawe	-	6	-	37.5	7.0
	Idifu	4	2	-	32.5	9.0
TR	Changarawe	1	5	1	50.2	4.0
	Idifu	4	3	-	53.0	4.7
PCI	Changarawe	-	3	3	54.5	5.3
<b>(Source: own illustration)</b>						

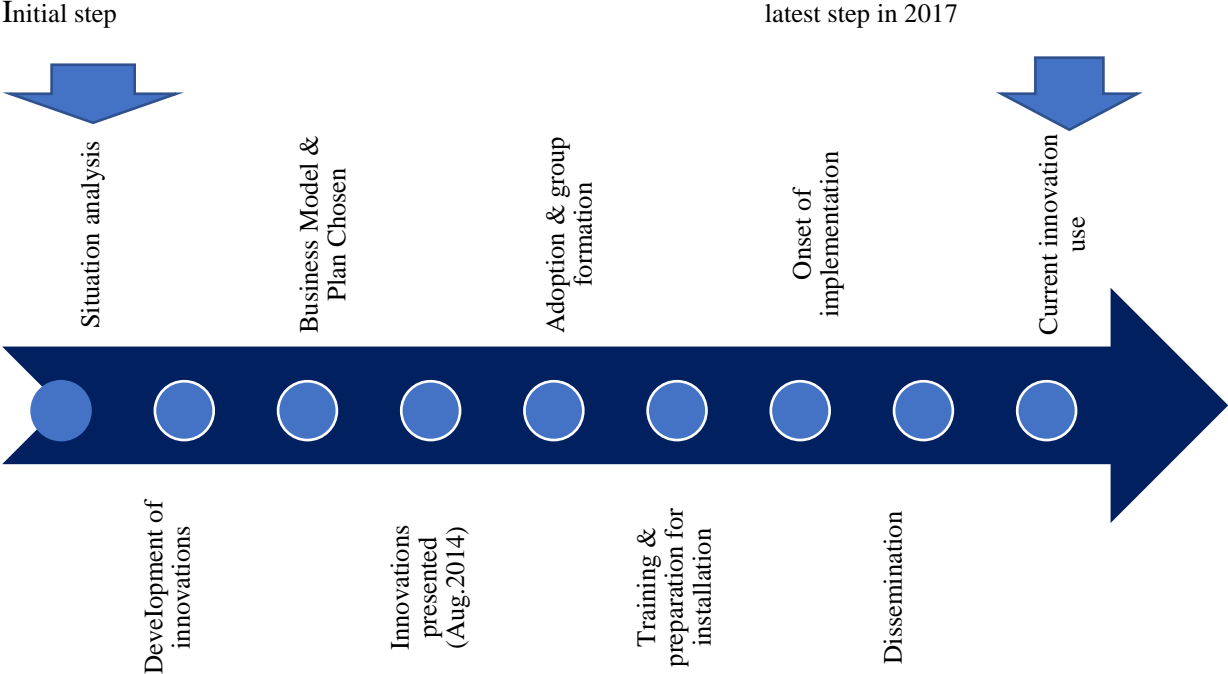
Majority of the interviewed farmers reported to be possessing a primary level education. Only four farmers possessed secondary and tertiary level education. The farmers in Changarawe were on average more educated than those in Idifu. The most educated group was the PCI farmers. The age of the farmers varied greatly. Farmers in Idifu tended to be younger than those in Changarawe with an average age of 45 years and 47 years respectively. The TR farmers were on average older than the KG farmers. Farmers' household sizes ranged from one-member (1 person per household) household to thirteen-member household (13 people per household). Farmers in Idifu tended to have bigger household sizes than those in Changarawe with average household sizes of 6.4 and 5.3 individuals per household respectively.

### 5.2 The implementation processes of the three innovations.

One of the study objectives was to describe the process of implementation and this section focused on that objective. The main steps were identified in section 5.2.1. The key actors engaged at each stage highlighted. The detailed illustration of the implementation process per innovation is visualised in the aggregated process Net-Map section (5.2.2).

**5.2.1 The Implementation steps, actors and their roles.**

The three innovations were implemented in a stepwise manner as shown in this section. The main steps in the implementation process of the three innovations from farmers’ and experts’ narratives are given below.



(Source: Own compilation)

**Figure 6: The main implementation steps**

**Situation analysis**

This was the first step along the implementation path. It was initiated by experts who sought permission from the village authorities to conduct research in each village. The village authority (Chairperson, secretary, treasurer and VEO) informed the rest of the community about the incoming project and prepared a few farmers (one hundred and fifty residents per village) to meet with the experts. The experts from SUA came and conducted a baseline survey by interviewing the identified farmers hence identifying the challenges along the rural food value chain per village.

**Development of innovations, choice of business plan and implementation Model**

After the problem identification, the experts’ narratives revealed that potential solutions were identified by both farmers and experts. The most promising (preferred) solutions were chosen by farmers and the choices made led to the formation of ten food securing innovations. The PCI experts’ narratives further revealed that the SUA experts then designed the model for

implementing the PCI by adapted the Bangladesh semi-intensive poultry keeping model to the Changarawe context. These further mentioned of the formation of a business plan and an innovation fund. The fund which was developed by ACT and MVIWAT. It was to finance several activities in the PCI such as purchasing the chicken. These two steps, however, were not revealed in the farmers' narratives.

### **Presentation of innovations**

The surveyed farmers in each village met with the experts in August 2014 who introduced the ten innovations to them. Each innovation was explained details and information such as its potential to impact positively on the lives of adopters was given. The experts invited farmers to choose innovations of their choice.

### **Adoption of innovations and formation of groups**

The farmers made adoption decisions by joining implementation groups of interest. The interviewed farmers revealed that this was free of charge. The PCI farmers, said that they had to show a certain level of financial capacity to manage the innovation. The formation of groups was monitored by MVIWATA officers who trained the members on how to manage their groups. MVIWATA also trained the PCI farmers on entrepreneurship.

### **Technical training and preparation for innovation installation**

Each group received theoretical training on how to install, use and manage their innovations. This training was done by SUA and ARI experts. The farmers were then told to prepare their farms so that they could start implementing. The Tied Ridge farmers identified suitable plots for making trial plots and the soils on these plots were tested to verify their suitability to accommodate the innovation. The Kitchen Garden farmers were told by the SUA and ARI experts to collect local materials for making the gardens. These two groups then received practical training on how to install the innovations. The PCI farmers were shown samples of suitable poultry houses and they were told to go and build them. Upon completion, the houses were inspected and assessed by Field Assistant together with a selected committee of farmers for their suitability to house the chicken.

### **Onset of the implementation**

The farmers received materials from the experts (FA, ARIs, and SUA depending on the innovation) and started implementing. The sequence of activities carried out in this step progressed differently per innovation. For example TR farmers made the trial plots supervised by the FA and in some cases by ARI experts, KG farmers made own pocket bags at times under



the supervision of group leaders or the FA. The TR and KG farmer groups started implementing at the same time while PCI farmers received chicks from SUA and implemented in two phases. All the TR farmers in each village received similar materials. This was the same for the KG farmers. The PCI farmers, however, received varying chicken breeds per phase (batch). The activities of farmers were monitored occasionally by MVIWATA, ARI, FA and SUA experts. Several other actors outside the project played several roles especially in the PCI (VLE, the business community traders of feeds and drugs, chick suppliers, poultry traders).

**Dissemination**

A Farmer Field Day (FDD) was organised where all innovations were showcased and farmers’ success stories shared to the entire village community, neighbouring villages and to the district leaders. One of the KG experts’ revealed that end line survey had been conducted and the results disseminated by ZALF and ACT/TFC to national stakeholders.

**Current use status**

Farmers revealed their progress along the implementation path in each village at the time of data collection in 2017. This was in terms of the extent to which they were using the innovation, also referred to as the degree of implementation (see section 5.6).

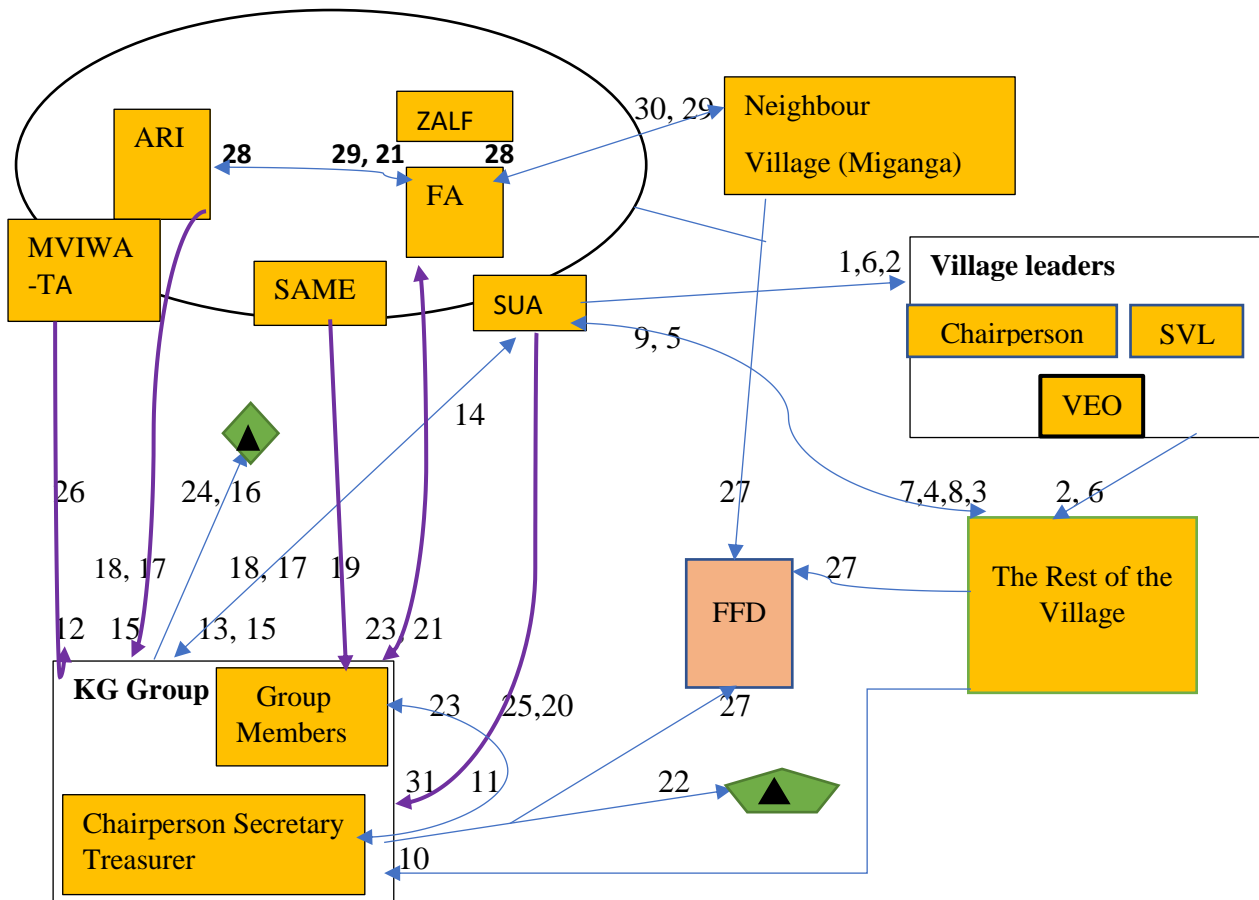
**5.2.2 The aggregated process Net-Map**

The individually drawn process Net-Maps were aggregated to generate one aggregated process Net-Map for per innovation per village as follows:

Innovation	No. of maps from individual interviewees merged	
	Famers’ aggregated process Net-Maps	Experts’ aggregated process Net-Maps
<b>KG</b>	12 (6 per village)	7
<b>TR</b>	14 (7 per village)	7
<b>PCI</b>	6	6
<b>Source: Own compilation</b>		



The KG farmers’ aggregated process Net-Maps were from twelve farmers, the TR and PCI maps from fourteen and six farmers respectively. The experts’ maps were from twenty individually drawn maps. The yellow shapes in the maps show actors and the arrows represent activities in the different steps of the process. The arrows were numbered in a chronological order. The key linkages were highlighted while key steps were indicated written in bold letters.



## The aggregated Process Net-Maps for Kitchen Gardens




1. Initial contact for survey
2. Informs 150 people to prepare to receive guests
3. **Baseline survey**
4. **Meeting to identify problems**
5. Prioritization of key issues and potential solutions
6. Inform about future meeting
7. Meeting held
8. **Innovations introduced**
9. **Adoption decision.**
10. **Formation of implementing groups.**
11. Election of group leaders
12. **Monitoring of the new groups**
13. **Training on nutrition & KG types**
14. Selection of pocket type bag
15. Give seeds for nursery bed.
16. Nursery bed set up.
17. Supervision of nursery bed establishment
18. Inform to collect material for making collective KG

19. **Practical lesson on making of trial pocket bags.**
20. training of trainers
21. **distribution of seeds and bags.**
22. **Individual KG made**
23. **Supervision of KG construction.**
24. Vegetables at maturity are harvested
25. Training on cooking and nutrition education done
26. **Monitoring.**
27. **Farmer Field Day held.**
28. Seek permission to implement
29. permission granted but these to buy own materials.
30. Assistance with implementation in Miganga
31. **End line survey**

Nursery Bed , Farmer Field Day ,

Entry points for challenges  Pocket Bags 

Information flow 


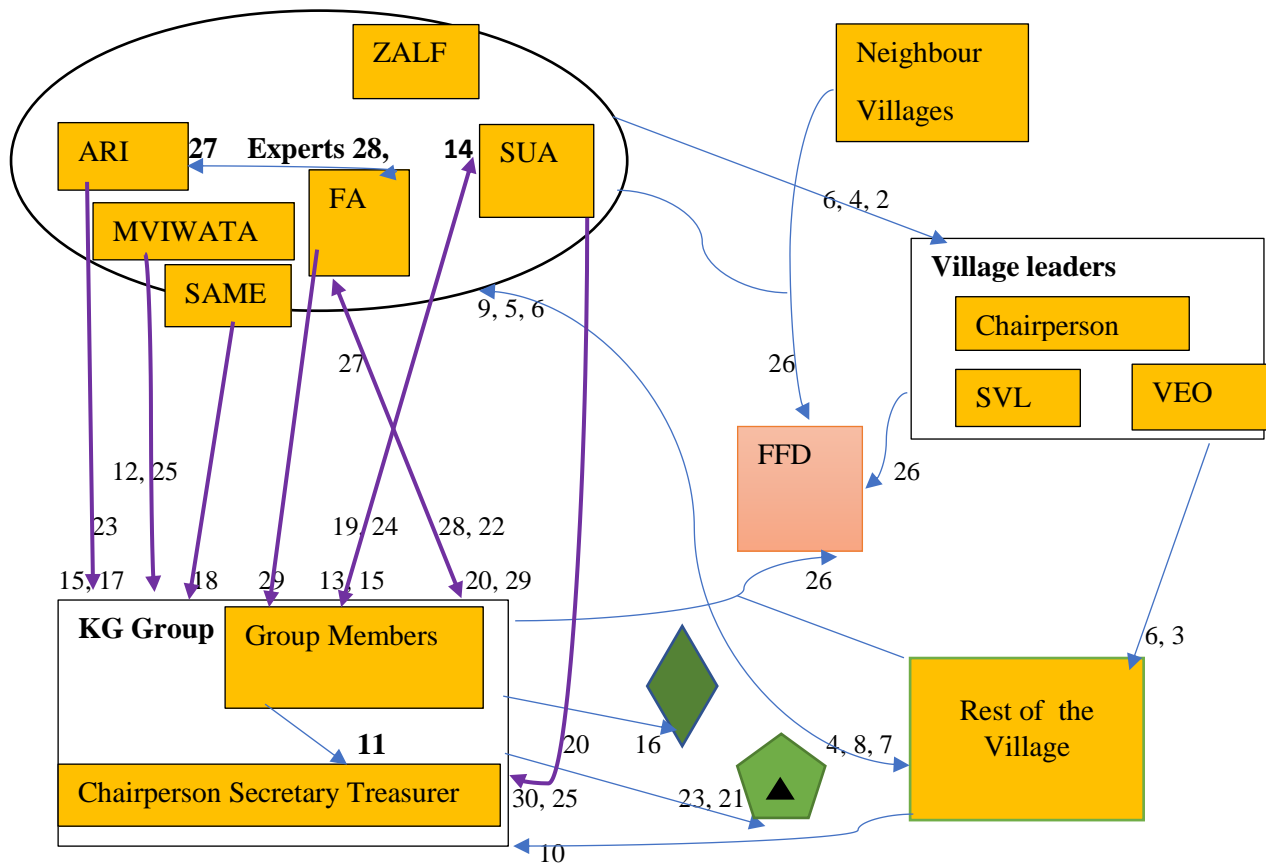
Support, training and monitoring 

Figure 7: Experts' aggregated process Net-Map for KG in Idifu



1. Initial contact for survey
2. Informs & invites 150 people for meeting
- 3. Baseline survey**
- 4. Meeting to identify problems**
5. Prioritization of key issues and potential solutions.
6. Inform about future meeting
7. Meeting held
- 8. Innovations introduced**
- 9. Adoption decision.**
- 10. Formation of implementing groups.**
11. Election of group leaders
- 12. Monitoring new groups**
- 13. Training on nutrition & on KG types**
14. Selection of pocket type bag
15. Give seeds for nursery bed.
16. Nursery bed set up.

17. Inform to collect material for making collective KG
18. Practical training & illustration on making of trial pocket bags
19. Training of trainers
- 20. Distribution of seeds and bags.**
- 21. Individual KG made**
- 22. Supervision of KG construction process.**
23. Vegetables at maturity are harvested
- 24. Training on cooking and nutrition education done**
- 25. Monitoring.**
- 26. Farmer Field Day held.**
27. Pests attack, inform
28. Distribution of pesticides
- 29. Train on using organic pesticides**
30. End line survey

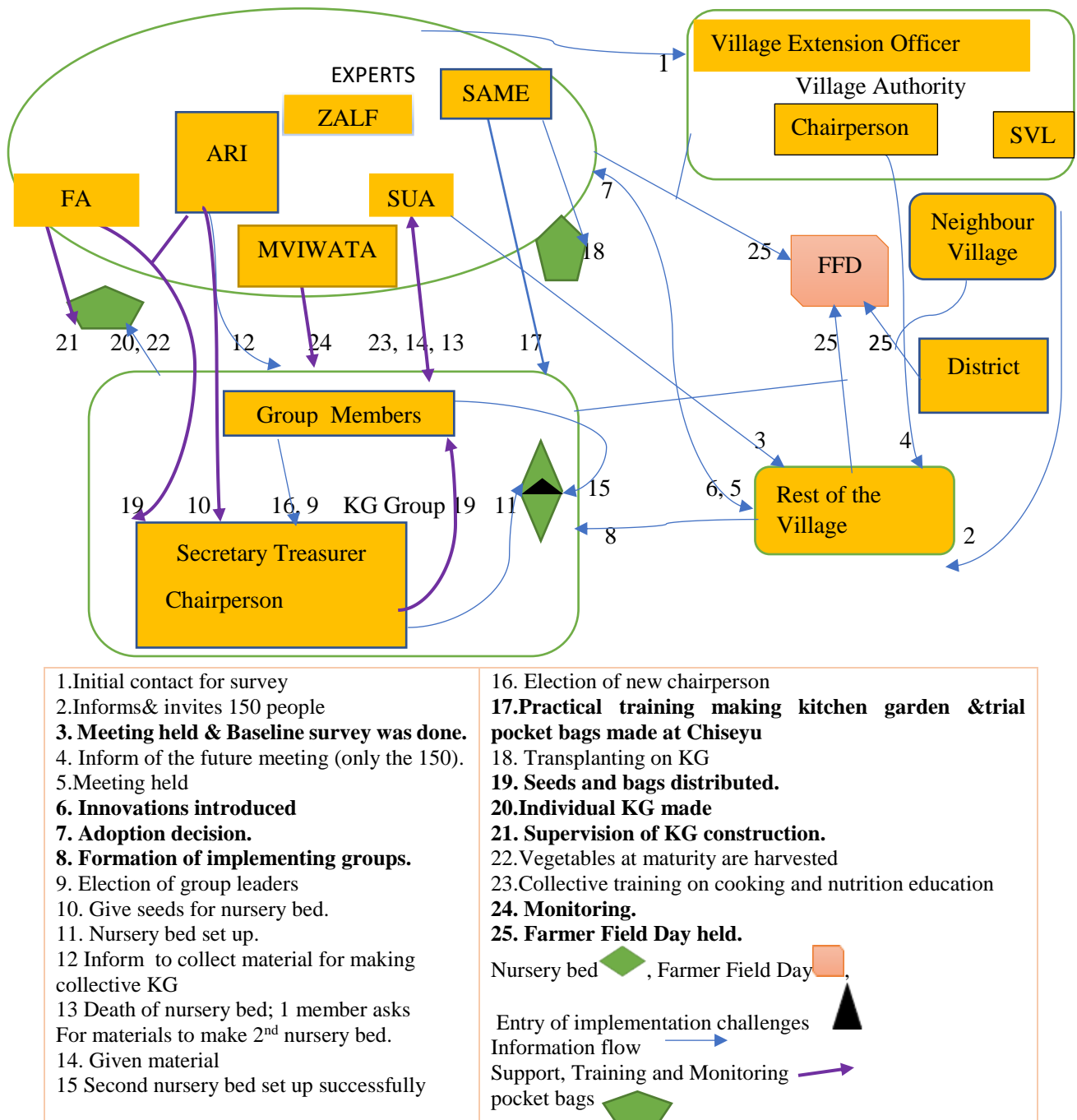
Nursery bed Farmer Field Day Entry point for challenges pocket bags

Support, training and monitoring Information flow

**Figure 8: Experts' aggregated process Net-Maps for KG in Changarawe**

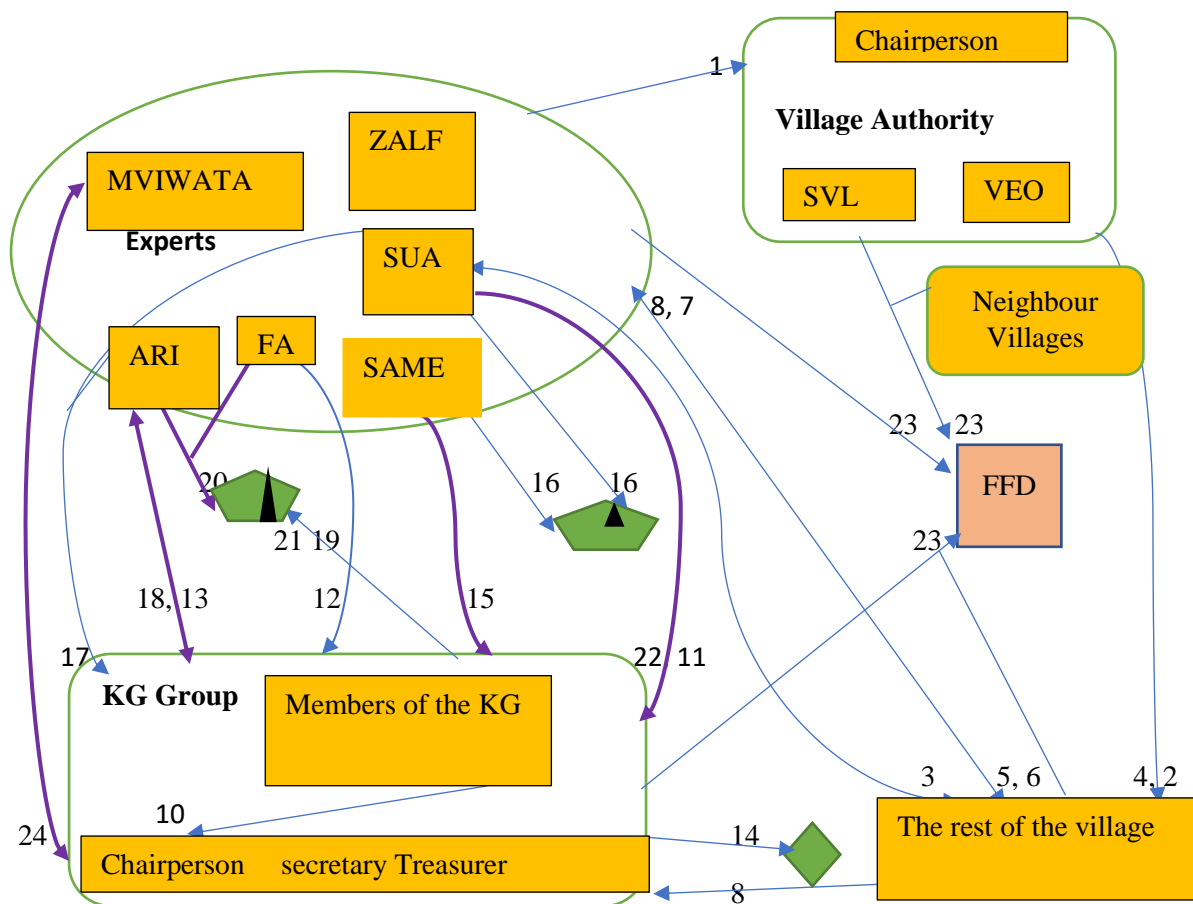
The aggregated steps for both villages were quite similar. The Differences were seen in the two maps because of; the decision by farmers from Miganga to adopt the innovations and the need to control pests in Changarawe.

### The farmers' aggregated process Net-Map for kitchen garden



**Figure 9: Idifu KG farmers' aggregated process Net-Map**

Initially, the seeds were planted first in the nursery bed and later the seedlings transplanted onto the made pocket bag. The current situation reported was farmers planted lately directly on the pocket bag.

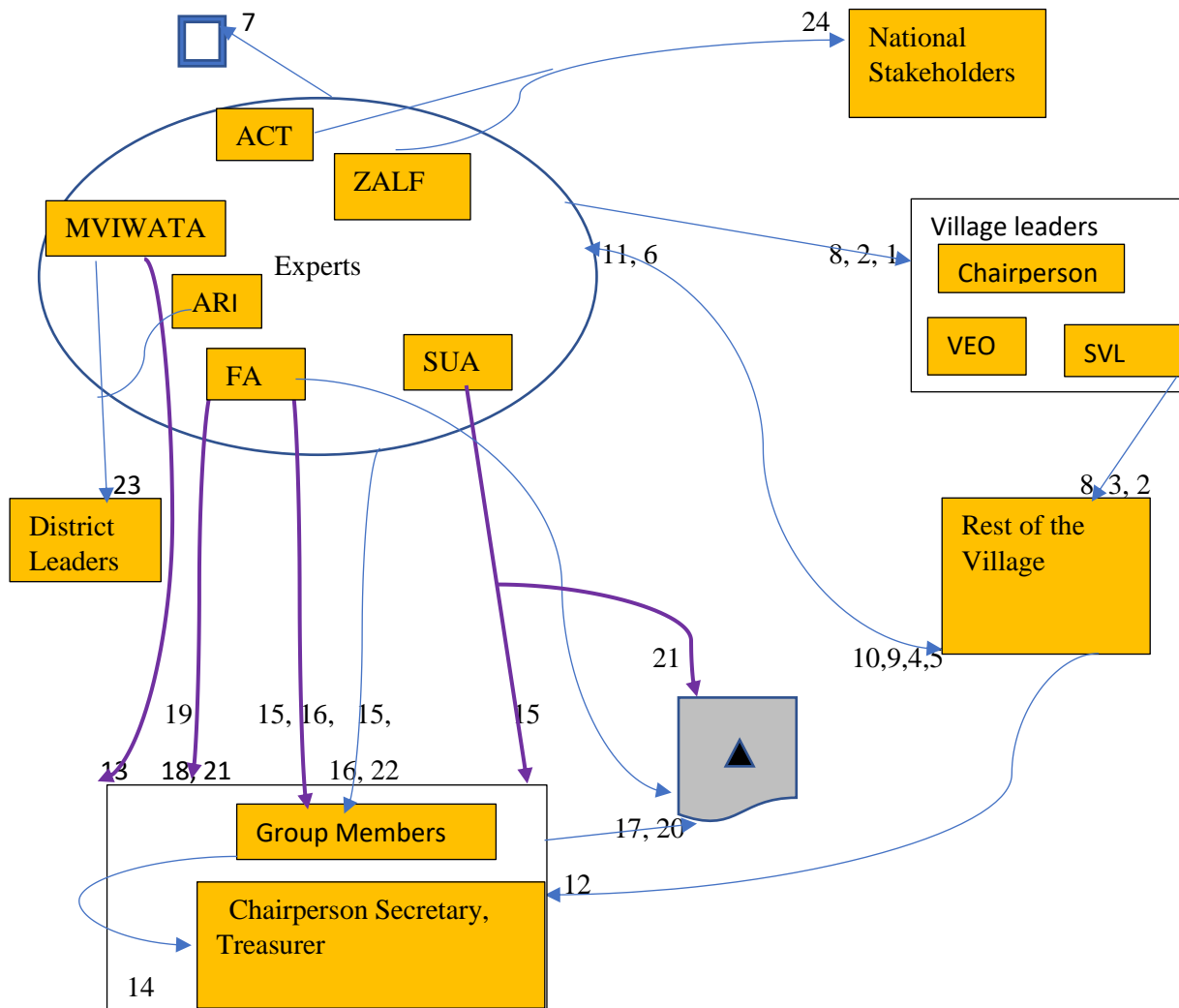


- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Contact and informs about pending baseline survey</li> <li>2. Informs 150 resident to get ready.</li> <li><b>3. Baseline survey</b></li> <li>4. Invitation to meet scientists</li> <li>5. General meeting held</li> <li><b>6. Innovations introduced</b></li> <li><b>7. The decision to adopt innovations.</b></li> <li><b>8. Formation of implementing (UPS) groups</b></li> <li>9. Leaders elected.</li> <li><b>11. Theoretical training on nutrition held.</b></li> <li>12. Told to &amp; collect local materials for making KG.</li> <li>13 given seeds for making nursery bed.</li> <li>14. Nursery bed made</li> <li>15. Practical training on making pocket bag type of KG</li> <li>16. Trial bag made.</li> </ol> | <ol style="list-style-type: none"> <li>17. Farmers told to implement at home</li> <li><b>18. Distribution of seeds and bags.</b></li> <li><b>19. Individual pocket Bags made</b></li> <li><b>20. Supervision of individual implementation.</b></li> <li>21. On maturity harvest vegetables</li> <li>22. Training on how to cook vegetables once the vegetables are mature.</li> <li><b>23. Farmer Field day held in Changarawe</b></li> <li><b>24. Monitoring of group</b></li> </ol> <p>             Nursery bed, <span style="color: green;">◆</span><br/>             Farmer Field Day, <span style="color: orange;">□</span><br/>             Entry of implementation challenges, <span style="color: black;">▲</span><br/>             Pocket bags <span style="color: green;">◡</span><br/>             Information Flows <span style="color: blue;">→</span><br/>             Support, Monitoring and Training <span style="color: purple;">→</span> </p> |
|---|--|

**Figure 10: Farmers' aggregated process Net-Map for the KG in Changarawe**

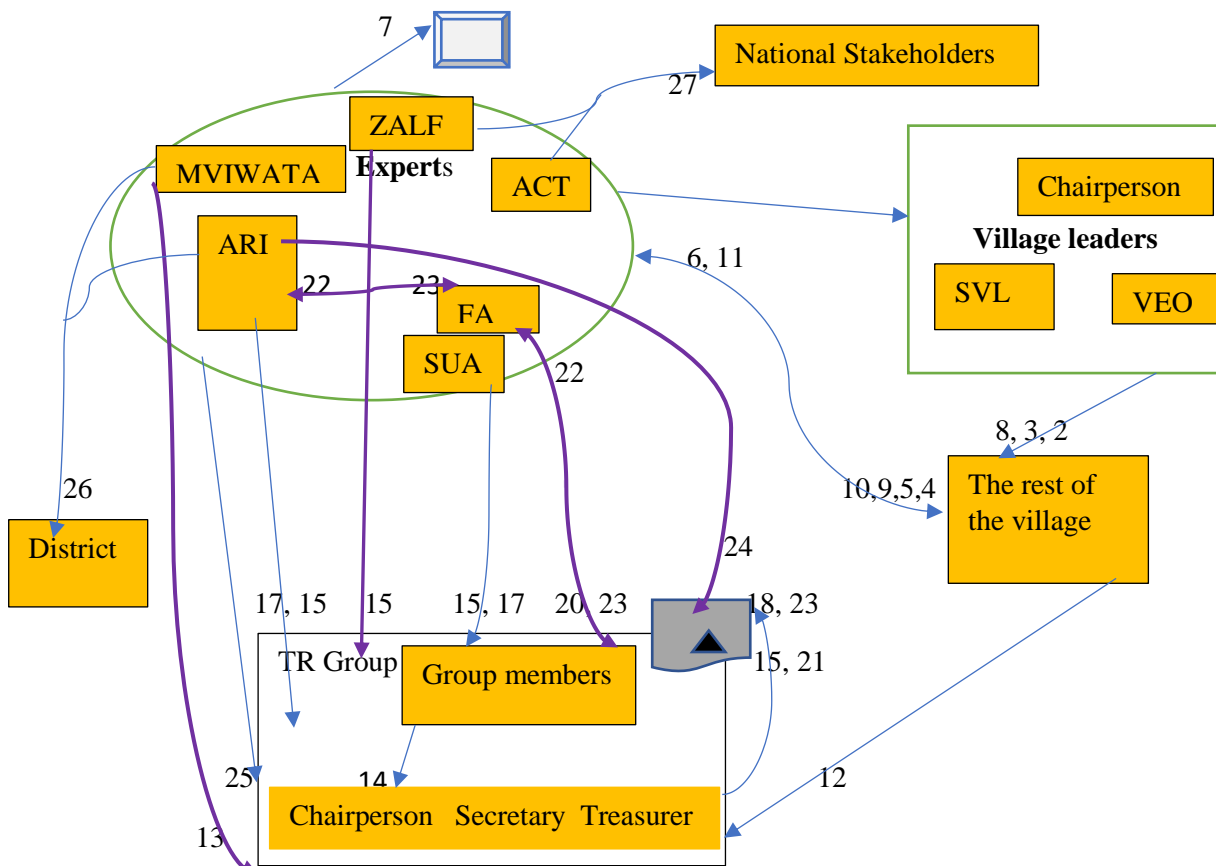
From the farmers’ recollections, the implementation steps for both villages were also almost similar. Changarawe farmers faced pest challenges necessitating measures to control them unlike in Idifu. The Nursery bed installation in Idifu was challenging with seedlings not germinating necessitating repetition of the step. These variations contributed to the difference in the sequence of steps.

### Experts' aggregated Process Net-Maps for Tied ridges' implementation



<ol style="list-style-type: none"> <li>1. Initial contact and scoping study</li> <li>2. Obtaining village register.</li> <li>3. Inform about pending meeting</li> <li>4. Baseline survey was done</li> <li>5. Problem identification</li> <li>6. Prioritization of issues in the community.</li> <li>7. Development of innovations.</li> <li>8. Inform (150 people) about pending meeting.</li> <li>9. Meeting held</li> <li>10. Introduction of the innovations.</li> <li>11. Decision to adopt</li> <li>12. Formation of groups</li> <li>13. Training and supervision of new groups</li> <li>14. Election of leaders</li> <li>15. Training</li> </ol>	<ol style="list-style-type: none"> <li>16. Measuring Individual plots for trial plots</li> <li>17. Making of TR on own trial plots</li> <li>18. Supervision &amp; assistance</li> <li>19. Distribution of Seeds</li> <li>20. Planting and farm management</li> <li>21. Recordings and monitoring</li> <li>22. Disseminated of findings to farmers</li> <li>23. Dissemination of research findings at district level</li> <li>24. Disseminate research findings at national level</li> </ol> <p> <b>Trial plots</b> <b>Points of entry of challenges</b> </p> <p> <b>Development of innovations</b> <b>information flows</b> <b>support, monitoring and training</b> </p>
---	--

Figure 11: Experts' aggregated process Net-Map for TR implementation in Idifu

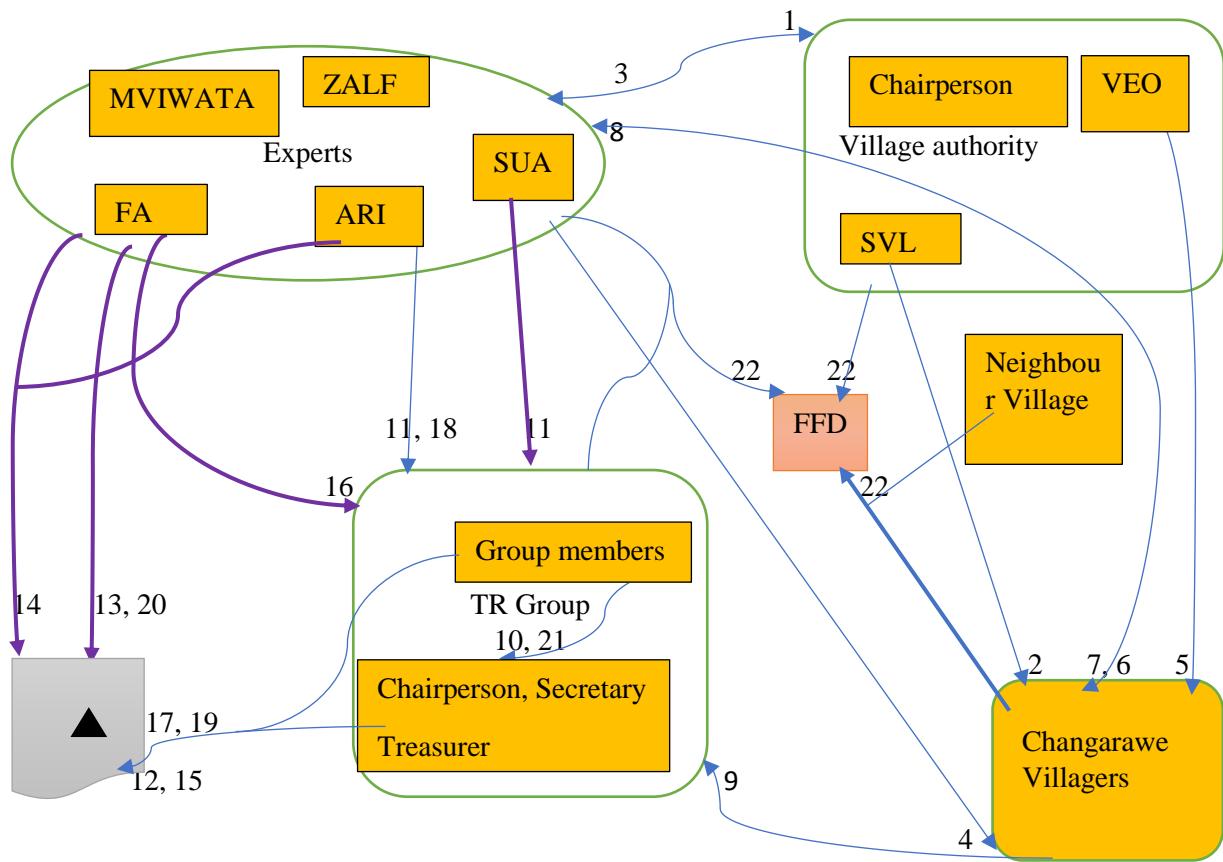


- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Initial contact and scoping study.</li> <li>2. Obtaining village resister</li> <li>3. Inform about pending meeting</li> <li>4. <b>Baseline survey</b></li> <li>5. <b>Problem identification.</b></li> <li>6. Prioritization of issues in the community.</li> <li>7. <b>Development of innovations.</b></li> <li>8. Inform (150 people) about pending meeting.</li> <li>9. Meeting held.</li> <li>10. <b>Introduction of the innovations.</b></li> <li>11. <b>Adoption decisions made</b></li> <li>12. <b>Formation of the group</b></li> <li>13. Training on group management and supervision.</li> <li>14. Election of leaders</li> <li>15. <b>Technical Training &amp; inform to select trial plots' sites</b></li> <li>16. <b>Selection &amp; preparation of trial plots</b></li> <li>17. <b>Measuring &amp; testing farmers' trial plots</b></li> </ol> | <ol style="list-style-type: none"> <li>18. <b>Making of TR on the plots</b></li> <li>19. <b>Supervision &amp; Assistance (support)</b></li> <li>20. <b>Distribution of Seeds</b></li> <li>21. <b>Planting and farm management</b></li> <li>22. Armyworms attack and project informed</li> <li>23. Pesticides distributed and used to control armyworms.</li> <li>24. <b>Recordings and monitoring</b></li> <li>25. <b>Disseminated of findings and researchers to farmers</b></li> <li>26. Dissemination of research findings at district level</li> <li>27. Dissemination research findings at national level</li> </ol> <p>           Trial plots  Entry point for challenges <br/>           Development of innovations  support, training and monitoring <br/>           information flows  </p> |
|---|--|

**Figure 12: Experts' aggregated process Net-Map for TR in Changarawe**

Most of the steps for this innovation were similar in both villages. The differences stemmed from the degree of description of the steps by some experts in each village. Pest attack (Armyworms) was mentioned in Changarawe hence the process having more steps than in Idifu (pests control steps).

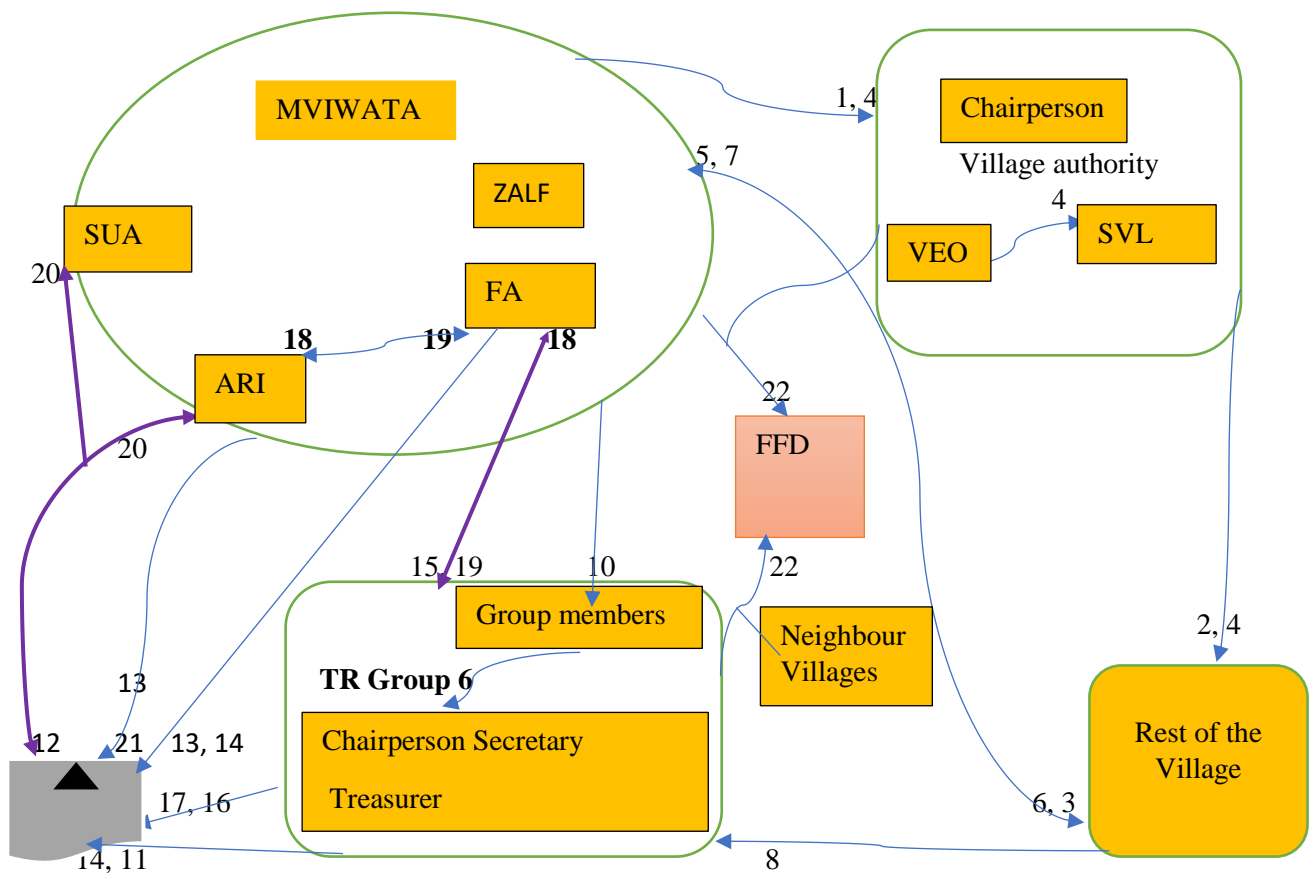
### Farmers' recollection of the steps and actors engaged in TR the implementation



- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Initial contact, request for village register</li> <li>2. Names of entire village registered</li> <li>3. Names given forwarded</li> <li><b>4. Baseline Survey of (150) done.</b></li> <li>5. Inform villagers of a future meeting with experts.</li> <li>6. Meeting between held.</li> <li><b>7. Introduce innovations.</b></li> <li><b>8. Adopt decisions made.</b></li> <li><b>9. Group formation.</b></li> <li>10. Election of group leaders.</li> <li><b>11. Theoretical training and told to select plots.</b></li> <li>12. Selection and preparation of baby plots.</li> </ol> | <ol style="list-style-type: none"> <li><b>13. Soils on these plots tested.</b></li> <li><b>14. Practical training on making trial plots</b></li> <li>15. Farmers' baby plots (trial TR) made</li> <li><b>16. Seeds &amp; fertilizers distributed</b></li> <li>17. Planting of seeds on</li> <li>18. Rain gauges distributed.</li> <li><b>19. Managing &amp; caring for growing garden</b></li> <li><b>20. Monitoring</b></li> <li>21. Harvesting and giving back 0.5kg of harvest to return to ARI</li> <li><b>22. Farmer Field Day</b></li> </ol> <p>Entry of Implementation challenges ▲ Trial plots<br/>Farmer Field Day FFD</p> |
|--|---|

Figure 13: Idifu TR farmers' aggregated process Net-Map



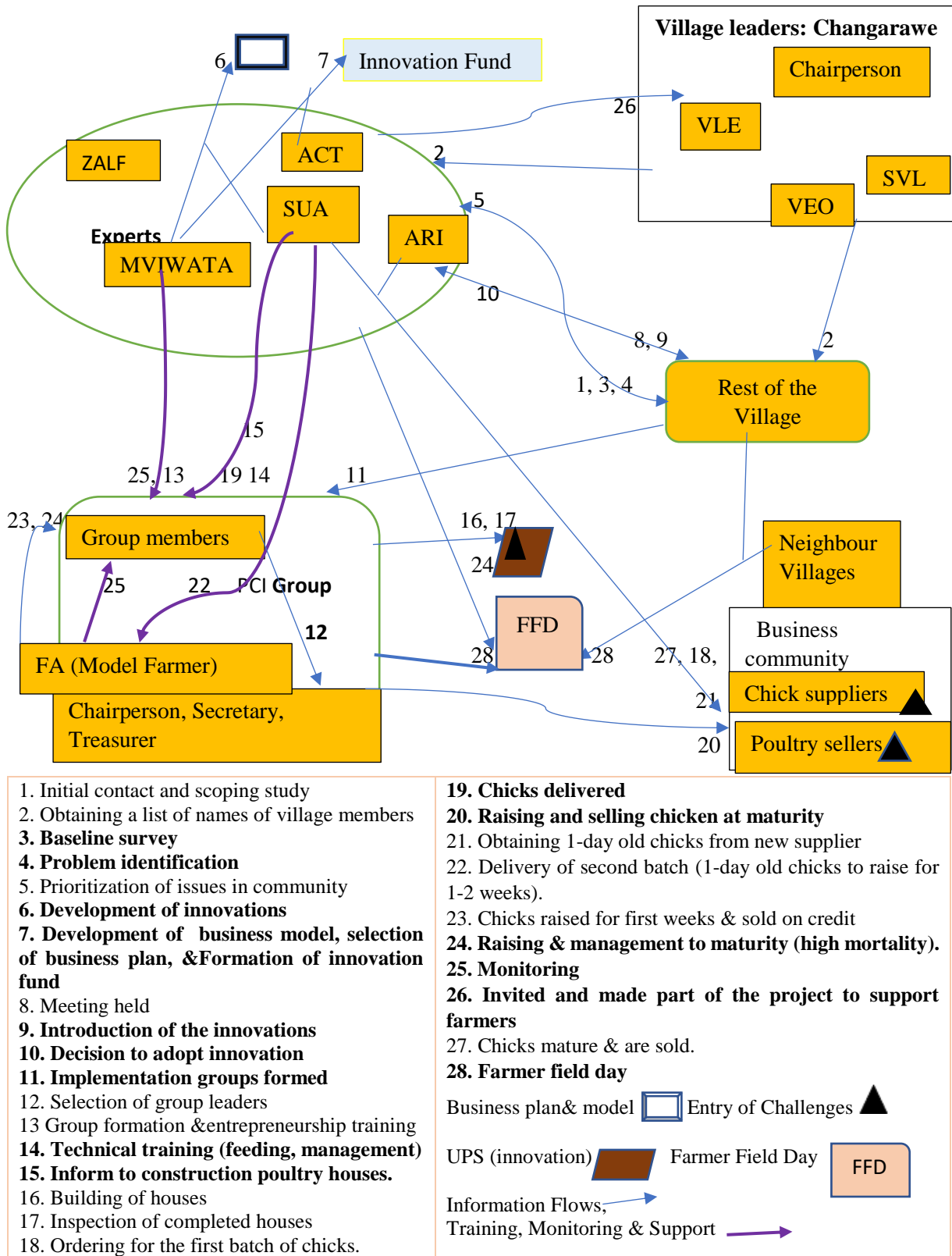


<ol style="list-style-type: none"> <li>1. Initial contact &amp; inform about baseline survey.</li> <li>2. Informed to get prepared to be surveyed.</li> <li>3. <b>Baseline survey</b></li> <li>4. Inform about a future visit to the Community.</li> <li>5. Farmers meet with scientists.</li> <li>6. <b>Introduction of the innovations.</b></li> <li>7. <b>The decision to adopt innovations.</b></li> <li>8. <b>Implementation groups formed.</b></li> <li>9. <b>Selection of group leaders.</b></li> <li>10. <b>Theoretical training and told to prepare trial plots.</b></li> <li>.</li> </ol>	<ol style="list-style-type: none"> <li>11. <b>Selection and preparation of baby plots</b></li> <li>12. Soil sampled and tested for suitability</li> <li>13. <b>Practical training on how to make TR</b></li> <li>14. <b>TRs made on baby plots</b></li> <li>15. <b>Distribution of seeds &amp; fertilizers</b></li> <li>16. <b>Planting on ridges</b></li> <li>17. Weeding and management of plots</li> <li>18. Armyworms attack, inform &amp; seek for a solution.</li> <li>19. <b>Received pesticides to control the pests</b></li> <li>20. <b>Monitor the plots</b></li> <li>21. Harvesting: a sample for testing</li> </ol> <p>Point of entry of implementation challenges ▲</p> <p>Trial plots (baby plots), Field Day □</p> <p>Flow of information →</p> <p>Material support, monitoring and supervision →</p>
---	--

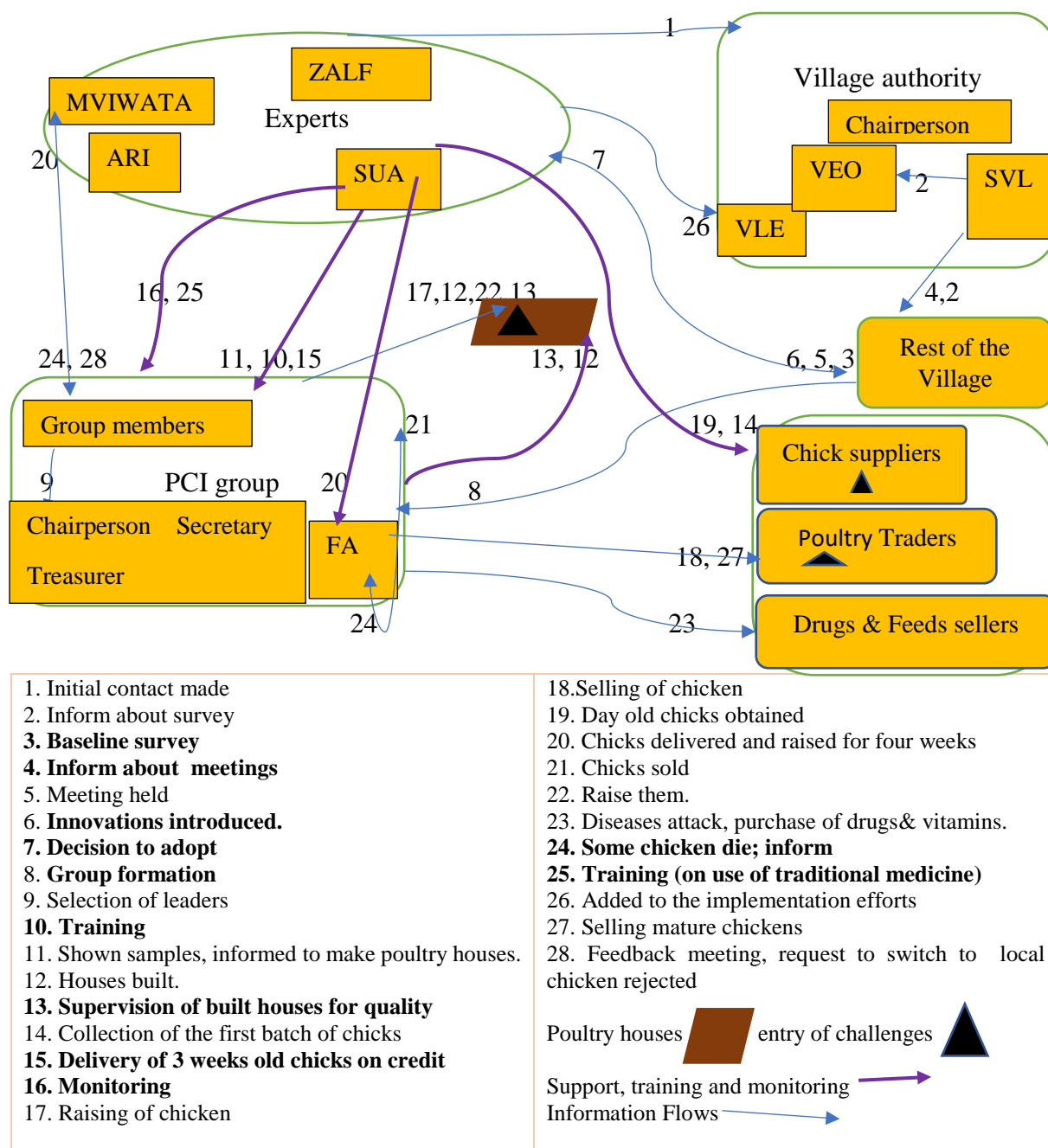
**Figure 14: Chagarawe TR farmers' aggregated process Net-Map**

There were small variations between farmers' maps in the two villages: Farmers in Idifu received rain gauges unlike in Chagarawe, pests attacked crops in Chagarawe but absent in Idifu. These variations contributed to the difference in the aggregated steps of the process.

**The aggregate process Net-Map for Poultry Crop Integration (PCI) implementation**



**Figure 15: PCI experts' aggregated process Net-Map**



**Figure 16: PCI Farmers' aggregated process Net-Map**

The farmers' and expert' aggregated steps differed slightly. Steps 4, 6, 7 and 18 in the experts' process Net-Maps were absent in the farmers' descriptions. The breeds of chicken differed in the first and second batch as revealed in farmers and experts' narratives.

### 5.3 Which actors influenced the implementation process most?

The most influential actors in the farmer-farmer and expert-farmer ratings were obtained as previously explained in the methodology (see section 4.3). After rating all actors on this criterion, those perceived to be most influential were extrapolated from table 10 (see annexe) and given in the table 5 below. The actors given in this table were mentioned and ranked by at least three actors from each group of participants on a particular criterion. The total number of ratings (N) assigned to each actor had to be nine and above ((N)>=9). These were used in generating the mean ratings. The bigger mean value of the ratings assigned to an actor, the higher their perceived level of influence was. If two actors had the same mean level of perceived influence assigned to them, the one with a higher N value was considered to more influential (see 4.3, statistical analysis). Subscripts a, b, c show ratings whose distributions differed significantly after executing the Mann-Whitney U-test as explained in chapter 4.

**Table 3: Farmers' perceptions of the most influential actors in the implementation process.**

Ranking (1 <sup>st</sup> -5 <sup>th</sup> )	The KG		The TR		PCI	
	Changarawe	Idifu	Changarawe	Idifu	Changarawe	
Farmers' perceptions	1 <sup>st</sup>	FA (5.00)	ZALF, ARI, SUA (5.00)	FA&ZALF (5.00)	G.Mem. (4.57)	MVIWATA (4.00)
	2 <sup>nd</sup>	MVIWATA(4.83)	-		FA (4.43)	Ptrad. (4.00)
	3 <sup>rd</sup>	ARI(4.83)	-	MVIWATA (4.57)	Chair.(4.43)	ZALF (3.6)
	4 <sup>th</sup>	SUA(4.67)	FA (4.83)	SUA	SUA (4.29)	SUA (3.33)
	5 <sup>th</sup>	G.Mem. (4.13)	G.Mem (4.83)	ARI (4.43)	ZALF(4.29)	FA (3.33)

Source: Own illustration

**Table 4 Perception of the of the experts on which actors were most influential**

Ranking (1 <sup>st</sup> -5 <sup>th</sup> )	In the KG	In the TR	In the PCI	
Experts' Perceptions	1 <sup>st</sup>	Treas.(3.25)	ARI, G.Mem. (4.43)	G.Mem. (4.33)
	2 <sup>nd</sup>	Chair. (3.13)	-	MVIWATA(3.33)
	3 <sup>rd</sup>	G.Mem. (2.75)	FA(4.14)	SUA (3.33)
	4 <sup>th</sup>	MVIWATA (2.67)	Chair.(3.86)	FA (3.25)
	5 <sup>th</sup>	Sec. (2.63)	SUA , Sec. (3.71)	ARI (3.17)

V/comm. = village community Sec= group secretary, Treas. = Group treasurer N/villages= neighbour Chair = Chairperson of group G/Mem = group members Ptrad = Poultry traders D&F =Drugs & Feeds, C.sup= chick suppliers (source: own compilation).

The farmers in Changarawe on average ranked the experts as the most influential actors in the implementation process. The experts (FA, ZALF, MVIWATA, ARI and SUA) were on average

perceived by the Tied Ridges and Kitchen Garden farmers to be influential with higher levels of influence (mean influence > 4.00). The KG farmers also ranked themselves as influential actors. The PCI farmers identified almost the same experts but the perceived level of influence of the experts on the implementation process was lower (mean influence  $\leq 4$ ). The PCI farmers in addition felt that the poultry traders were influential in Changarawe village. The Idifu Kitchen Garden farmers also on average ranked the experts as the four most influential actors (ZALF, SUA, ARI and FA). Their TR counterparts felt that both actor groups influenced the process (members of the group, FA, ZALF and SUA). The perceived levels of influence of these actors were on average high ( $5.00 \leq \text{influence} \geq 4.29$ ).

As farmers rated the most influential actors, they voiced their opinions on why they believed that these were influential. Some believed that actors within their reach such as Field Assistant were most influential. Others felt that the actors who supplied materials, the custodians of knowledge and those who monitored were most influential. This was revealed in storylines like: *“The researchers (SUA, ARI) taught us the importance of keeping chicken. They have a very big influence, MVIWATA too. (..) We call the Field Assistant. Even at night, he will be there for us, he has a very big influence”* (Interviewee 54). The actors perceived to be committed to supporting the implementation process were also believed to be very influential. This perceived commitment was indirectly linked to the distances over which the actors travelled to reach the villages. One such actor group were the researchers from ZALF who were perceived to be influential by one Idifu TR farmer who said: *“These are very important, they came all the way from Germany to bring us this project”* (Interviewee 4).

Some experts believed that farmers were willing and dedicated to carrying out the necessary activities to make innovations functional hence ranking these farmers as the most influential actors. Other experts considered the experts (SUA, FA, MVIWATA and ARI) to very influential and this was attributed their full involvement during the implementation process. The KG experts on average assigned lower ranks to the actors engaged in the process compared to the TR and PCI experts. The experts also on average assigned lower ratings than farmers when rating the actors engaged in the implementation process of similar innovations. For example, both groups of interviewees in the Kitchen Garden perceived the Secretary and Treasurer of the group to be very influential. The farmers ranked these two actors more highly than the experts.

## **5.4 Which factors facilitated the implementation process?**

Several factors were mentioned as having driven the farmers to make the initial innovation adoption decisions and to have enabled them to install and use the innovations. These included: The goals for implementing, the attributes of the innovations focusing mainly on the perceived benefits, training, support monitoring, supervision and the environmental factors.

### **5.4.1 Implementation goals as facilitating factors**

The goals for implementing gave insights into why farmers had taken up the innovations (the initial drivers). Most Kitchen Garden farmers in both villages, especially the women, stated the need to increase availability and access to vegetables in their households as the reason why they had adopted it. They had believed that having more vegetables would lead to increased vegetable consumption and improved diet diversity which would lead to better nutrition statuses of their family members. This interest was generated due to the knowledge shared by experts when introducing the innovations: *“They said that if you have young children or are still have children this group is will be good for you. Since I have young children, I thought it would be beneficial to me”* (Interviewee 18). A few male farmers in Changarawe, in addition, hoped to grow more vegetables which they could sell and gain income: *“I am a small time businessman. I decided to join so that I could gain from it”* (Interviewee 44).

Gaining income and reducing poverty was also the main reason for adoption and implementing PCI. All farmers had been keeping indigenous chicken in free range system and some of them mentioned that they had joined the PCI implementation group because it was compatible with their needs and experiences. Others had anticipated to gain more knowledge on raising the new breeds which they would use to improve on their local chicken enterprises. *“I joined this group because I am a poultry keeping indigenous chicken so I wanted to join this as well”* (Interviewee 52). One farmer also believed that raising the improved breeds would lead to increased household incomes and improved food situation: *“I entered this group to get out of poverty. I can get eggs from these chicken which I sell”* (Interviewee 56).

Farmers’ narratives revealed that many of them from both villages had adopted the Tied Ridges because they had been told by experts that these were good and would promote water conservation on their farms. This would improve the soil conditions leading to higher harvests from fields with Tied Ridges than on flat cultivation. One TR implementer in Changarawe said:

*“We were told that these ridges conserve water, we usually suffer from famine due to little rain. Being hungry is shameful”* (Interviewee 36).

The experts’ goals or motivations for facilitating the implementation of the three innovation were the projects’ goals for introducing the innovations. One KG expert said: *“This innovation was primarily introduced to improve household consumption of vegetables. Income is secondary”* (Interviewee 23). The TR was promoted because it would capture and conserve rainwater in situ after a big storm, hence reducing speed of surface runoff. This would improve the soil conditions: *“The TR act like a bucket. They harvest water unlike under flat cultivation where the water will runs off”* (Interviewee 20). The PCI was implemented to *“address liquidity constraints faced by farmers since they tended to selling under stress (...) It was meant to be source of income to smoothen liquidity in consumption”* (Interviewee 26).

#### **5.4.2 Gains from the implementation process as influencing factors**

Farmers’ narratives highlighted several benefits from being part of the implementation process. These included increased incomes, food, knowledge and social capital. The gains were explored on an individual and group level.

##### **Perceived benefits of the farmers’ from using the innovations on an individual level**

Farmers were asked if they thought that they had gained in terms of food, income and knowledge from the implementation process. The responses were given varied from yes, no, I don’t know, hard to tell etc. The number of farmers who gave the responses were converted into percentages and are given in table 8 (see Annexe).

When asked if they thought that they had gained incomes, more farmers from the PCI group answered positively compared to the KG and TR farmers. The TR farmers had the least positive responses. When asked if they gained food, the percentages of farmers who reported gaining food in PCI and KG were almost equal and higher than the percentage of farmers who reported to be gaining food in the TR. The gain in vegetables from KG implementation seemed higher in Changarawe than in Idifu. The gain in food from the TR was higher in Idifu than in Changarawe. All farmer groups reported having learnt out of the implementation process. They reported learning and were applying the knowledge on the farms thus leading to the perceived increase in food and income in their households. *“There has been an increase in food. Besides farming on Tied Ridges, I am also using the knowledge from the training on how to farm in a scientific way. This is because of the knowledge I got from the training about proper spacing”* (Interviewee 6).

**Perceptions by both actor groups on which actors gain most from the process.**

The actors gaining most income, food and knowledge from the implementation process were identified as indicated in tables 11-13 (see annexe). Using the approach used to identify the influential actors, the five most gaining actors per criterion per innovation were identified and are given below:

**Table 5 Perceptions of farmers on which actors gained most.**

Ranking (1 <sup>st</sup> -5 <sup>th</sup> )		Kitchen Garden		Tied Ridges		PCI	
		Changarawe	Idifu	Changarawe	Idifu	Changarawe	
Farmers' perceptions	income	1 <sup>st</sup>	ARI, SUA, FA (4.50)	G/M (3.17)	ZALF(2.50)	FA (2.86)	P/trad (4.50)
		2 <sup>nd</sup>	-	Chair, Treas. (3.00)	MV_TA, SUA ARI (2.00)	V/com, Sec. (2.57)	C.sup. (4.17)
		3 <sup>rd</sup>	-	-	-	-	D& F sellers (3.8)
		4 <sup>th</sup>	MV_ (3.50)	Sec (2.83)	-	G/M (2.00)	ZALF (3.60 <sup>c</sup> )
		5 <sup>th</sup>	ZALF (3.25)	V/com. (2.17 <sup>c</sup> )	V/Com, FA (1.43)	Treas. (1.86)	MV_TA, FA (3.50)
	food	1 <sup>st</sup>	Treas. (4.60)	G/M (4.17)	FA, Chair.(1.57)	Chair (3.04 <sup>b</sup> )	MV_TA (4.00 <sup>a</sup> )
		2 <sup>nd</sup>	Chair., Sec (4.33)	Chair. (4.00)	-	G/M (2.90)	P/trad (4.00)
		3 <sup>rd</sup>	-	Treas., Sec. (3.83)	G/M Sec. Treas. (1.43)	Sec (2.76 <sup>c</sup> )	ZALF (3.60 <sup>c</sup> )
		4 <sup>th</sup>	SUA, ARI (4.17)	-	-	Treas. (2.50 <sup>c</sup> )	FA, SUA (3.33)
		5 <sup>th</sup>	-	ARI (3.50)	-	FA (2.42)	D&F (3.20)
	knowledge	1 <sup>st</sup>	Treas. ( 4.80)	ZALF (4.83)	Chair. (4.29)	G/M & Chair (3.33)	Chair. (4.33)
		2 <sup>nd</sup>	Chair., Sec. (4.50)	ARI (4.67)	Sec, Treas. VEO, (4.00)	-	G/M Sec (4.17)
		3 <sup>rd</sup>	-	Chair.(4.50)	-	Treas. (3.17)	-
		4 <sup>th</sup>	G/M 4.33)	Treas.( 4.33)	-	Sec. (3.00)	Treas. (4.00)
		5 <sup>th</sup>	MV_TA (3.17)	Sec (4.17)	V/com. FA 1.29	FA (2.83)	ZALF(3.20)

**V/com. = village community Sec= group secretary, Treas. = Group treasurer N/V= neighbour Chair = Chairperson of group G/M = group members Ptrad = Poultry traders D&F =Drugs & Feeds, C.sup= chick suppliers. MV\_TA a, b & c is statistical significance at 1%, 5% and 10% Source: own illustrations**



**Table 6 Experts' perception on the actors gaining most income, food and knowledge**

Ranking(1 <sup>st</sup> -5 <sup>th</sup> )		Kitchen Garden	Tied Ridges	Poultry Crop Integration	
Experts' perceptions	income	1 <sup>st</sup>	Treas. (3.25)	G/Mem (3.57 <sup>c</sup> )	P/trad. (4.50)
		2 <sup>nd</sup>	Chair. (3.13)	Sec. (3.43)	C.sup (3.50)
		3 <sup>rd</sup>	G/Mem (2.75)	Chair.(3.29 <sup>a</sup> )	F & D sellers (3.00)
		4 <sup>th</sup>	MVIWATA (2.65)	FA (2.43)	GMem. (3.00)
		5 <sup>th</sup>	Sec. (2.63)	ZALF (1.71)	Sec (2.67)
	Food	1 <sup>st</sup>	Treas. (3.88)	Treas. (4.00)	G/Mem (3.67)
		2 <sup>nd</sup>	Chair.(3.25)	G/Mem (3.71 <sup>b</sup> )	Sec., Treas. Chair. (3.17 )
		3 <sup>rd</sup>	G/Sec (3.13)	Chair.(3.43)	-
		4 <sup>th</sup>	G/Mem (2.50)	V/comm. (2.57)	-
		5 <sup>th</sup>	V/comm. (2.25)	FA (1.71)	FA (2.75)
	Knowledge	1 <sup>st</sup>	Chair. (4.50)	G/Mem, Sec (4.14)	G/Mem (4.00)
		2 <sup>nd</sup>	Treas. (4.38)	-	FA (4.00)
		3 <sup>rd</sup>	G/Mem, Treas. (4.13)	Chair. (4.00)	VEO (3.75)
		4 <sup>th</sup>	-	FA (3.86 <sup>c</sup> )	Chair. Sec, Treas. (3.67)
		5 <sup>th</sup>	ZALF (3.86)	SUA (3.71 <sup>a</sup> )	
<b>Source: Own compilation</b>					

**Which actors gain most income from the implementation process?**

The KG farmers in Changarawe believed that the experts (ARI, SUA, FA, MVIWATA and ZALF) gained most income from being part of the implementation process. The perceived gain by experts were on average medium to high ( $3.25 \leq \text{experts' income gain} \leq 4.50$ ). While a number of KG farmers in Changarawe also believed that they gained some incomes, these were perceived to be little because many were not selling vegetables due to having few bags: *“All the other members (of the group) have little change in income because they have on average 1-2 bags”* (Interviewee 46). Others reported that they were not selling vegetables because the innovation had been introduced to increase vegetable consumption. Two farmers reported giving vegetables to their friends and family in Changarawe instead of selling.

The TR farmers and PCI farmers in this village also believed that the experts gained most income in terms of salaries and allowances from the project: *“All these scientists get money, some use aeroplanes to come here, and they do not come on foot. They are training us, waking up every day to teach. They all get money”* (Interviewee 39). The TR farmers, in addition, believed that the group members gained little increment in harvest due to the bad seasons in the previous year and therefore gained small or no increments in income. Many of these farmers also reported that they had not expanded beyond the trial plots due to the harsh climatic conditions. The PCI farmers also believed that poultry traders and feed sellers gained a lot of

income. The poultry traders were perceived to be gaining from buying chicken cheaply from the farmers and selling them at a higher price to buyers in their network.

The Idifu TR farmers believed that the people using the Tied Ridges like the group members, village community and the FA gained more harvests which they sold hence earning more incomes. This was the reason given as they identified and rated these actors as the topmost income gainers in the TR implementation process. To cross-check if there were any truths in this belief, the researcher guided by the FA visited two farms where TR were being practised by non-group members in this village. The Idifu KG farmers reported gaining more incomes from selling vegetables and using the incomes to buy goods and services hence others gaining this way.

Among the experts, the perceptions on who gained most income also differed across the three innovations. The top gainers in the Kitchen Garden were believed to be group members (plus their leaders) and MVIWATA officers. The TR experts believed that farmers and the Field Assistant gained most income from the TR implementation process. The PCI experts believed that the poultry traders gained most income followed by chick suppliers, feed traders and group members.

#### **Which actors are gaining most food from the process of implementation?**

The Kitchen Garden farmers in Changarawe perceived their group leaders and experts (SUA and ARI) to be gaining most food. The KG farmers in Idifu believed that it was the group members (including the leaders) and the ARI experts gaining most food. The experts' perceived gain in food was in form of salaries and allowances which were then used to buy food. Other farmers believed that the experts were practising the Kitchen Gardens in their homes. The TR farmers perceived the members of the group (plus their leaders) and FA to be gaining the most food in both villages. The PCI farmers ranked MVIWATA, as the actor(s) gaining most food. These were perceived to be followed by the poultry traders, ZALF, FA, SUA and feed traders respectively.

The experts on average believed that the farmers in their respective groups and their leaders gained most food. The perceived gain in food was highest in the TR implementation followed by the KG and least in the PCI. It was believed that farmers were gaining more food on their trial plots in comparison to plots if they grew similar crops. The experts' narratives revealed that their beliefs were backed by scientific knowledge. One experts said: "*I tried out the*

*innovations in the mother plot and I observed that on plots with TR and fertilizer micro-dosing, the yield was higher than on flat cultivation” (Interviewee 2).*

**Which actors gain most knowledge out of the implementation process?**

The farmers in Changarawe believed that on average, the group members and their leaders gained most knowledge out of the implementation processes. The two groups of farmers in Idifu had different perception. The TR farmers believed that their group members learnt most while the KG farmers believed that experts gained most knowledge. One common storyline in farmers’ interviews as they supported their views on why they believed that they had learnt most, was their perceived ability to install the innovations on their own. This was a common theme especially among the Kitchen Garden farmers who in addition reported to be possessing nutrition knowledge and better vegetable cooking skills. This knowledge was said to be from the nutritional education (training) held in both villages: *“Before, I did not know how to make these pocket bags, plant on it and keep them (...) I learnt not only this but also how to prepare vegetables well” (Interviewee 13).* KG farmers reported to be saving money from utilising the knowledge gained. One farmer in Changarawe said: *“The lesson were useful to me, I learnt how to grow own vegetables and save money. Before I was buying vegetables but these bags help me save money which I use for buying onions, oil and other things” (Interviewee 45).*

TR farmers believed that they had learnt to farm in a “technical way” from the several training organised by Trans-SEC. The knowledge gained was perceived to be very good and they would use it in farming to reducing poverty and food insecurity. Learning was also a common theme among PCI farmers who believed that they would use the knowledge acquired to run the local poultry enterprises. The farmers had varying views on whether the experts gained knowledge or not, and to what extent across the three innovations. While some farmers believed that only group members gained knowledge, others believed that the learning occurred not only among the farmers but also among experts; *“We are all learning (the group members). Scientists teach us we learn from them, field assistant guides us, he doesn’t learn from us” (Interviewee 50).*

The experts facilitating the innovations’ implementation also believed that farmers learnt most. The narratives of the three kitchen Garden experts revealed that in addition to the general training given to groups, special training had been given to the group leaders to train the adopters further. The experts believed that farmers on average gained highly in all the three innovations (knowledge gain  $\geq 3.67$ ).

### **5.4.3 Support, monitoring and supervision of the innovations.**

The farmers' narratives highlighted the Field Assistant's presence and how this actor supported them not only during the innovations' installation but also at various points as they carried on with the different activities in the implementation process. The FA supervised the activities, provided farmers with materials and linked farmers to experts as and when need arose. The ARI, MVIWATA and SUA experts monitored farmers' progress during the implementation process: *"After we were given chicks, people from SUA came regularly to see how we were progressing, if the chicks fell sick, they were advising us how to deal with the situation"* (Interviewee 54). The farmers also mentioned receiving seeds, fertilizers, bags and chicks before embarking on implementing.

### **5.4.4 Group registration and group support**

One Tied Ridge farmer in Idifu and two PCI farmers joined the groups, started and persisted in using the innovations because they believed that their groups would be registered and this would make it easier for them to easily access loans from banks: *"We learnt in the seminars that we will register our group. Once the group is registered, we can easily access loans"* (Interviewee 7). Another Tied Ridge farmer believed that being in a group was a good thing and it would help them work together to fight poverty. Implementing the innovations in a group format provided relief to farmers whenever they faced challenges. One PCI farmer revealed that after failing to buy drugs for the sick chicken, he approached the Field Assistant who also a group member and the FA shared chicken drugs with him. The KG farmers in Idifu had collected money as a group and bought for seeds which had enabled them to make collective kitchen bags to get income as a group. These farmers also planned to collectively buy seeds in future to make their gardens sustainable when the project exited the village.

### **5.4.5 Compatibility of innovation with needs, experience and innovation fit**

Farmers' transcribed interviews revealed that they joined the implementation groups because the innovations were compatible with their needs, values, previous knowledge and fit well in their routines: *"The PCI fits well into my other farm routines"* (Interviewee 50). One Tied Ridge farmer in Idifu already had prior knowledge about the new practices: *"Planting on Ridges is not so new, people in Tabora do it, and we plant sweet potatoes on ridges"* (Interviewee 8). Two KG farmers in Changarawe had been growing AIVS and other modern vegetables for commercial purposes and joined the groups to expand their businesses.

#### **5.4.6 Observability of results and comparative advantage**

One farmer in Idifu stated that they had observed as the experts set projects' trial plots (mother plots) in this village and had liked what the experts were doing. The farmer joined the Tied Ridges' group when the innovations were introduced. Farmers in Idifu stated that they had tried out the innovations and had received higher yield from their trial plots in the first year of implementation. Other Idifu community members after observing their colleagues gaining more harvests had decided to also try out the innovations on their own. The TR farmers after gaining some increments from using one trial plot had set up more plots to expand the extent of TR trial usage. Farmers' narratives further revealed that they had observed that when it rained the water stayed on the TR plot, unlike cultivation.

The Kitchen Gardens farmers grew communal bags in both villages for the groups to sell and gain money after trying out the innovations on their own farms. They gained vegetables and sold although, by the time of data collection for this thesis, these collective bags were no more, apparently due to conflicts regarding how to manage the harvests from these bags. Farmers in Miganga had on hearing the success stories in Idifu approached the project and had started to use the kitchen gardens. This was revealed in the transcribed interviews of both farmers and experts in this village.

#### **5.4.7 Perceived ease of use**

Idifu Farmers in their interviews kept referring to growing on Tied Ridges as a good thing because the ridges required less weeding and the Tied Ridge plots could be used for more than one season. One expert assumed that this could be possible because making ridges would bury some weed seeds. A number of the Kitchen Garden farmers in Idifu especially the women felt that growing vegetables on pocket bags made their lives easier in comparison to when they had to go to the farms to scavenge for vegetables: *"I thought that it would be easier for me and my family to get vegetables near home. I approached the Field Assistant who helped me install the innovations and then later I joined the group"* (Interviewee 17).

#### **5.4.8 Communication/information flows in the implementation social systems**

Communication between the two actor groups facilitated the process since problems were solved, materials delivered and activities executed through verbal communication. Initially, information between farmers and experts was channelled through the village authority. Later, after the meeting and presentation of innovations, farmers got information directly from experts

during face to face interaction. Information and materials were also exchanged between farmers and experts through the Field Assistant. Communication also occurred in form of knowledge exchange during training and feedback meeting organised by the project.

#### 5.4.9 Fairness and trust in the implementation process

Research participants identified and ranked the actors whom they thought were trustworthy as indicated in table 14 (see Annexe). The most trustworthy actors according to the farmers and experts are given below:

**Table 7 Actors perceived to be most trustworthy in the process of implementation**

Ranking (1 <sup>st</sup> -5 <sup>th</sup> )	The KG		The TR		PCI	
	Changarawe	Idifu	Changarawe	Idifu	Changarawe	
Farmers' perceptions	1 <sup>st</sup>	SUA (5.00)	ZALF, SUA,FA ARI, (4.50)	ZALF (4.67)	G/Mem (5.00)	SUA, FA (4.83)
	2 <sup>nd</sup>	MVIWATA (4.67)	-	ARI (4.57)	SUA, FA (4.29)	-
	3 <sup>rd</sup>	FA (4.50)	-	MVIWATA, Treas. SUA, FA (4.43)	-	ZALF (4.80)
	4 <sup>th</sup>	ARI (4.33)	-	-	ZALF,ARI (4.00)	MVIWATA, C.sup G/Mem (4.50)
	5 <sup>th</sup>	Chair, Sec. (3.83)	MVIWATA (4.40)	-	-	-

Source: Own compilation

Ranking (1 <sup>st</sup> -5 <sup>th</sup> )	KG	TR	PCI	
Experts' perceptions	1 <sup>st</sup>	ARI & SUA (4.38)	G/Mem, Sec (4.14)	MVIWATA, ARI & SUA (4.00)
	2 <sup>nd</sup>	-	-	-
	3 <sup>rd</sup>	ZALF (4.29)	Chair. (4.00)	-
	4 <sup>th</sup>	-	FA(3.86)	G/Mem (3.50)
	5 <sup>th</sup>	FA, Chair., Treas.(4.00)	SUA (3.71)	ZALF (3.50)

V/comm. = village community Sec= group secretary, Treas. = Group treasurer N/villages= neighbour Chair = Chairperson of group G/Mem = group members Ptrad = Poultry traders D&F =Drugs & Feeds, C.sup= chick suppliers (Source: Own compilation)

Farmers implementing the three innovations in Changarawe on average trusted the experts most. The KG and PCI farmers in this village, in addition, ranked the group chairperson (KG), secretary (KG) and group members (PCI) among the most trustworthy actors. These were however ranked lower than the experts. The KG farmers in Idifu believed that ZALF researchers were most trustworthy while the TR farmers believed that it was the group members. Many farmers revealed in their interviews that experts were very trustworthy because they had treated all farmers in the groups equally and had distributed similar quantities of

materials. Other farmers mentioned that the experts were responsible for the core existence of the project: *“The researchers are the most trustworthy, they are the foundations of this project. I believe in these, most especially those from SUA. Those especially did a good job”* (Interviewee 55).

The experts facilitating the Kitchen Garden and the Poultry Crop Integration on average trusted SUA, ARI and MVIWATA while those facilitating Tied Ridges’ implementation on average trusted the group members (and their leaders). The PCI experts had varying opinions on the trustworthiness of the farmers with some believing that farmers had inflated figures while reporting the death of chicks. Farmers’ repayments of the loaned funds were also perceived to be poor as mentioned by one expert when rating them on this criterion. All research participants believed that the implementation processes had been conducted in a fair way.

## **5.5 Which factors are hindering the implementation process?**

Several challenges were highlighted as hindering farmers’ implementation efforts. These included: Failure to observe results, difficulties in using innovations, high costs, information gap and marketing constraints as shown in table 9 in the annexe section.

### **5.5.1 Failure to observe results from implementation efforts.**

Much as some farmers reported gaining food in the previous section, a number of them believed that they were not gaining sufficient amounts due to:

#### **Water constraints**

Many Idifu farmers attributed their observing little or no harvests from implementing the innovations to be arising from lacking adequate water. The Kitchen Garden farmers in their interviews revealed that the water pump had broken down, making watering the vegetables an expensive venture in dry season. The rains had also not come on time and the Tied Ridges’ farmers in this village kept referring to this situation as the “conditions” that led to low gains in terms of food and income. One Tied Ridge farmer in Idifu alleged further that they had obtained higher yields on flat cultivation than on ridges trial plots and was contemplating abandoning the innovation use altogether. When asked about this observation, two experts attributed this to be as a result of delayed field preparation by farmers who waited for the onset of the rainy seasons. This was because the soils were very hard to prepare in dry season. The experts further believed that the farmers practised dry planting (plant in the dry soils before the rains come) on their flat cultivation giving these crops a higher comparative advantage over the Tied Ridge

plots. Another cause of crop failure in Changarawe had been attributed to floods the previous year that had not only made KG to rot but had also washed away the Tied Ridges

#### **Pests and diseases**

This challenge was more pronounced in interviews with farmers in Changarawe where the three groups of farmers reported having faced this challenge. The Kitchen Garden farmers mentioned that chicken attacked the vegetables. Insect pests also affected the KG in Changarawe. To control chicken damage, experts had advised farmers to place the pocket bags in enclosures like mosquito nets. Insect pests had been controlled using non-chemical control methods taught to the farmers by the Field Assistant. TR farmers in Changarawe revealed in their interviews that armyworms and cattle had attacked their crops. Farmers had been given chemical pesticides to fight armyworms in maize. Fleas had attacked chickens in the second batch (PCI) causing blindness and death of the mature chicken. High mortality rate had been due to fowlpox and Newcastle diseases. Kitchen Garden farmers in Idifu had also been affected by chicken pests that were controlled using similar approaches employed in Changarawe.

#### **Farmers' perceived laziness and indifference**

While some experts believed that planting on the ridges was having an impact on food security, others thought otherwise. One expert believed that Tied Ridge farmers were getting little or no harvest in Idifu because they were lazy and were not implementing fully the innovation to have a considerable yield. Two group leaders of the Kitchen Garden had a similar opinion about their group members. They believed that due to laziness, farmers did not make more bags let alone repair the damaged ones even when reminded by the group leaders. Some KG farmers alleged that this was because a few farmers were less interested in the innovation itself and more in the allowances given by the project as reimbursement for attending monitoring meetings.

#### **5.5.2 Perceived difficulty to install or use the innovations.**

An alternative discourse emerged as farmers and experts discussed the perceived little or no yield in the PCI and TR. Many cited the difficulty to make Tied Ridges using a hand hoe, especially in Idifu during the dry season as hindrance to farmers' decisions to expand the size of the TR plots. One expert said *"Using Tied Ridges is hard. Making the Tied Ridges takes a lot of time. (...) considering the nature of the rains, the planting window is too narrow. So the opportunity cost is too high"* (Interviewee 20). TR farmers in Changarawe felt that TR were difficult to make due to the high weed density making farming using TR tedious and *"a double job: "The weeds disturb, one has to clear the many weeds before making ridges (Interviewee*



40).” Weeding was even made harder by the small spacing between ridges. PCI farmers believed that the breeds promoted disturbed a lot due to their perceived high susceptibility to diseases.

### **5.5.3 High costs incurred**

The high costs in establishing and using the innovation was a common theme in PCI farmers’ interviews. These farmers mentioned facing financial difficulties while setting up poultry houses, purchasing feeds, vaccinating and treating diseases. The project had anticipated that farmers would use surplus grain from the crop enterprises to feed the chicken but the previous season had been unfavourable and yields had been low. As a result, farmers needed to buy poultry feeds. One farmer who had not budgeted for that eventuality and other expenses said: *“We did not have money for buying our own food” (...)* *The chicken fell sick, the FA came with bwana mifugo (VLE) who saw them, wrote for me a drug which was Tsh. 14,000 in the veterinary shop in Kilosa. I did not buy it, I did not have money”* (Interviewee 51).

The farmers who had received chicks in the second batch said that the price per chick had been higher than in the first phase (that is Tshs. 4500 in second batch versus Tsh.2500 in first batch). This had been attributed to the delivery of one-day-old chicks to the Model farmer by the project to raise them up to four weeks thus leading to a cost price per chick. The market price for the mature chicken had been low (Tsh.6000 – Tsh.8000 per chicken) leading to even lower profit margins. Due to the high costs and challenges faced when raising the promoted breeds, one farmer said that they had requested to be allowed raise local chickens that are easier to manage and to sell but this had been rejected.

Some of the pest control measures such as using mosquito nets in the KG were perceived to be costly: *“When buying these nets, one needs Tshs. 5000. How can I buy a net for a bag when I do not have one to sleep in?”*(Interviewee 41). The high costs were anticipated in the future implementations of TR by four farmers who believed that as they aged, they would become weaker and unable to install TR manually on their own. This would require hiring labour which would not be feasible if they had no money hence abandoning the innovation for flat cultivation.

### **5.5.4 Low knowledge and incomplete information**

Three farmers did not vaccinate the chicks believing that they had already been vaccinated. Others did not treat the chicks on time leading losses. One farmer attributed this to lack of

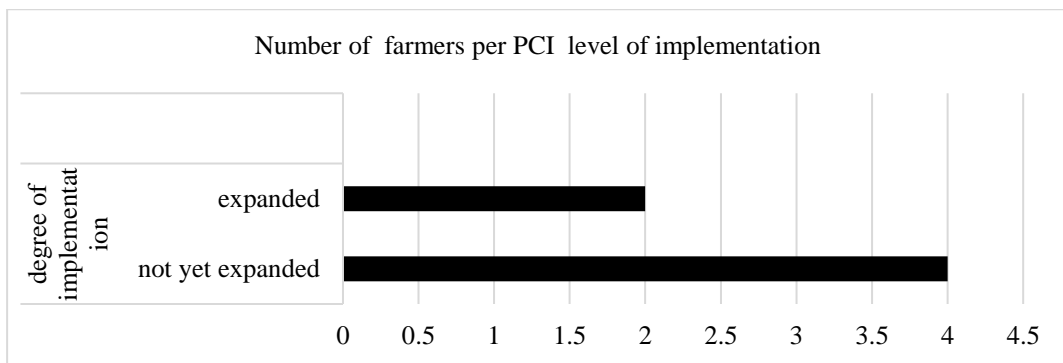
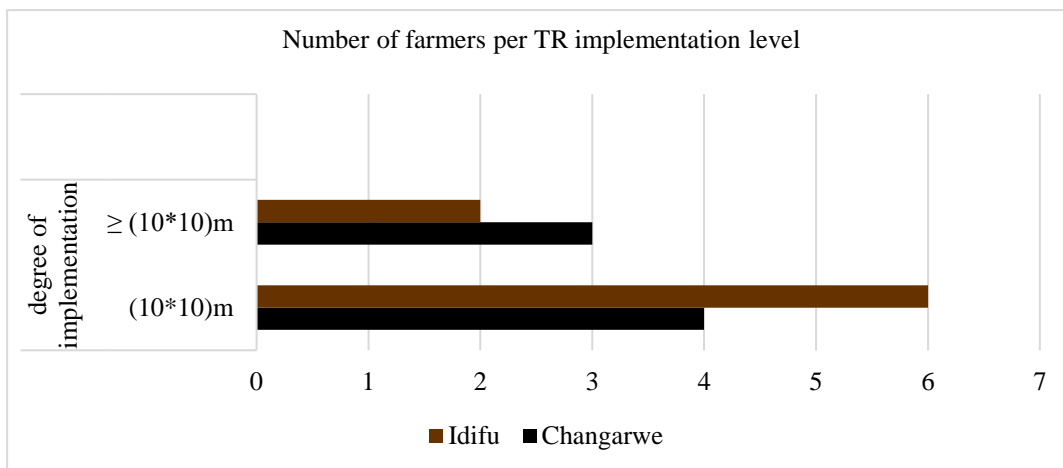
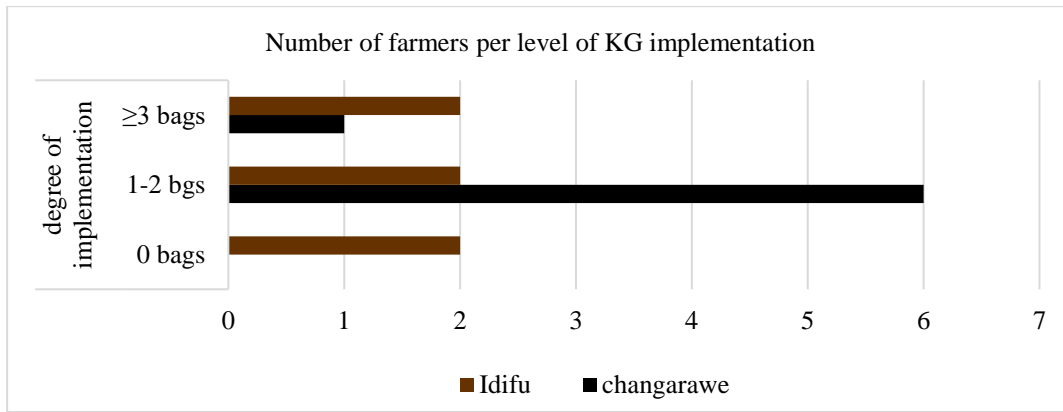
knowledge on how to treat the birds. Another farmer who knew how to treat them said that he but was taking long to isolate the sick ones: *“Once I learnt to isolate the sick ones from the normal birds, I managed to reduce the rate at which the birds died”* (Interviewee 50). The belief that the chicken had been vaccinated was refuted by a PCI expert who insisted that farmers had been told that they had to vaccinate on their own. Two experts instead believed that failure to vaccinate was more due to the irresponsibility of the farmers and lack of serious commitment to the project.

#### **5.5.5 Marketing constraints**

According to three PCI farmers, the promoted breeds were difficult to sell at maturity leading to farmers receiving low prices from the poultry traders. In addition, farmers believed that the chicken were not as tasty as the local breeds, an idea that according to them was in line with the opinions of the poultry traders. To enable PCI farmers gain access to poultry markets easily, the experts had trained them on how to use an SMS platform to send out messages to potential buyers. Only one farmer with the highest level of education had successfully used the platform. Others had failed to use at first but due to further trainings, they were now confident that they could ably use it in future.

#### **5.6 Degree of implementation (extent of innovation use) of the innovations.**

Famers were asked to explain the extent to which they were using the innovations as they gave their opinions on how much each thought that they had gained in terms of food and income. Each Kitchen Garden farmer was asked to give the number of pocket bags they had. Tied Ridge farmers were asked if they were still using the standard trial plots (10m\*10m) or whether they had more. PCI farmers were asked if they had bought and were keeping more chicken after selling those lent to them by the project. The answers given were used to generate the graphs below using Microsoft Excel. On the vertical axis is the extent or level of use (also the degree of implementation of the innovations). On the horizontal axis is the number of farmers from each village at each degree of implementation.



**Figure 17: Level of (degree) of implementation of the innovations**

(Source; own computation from Microsoft Excel)

Generally, the degree of implementation was highest among the Tied Ridge farmers and lowest among PCI farmers. Among the Kitchen Garden farmers, those in Idifu seemed to have implemented it to a greater extent in comparison to the farmers in Changarawe (many had made more bags than the initial two bags made at the onset of the implementation process). More farmers in Changarawe however still had the pocket bags than in Idifu where some had

apparently died off and were yet to be replaced. One Idifu farmer was planning to switch from pocket bags type to another type. In the Tied Ridges implementation, more farmers in Changarawe expanded their plots in comparison to farmers in Idifu. The total number of farmers who had expanded in both villages was however very small (six out of sixteen farmers). This had been attributed especially to the rains not coming on time, the need to obtain permission to expand from experts, and to the perceived difficulties in installing the Tied Ridges: *“I have not expanded because the rains are not enough. I am still on trial plot”* (Interviewee 6).

Among the PCI farmers interviewed, all had sold off or consumed the first stock given to them by the project and only two were still using the innovation. Of these, one had bought an improved breed while the other had kept part of the chicken from the project as parent stock. The other four farmers did not have a clear plan and of them said, *“The project is going to give us more chicken for the real implementation since those given to us before had been for trial”* (Interviewee 53).

### **5.7 Opinions on growing African Indigenous Vegetables (AIVs)**

Most farmers thought that AIVs were good for consumption and all confessed to consuming them at least once a week. Some of the Kitchen Garden farmers visited were growing AIVs alongside the “modern vegetables”. There were AIVs grown on the ground in enclosures their pocket bags with the promoted vegetables. One KG farmer in Idifu, however, was growing AIVs like *Mchicha* and *Mgagane* on the pocket bags as well. Others also grew AIVs on small vegetable patches near the homesteads or in the main garden. The commonly grown AIVs were spider plant, Finger lady, *Majani ya Kunde*, *Majani ya maboga*, *Mchicha* and *Sukuma wiki*, *Kisanvu*, *Matembele*.

Some farmers in did not actively grow the AIVs believing that these grew on their own in the wild where many farmers would freely access them during rainy season. Those picked from the wild included: *Mlenda pori*, *Mchicha pori*, *Mlenda Mgunda*, *Mfenwe*, *Mlenda Mbata* and *Mzimwe*. When asked if they could grow the AIVs on pocket bags, many farmers believed that this would be hard due to their bushy nature. There were farmers interested in growing AIVs but believed that this would be difficult since they did not have access to seeds.

More farmers in Changarawe than in Idifu considered AIVs to be very nutritious. Changarawe farmers were more open to growing and selling a few of them, especially *Kisanvu* and *Matembele*. *Matembele* compared to Idifu farmers. The marketability of these vegetables in Changarawe was linked to the season. The farmers believed that in dry season, these would

sold more easily than in rainy season. The Idifu farmers did not think it would be easier to sell the common AIVs since they harvested, dried and stocked them (especially *Mlenda and Majani ya Kunde*) for use during dry season.

## **6. Discussion**

The main objective of this study was to explain the implementation processes of the three innovations by exploring the perceived facilitating and hindering factors; to identify how these may have contributed to the differences in the performance of the innovations. This is anticipated to be influencing farmers' decisions to increase the extent to which they are implementing (the degrees of implementation of the innovations). This was guided by several specific objectives and research questions in first chapter leading to the information presented the fifth chapter (results chapter). The results have been discussed using concepts from the conceptual framework in the literature review chapter and research questions as follows:

### **6.1 The steps and actors in the implementation of the three innovations**

The farmers' and experts' interviews revealed that the implementation process of each innovation consisted of several key steps such as situation analysis, selection of potential implementers and training them before the onset of the innovations' installation, monitoring and evaluation as innovation use progressed, among others. These steps are similar to those identified by MEYERS ET AL. (2012) in their study on good quality implementation. The existence of these steps in the implementation process of Trans-SEC's innovations means that the project paid attention to what really mattered for high-quality implementation to be achieved. High-quality implementation of innovation is necessary for the delivery of high-quality technologies to adopters (Nguyen et al. 2018). Ensuring high-quality innovations' installation by the Trans-SEC project means that the farmers experienced lesser magnitude of challenges related to the innovations themselves. This could not only have made the implementation path less stressful to the implementers but also made the innovations more capable of withstanding the many hurdles in their social systems. This could have increased the chances of attaining sustainable routinization of research into practice as highlighted by NGUYEN ET AL., (2018) in their study on the impact of quality management practices on sustainability performance.

Describing the process also revealed a diversity of actors and how they interacted. The interactions were purpose-driven as revealed in the aggregated process Net-Maps (to deliver materials, give instructions, train and execute transactions). These were all possible due to the communication among members in the innovations' social systems as theorised by ROGERS (1995) in the Diffusion of Innovations' Theory. It also revealed a few adaptations made in the

implementation process such as; enlisting the Village Livestock Extension Officer in Changarawe to increase farmers' access to technical support, changing of chicken breeds in the Poultry Crop Integration and making adjustments in the implementation of interventions when challenges arose. Adjusting the implementation process is advocated for in several studies (GEELS, 2004; WEST, 2002; ROGERS, 1995) which emphasize its' importance in making innovations fit the users' contexts and routines. This could be the reason why the project made adjustments; to adapt the innovations to their contexts. This is referred to as reinvention in the Diffusion of Innovations theory (ROGERS 1995).

## **6.2 Who were the influential actors the implementation process?**

The different actor groups had varying opinions on who influenced the process the most and why they were perceived to be influential. These ranged from members of groups to the experts such as MVIWATA officers, SUA and ARI researchers and the Field Assistants. The differences could be attributed to each actor group having different experiences as they interacted with each other in the social system and with the innovations. This is in line with findings from some studies where several researchers emphasized that actors (groups of actors) from diverse backgrounds engaged in an activity have different experiences. This leads to differences in how they perceive situations and processes (differences in perceptions) (Denzau & North 1994; Otto-Banaszak et al. 2011). Differences in experiences and perceptions lead to differences in preferences and value systems. The more diverse a study sample is, the higher the likelihood of the existence of varying perceptions and opinions among the interviewees (VAN DEN BRINK & MEIJERINK 2005). The interviewees in this thesis were from diverse backgrounds contributing to their differing perceptions and opinions on who was most influential as hypothesised by VAN DEN BRINK & MEIJERINK (2005). Both the experts and the farmers felt that actors who supported the process, had power over resources used in the implementation process and those who were committed to the process very influential. These reasons for actors' perceived influence are identical to those highlighted in several studies that examine the implementation of interventions (Aberman et al. 2009; Gevorgyan et al. 2013).

## **6.3 The benefits from the implementation process: Which actors gain most?**

The various actors were believed to have gained especially in terms of food, income and knowledge. When asked rank the actors who gained most, the opinions of the different farmers groups and experts varied; experts tended to rank farmers while farmers had diverse opinions.

This could be attributed to the fact that farmers and experts had different knowledge levels on the ability of the innovations to have an impact on these criteria. The experts' knowledge was based on field trials and knowledge acquired through publications while farmers knowledge was based on own experiences as they used and managed the innovations. This is backed up by INGRAM ET AL. (2010) who emphasized that farmers and experts have different understanding of situations. Their goals, contexts of work and methods for evaluating the studied phenomenon (Ingram et al. 2010) influence their perceptions. To get a clearer picture on whether farmers gained, each was asked about their own situation (that is if they had individually gained). These also varied. The gains in terms of food and income were linking to existing literature per innovation as follows:

### **6.3.1 The gain in the Kitchen Gardens:**

The Kitchen Garden farmers reported having more access to vegetables. This led not only to higher vegetable consumption among implementers but also to income gains as they sold the surplus. These study findings are similar to observations from a study conducted in Nepal on the impacts of adopting the Kitchen Gardens promoted in conjunction with nutritional education (Jones et al. 2005). The promotion of this innovation in combination with cash transfers in Lesotho also had similar results (FAO 2015). A number of farmers also attributed their income gain to reduced expenditure on vegetable purchases which is also in line with highlights in studies on the impact of Kitchen Gardens conducted by GALHENA ET AL. (2013) and MOHSIN ET AL. (2017).

### **6.3.2 The gains in the Tied Ridges' implementation**

The transcribed interviews revealed that farmers gained more yields (hence food) from their trial plot than on flat cultivation in Idifu when the rains came on time and in sufficient quantities. This is in line with findings from impact assessment studies on the effect growing crops on Tied Ridges conducted in semi-arid areas of Zimbabwe, Kenya and Ethiopia (BELAY ET AL. 1998; PALE ET AL. 2009; ARAYA & STROOSNIJDER 2010; BIAZIN & STROOSNIJDER 2012; NYAMADZAWO ET AL. 2013). Farmers in relatively humid Changarawe did not perceive to be gaining much yields as they had anticipated and were facing challenges like over flooding when the rains fell in plenty. This is also in line with findings from several researchers who highlighted that when an area receives too much rainfall, lower crop yields occurs on Tied Ridges (Biazin & Stroosnijder 2012; Nyamadzawo et al. 2013). NYAMADZAWO ET AL. (2013) specifically recommend that Tied Ridges should not be used in areas that receive more than



800ml of rainfall because waterlogging is likely to occur. This validates farmers' claims in Changarawe. NYAMADZAWO ET AL. (2013) further point out that using TR in areas with sandy soil would be of no use since the water would percolate very fast increasing the distance through which plant roots have to absorb water leading to lower productivity.

### **6.3.3 The gains in the Poultry Crop Integration implementation**

Much as the implementation model used in the Poultry Crop Integration had proved a success in reducing poverty by generating incomes in Bangladesh (MACK ET AL. 2013) and leading to improvement in consumptions (DOLBERG 2007), the success stories in Changarawe were less. Farmers' narratives revealed several challenges which included: High disease incidence, mortality of birds, high costs. These led to low gains in income. Some of the challenges faced by farmers in Changarawe are similar to those identified in a study by PERMIN ET AL. (1998). These researchers suggested that the challenges hindered farmers' ability to realise economic benefits in the Bangladesh model of poultry keeping. The researchers further suggested that for the poultry in this model to be effective, farmers need to be supported in several ways such as provision of vaccination programs by the project, ensuring adequate disease and pest control, proper feeding, proper marketing strategies, putting into place adequate infrastructure and capital among others (PERMIN ET AL. 1998). Much as some of these were in place, key ones like vaccinations and disease control were not well managed as revealed in the narratives of both actor groups leading to low gains by some farmers in Changarawe.

## **6.4 The factors facilitating the implementation process**

### **6.4.1 Innovation attributes and their influence on the implementation processes**

The innovations were adopted after farmers were convinced that they were compatible with own needs and values, were better than previously used methods and had potential to improve their food and income situations. The interview transcripts, especially from farmers revealed that these innovations' attributes were some of factors influencing farmers' decisions to increase the degree of implementation of the innovations.

Disease outbreaks and lack of finances to effectively manage the innovation (meet the treatment and feeding costs) led to high mortality rates in the PCI. These led to perceived lower net profits not only due to increased production costs but also due to loss of stock. High incidences of diseases were also reported in several studies about similar interventions promoted in other countries. In these studies, the need for change promoting agents to set in place effective

mechanisms to carry out vaccinations and disease control was stressed (GUÈYE 2002; DOLBERG 2003; DOLBERG 2007; LWELAMIRA ET AL. 2009; OKENO ET AL. 2012).

The high costs as a limiting factor to the implementation of the PCI innovation is supported by a study SAMBO ET AL. (2015) on implementation of improved poultry systems in Ethiopia which highlighted this factor. Their study emphasized that the more advanced a poultry system is, the lower the likelihood of poor farmers implementing it due to lack of funds. High costs were deemed likely to limit Tied Ridge use in future. These findings are supported by BETT (2006) and other researchers whose studies on the adoption of water saving technologies in semi-arid areas (FREEMAN & MUBICHI 2017; SHIFERAW ET AL. 2009; AMSALU & DE GRAAFF 2007; BETT 2006).

Empirical data indicates that some farmers were still using the innovations and had expanded beyond their initial trial plots, pocket bags or bought and raised more chicken. This could be because such farmers were benefitting from the innovations. Benefitting from the innovation has been emphasized by BETT (2006) and ATKINSON (2007) as one attribute which facilitates the formation of positive opinions and perceptions by the implementers. This motivates them to increase the extent of innovation use. This implies that if implementers do not benefit when they are investing substantial amounts of resources and efforts in an innovation, they will become reluctant to use it. As SHIFERAW ET AL. (2009) that persistent failure to benefit from an innovation can lead to eventual rejection of the innovation.

Farmers mentioned finding difficulties in selling the promoted chicken because consumers preferred local breeds. The perceived incompatibility of the promoted breeds with consumers' preferences is in line with findings by GUÈYE (2002) whose studies in income and food deficient countries highlighted this observation. Compatibility as a key driver in the implementation of innovations has also been highlighted by several researchers. These emphasize the need for the existence of an innovation-value fit in the innovations' social system ( KLEIN & SPEER 1996; ELIA ET AL. 2014; ZHANG ET AL. 2015).

These observations about innovations' attributes as influencing factors in the implementation processes are in line with the Diffusion of Innovations theory (ROGERS 1995) which has been extensively used in several studies to explain behaviours of adopters and implementers (ROGERS 1995; POPA ET AL. 1996; GUÈYE 2002; KREIN ET AL. 2006; SAHIN 2006; PERKINS 2011; MEYERS ET AL. 2012; ZHANG ET AL. 2015).

#### **6.4.2 Training as a facilitating factor**

Farmers' and experts' interviews revealed similarities of perceptions and opinions regarding the actors perceived to be gaining most knowledge from the implementation processes, the farmers. These were believed to have learnt mostly from the training which could have strengthened their beliefs and confidence about their own abilities to implement. This enabled them to implement, making them active participants in the implementation processes. This is in line with observations made in several studies that emphasize that farmers' learning increases their confidence in the innovations and makes them more willing to use them (FRIIS-HANSEN 2005; SCHWARZER & RENNER 2000; JONES ET AL. 2005; SNIHOTTA ET AL. 2005). This belief that people learnt and have the capacity to implement is defined by SNIHOTTA ET AL. (2005) as the perceived self-efficacy of implementers. Perceived efficacy is one of the key variables in the Theory of Planned Behaviour, one of the theories whose concepts guided this study (AJZEN 1991).

#### **6.4.3 Trust as a facilitating factor**

The ability of actors in a participatory setting to trust each other makes implementation possible. High trust levels lead to greater cooperation in organised promotion of innovations (DASGUPTA & SERAGELDIN 2000; HERMANS ET AL. 2015) such as in the Trans-SEC project. This trust is revealed in the ratings of both farmers and experts who on average trusted each other with high trust levels. The high trust could be the reason why farmers accepted the innovations presented to them by the experts and allowed to try them out. The high interactions of farmers with experts could have deepened the trust actors had for each other as theorized by VOGEL ET AL. (2007). These researchers suggested that face to face interactions cultivates trust in teams contributing towards the achievement of a common goal (like in PAR collaborations).

#### **6.4.4 Availability and development of the market near the farmers.**

Having access to markets influences farmers' decisions to adopt and implementation of innovations (BETT 2006). A number of Kitchen Garden farmers in Changarawe agreed that vegetable markets existed within their vicinity and this motivated those interested in growing the vegetables for sale to adopt the innovation. Most of the PCI farmers did not have direct contact with buyers and relied on middlemen to sell their chicken. This could have been due to poor development of the poultry markets in the village making farmers vulnerable to exploitation by the middlemen. This is in line with findings in the studies conducted by GUÈYE

(2002) and PERMIN ET AL. (1998) where poor access to markets hindered the use of this innovations as a tool to reduce poverty.

#### **6.4.5 Support and monitoring as drivers in the process**

Support in an innovations' social system facilitates the use of the innovation. The transcribed interviews revealed that there was readily available support when farmers decided to adopt the innovations. This was in terms of material, supervision and monitoring. This support has been identified by PATTERSON ET AL. (2009) and KLEIN & SPEER (1996) as one of the structures that must be established by change agents to motivate implementers to put to use the promoted innovations.

#### **6.5 Growing the AIVs as farmers implement the innovations**

Some farmers were growing a few AIVs for sale while others picked them from their field or from the bushes. The general belief was that these were nutritious. A few were considered marketable and others unmarketable or bushes (bushes) which was in line with observations made in a previous study on AIVs in another part of Tanzania (CHIPUNGAHELO 2015).

#### **6.6 Conclusion**

The implementation of innovations has made some contributions towards improvement of food and income situations in the two study villages, thus improving the welfare of the implementers. Describing the process of the implementation of each innovation revealed a diversity of existing networks that have been set in place which may strengthen the communities as they work together in future to solve their challenges. Using the process Net-Map visualised and highlighted the actors engaged in the implementation and how these were linked to one another. It also enabled identification of the key actors who influencing the processes and points of entry of challenges per innovation per case study site. Such information can be a starting point in future for projects interested in introducing interventions to bring about societal change. These actors can be brought on board, especially those in contact with the farmers, reducing the time it would take to install and run a new project. If the Trans-SEC and HORTINLEA projects intend to replicate these innovations elsewhere, points of entry of challenges identified can be focused on in future. This can promote sustainability of the implementation of these innovations. This can also lead to a reduction of the implementation challenges in future and thus reducing implementation failure.

The greatest achievement observed is the high knowledge gain as revealed by the level of awareness the farmers have about the technicalities of installing and using the innovations. This

knowledge is useful to the farmers who if the conditions are favourable, will most likely continue using the innovations even after the project is long gone. The problems that hindered the implementation process and the factors that facilitated the processes have been identified and no single factor stands out as most prominent. Rather, these interacted with the innovations, leading to the beliefs, attitudes and perceptions of the farmers' towards the innovations. The perceptions and attitudes of farmers towards the innovations were key to farmers' decisions to increase the extent of innovation use.

### **6.7 Methodological limitations**

This study had some limitations that ought to be addressed when using this approach to obtain data in future studies. Data was collected from two villages using an interview guide which allegedly had some questions that had already been used by other students attached to the project in previous studies. This made it complicated to extract information with less bias from practice effect. Some interviewees seemed to already know some questions and had readymade responses. This was however discovered early enough in Idifu at the onset of interviews with farmers and as such, follow up questions had to be employed in numerous occasions to verify the validity of responses and to weed out coached responses.

Using the Process Net-Map tool for collecting opinions and perception had its own ups and downs. On a good note, it made the interviewing session less boring, interviewees were impressed by their output and also occasionally remembered extra information after visualizing the Map. This enabled timely making of corrections. On the other hand, farmers especially asked the interpreter to give them cues on which actors to assign which number of towers. Building towers on other peoples' perceived gain in food and income was difficult and in some cases, the interviewees flatly refused to rank actors saying they had no idea. Others wondered how they were to know such information and nevertheless ranked. Rating actors perceived to be trustworthy and influential was however easily done because the interviewees already knew these actors leading to less discrepancies in the follow-up questions. Using the Tool to collect a lot of data was bothersome to some interviewees who were not thrilled at the prospects of repeatedly ranking the actors on five criteria. Some interviewees made hasty ranking to get done with it rapidly. An interviewer using this tool to rank several criteria, therefore, needs to devise other backup means to be able to extract more information. This can be by asking follow up questions to weed out invalid responses. Also, it was tiresome to conduct more than two

interviews in a day which was at times done due to unavoidable circumstances encountered in the field.

Several factors were mentioned by farmers as having facilitated or hindered the implementation process of the three innovations. Not all were exhausted hence data yielded in this study does not provide a blueprint to implementation but rather contributes to the body of knowledge on implementation research. The study adds to existing literature about how several factors in the innovations' social systems hinder and facilitate the implementation process. The information was collected from two villages. While this allowed obtaining in-depth information, it is impossible to make inferences about how the innovations would be perceived by interviewees from different villages. It also limited the sample available for the study. At the onset of the interviewing process, the plan had been to have an even distribution of interviewees in terms of gender. Also, farmers who had been interviewed by other researchers attached to the project were to be avoided. This was rather difficult to maintain given the small study population of two villages. Some groups tended to be dominated by one gender making it almost impossible to compare the differences and similarities in perceptions of the different genders.

## **6.8 The recommendations**

The implementation process seems to have been conducted in a transparent way with several actors in charge and engaged in the several activities. This minimised concentration of power to a few actor and also enabled the use of most of the project the participants' skills, potential and resources. Evenly allocating roles and reducing monopoly of influence over activities enhanced this transparency and heightening accountability among actors since there were monitoring and supervision by different actors. Farmers were aware of most of the activities in their social systems and this coupled with transparency enhanced their trust in the project. Actively involving farmers promoted ownership and responsibility over the innovations. This Participatory approach of implementation with a diversity of actors was, therefore, a good strategy. This study recommends this approach to implementing elsewhere in similar settings. Farmers also reported to gaining in income and food although the extent to which this happened could not be fully substantiated given that the tools used in the study could only give perceived estimates. It would be interesting to study these innovations further to measure the actual gains that actors are getting using different tools. It would be interesting to verify if the farmers are actually applying this knowledge that they learnt in their daily life after the project is long gone.

Reducing potential challenges and actual challenges in the innovations' social system of different innovations need to be done to make the implementation contexts more innovation-friendly. This may include;

- Implementation or out scaling Tied Ridges with more of flexibility. That is, adjusting planting positions by growing in the basins in semi-arid regions and on top of the ridges in relatively humid regions. In Morogoro, farmers could be encouraged to pen the ridges during times of heavy rains to mitigate negative impacts of too much rain on yields.
- Assessing of the market potential of promoted chicken breeds needs to be done or use local breeds that fit within market needs. Farmers could be encouraged to collectively search for markets so as to minimise exploitation by middlemen.
- To reduce mortality, the project could buy the vaccines and drugs and make use of the Village Livestock Officer or any other trained farmer in the village to vaccinate the chickens on schedule could reduce the mortalities in this innovation.
- The PCI has potential to impact on incomes of farmers, re-inventing the wheel could yield better results. This study recommends use of the Benin Model instead of Bangladesh Model.

There is potential for adoption of the AIVs if they are promoted. Not all AIVs will be well received given the mixed opinions. Those that are marketable should be focused on because already consumption of these vegetables is not wanting. Vegetables like Pea leaves, Pumpkin leaves, lady's finger and *Matembele* were commonly mentioned as being Marketable. It would be interesting to gain more information and on these especially in Changarawe and their promotion in the KG. Growing these AIVs on Kitchen Garden may necessitate adapting the Kitchen Garden type because most of the preferred vegetables are either creeping or bushy plants which may not survive on the pocket bags.

## 7. References

- ABERMAN, N. ET AL., 2009. *Mapping the policy process in Nigeria: examining linkages between research and policy*, Washington DC: IFIPRI.
- ADAMU, U., MREMA, J.P. & MSAKY, J., 2015. Fertility Status and Suitability Assessment of Soils for the Production of Maize at Solomon Mahlangu Campus Farm, Morogoro, Tanzania. *Advances in Research*, 5(2), pp.1–12. Available at: <http://www.sciencedomain.org/abstract.php?iid=1155&id=31&aid=9539>.
- AHMED, O. ET AL., 2013. Exploring the opinions and perspectives of general practitioners towards the use of social networking sites for concussion management. *Journal of Primary Health Care*, 5(1), pp.36–42.
- AJZEN, I., 1991. The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, pp.179–211.
- AMSALU, A. & DE GRAAFF, J., 2007. Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. *Ecological Economics*, 61(2–3), pp.294–302.
- ANDERSON, C., 2010. Presenting and evaluating qualitative research. *American Journal of Pharmaceutical Education*, 74(8), pp.1–7.
- ANTWI, S.K. & HAMZA, K., 2015. Qualitative and Quantitative Research Paradigms in Business Research: A Philosophical Reflection. *European Journal of Business and Management*, 7(3), pp.217–225.
- ARAYA, A. & STROOSNIJDER, L., 2010. Effects of tied ridges and mulch on barley (*Hordeum vulgare*) rainwater use efficiency and production in Northern Ethiopia. *Agricultural Water Management*, 97(6), pp.841–847. Available at: <http://dx.doi.org/10.1016/j.agwat.2010.01.012>.
- ASSENGA, E.A. & KAYUNZE, K.A., 2016. Food Security Incidences Based on Dietary Energy Consumption, Dietary Diversity and Household Food Insecurity Access Scale in Chamwino District, Tanzania. *International Journal of Asian Social Science*, 6(11), pp.644–658. Available at: <http://www.pakinsight.com/archive/1/11-2016/11>.
- AWUNI, J.A., 2002. Strategies for the improvement of rural chicken production in Ghana. *Characteristics and Parameters of Family Poultry Production in Africa*. IAEA, VIENNA, pp.33–37. Available at: <http://www-naweb.iaea.org/nafa/Aph/public/4-strategies-awuni.pdf>.
- AXTELL, C.M. ET AL., 2000. Shopfloor innovation: Facilitating the suggestion and implementation of ideas. *Journal of Occupational and Organizational Psychology*, 73(3), pp.265–285. Available at: <http://onlinelibrary.wiley.com/doi/10.1348/096317900167029/full>.
- BARSKA, A., 2014. Attitudes of young consumers towards innovations on the food market. *Management (1429-9321)*, 18(1), pp.419–431. Available at: <http://search.ebscohost.com/login.aspx?direct=true>.
- BAXTER, P. & JACK, S., 2008. Qualitative Case Study Methodology : Study Design and Implementation for Novice Researchers. *The Qualitative Report*, 13(4), pp.544–559. Available at: <http://nsuworks.nova.edu/tqr/vol13/iss4/2>.
- BECKETT, R.C. & HYLAND, P., 2009. Effective Communication in Innovation Processes. , (1990), pp.96–106.
- BELAY, A., GEBREKIDAN, H. & ULORO, Y., 1998. Effect of tied ridges on grain yield response of Maize (*Zea mays* L.) to application of crop residue and residual N and P on two soil types at Alemaya,



- Ethiopia. *South African Journal of Plant and Soil*, 15(4), pp.123–129.
- BERG, B., 2009. A Dramaturgical Look at Interviewing. In *Qualitative Research Methods for the Social Sciences*. Boston: Allyn & Bacon, pp. 101–157. Available at: <http://www.sfu.ca/~palys/Berg-2009-DramaturgicalViewOfInterviewing.pdf>.
- BERGMAN, M.M., 1998. A Theoretical Note on the Differences between Attitudes, Opinions and Values. *Swiss Political Science Review*, 4(2), pp.81–93.
- BERRY, E.M. ET AL., 2015. Food security and sustainability: can one exist without the other? *Public health nutrition*, 18(5), pp.1–10. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25684016%5Cnfile:///Users/DURU/Documents/Mendeley Desktop/S136898001500021Xa.pdf>.
- BETT, C., 2006. Farm Level adoption decisions of soil and water management technologies in semi-arid eastern Kenya. In *48th Annual Conference of the Australian Agricultural and Resource Economics Society*. Melbourne, Victoria, pp. 1–30.
- BLAZIN, B. & STROOSNIJDER, L., 2012. To tie or not to tie ridges for water conservation in Rift Valley drylands of Ethiopia. *Soil and Tillage Research*, 124, pp.83–94. Available at: <http://dx.doi.org/10.1016/j.still.2012.05.006>.
- BIGGAM, J., 2012. *Succeeding with your Master's Dissertation: A step-by-step handbook* 1st Editio. O. U. Press, ed., Berkshire: McGraw Hill.
- BLAZY, J.M., CARPENTIER, A. & THOMAS, A., 2011. The willingness to adopt agro-ecological innovations: Application of choice modelling to Caribbean banana planters. *Ecological Economics*, 72, pp.140–150. Available at: <http://dx.doi.org/10.1016/j.ecolecon.2011.09.021>.
- BO, M., RIETVELD, P. & KNOCKAERT, J.S.A., 2013. Adoption of Electric Vehicle in the Netherlands – A Stated Choice Experiment. *Tinbergen Institute Discussion Paper*, 100/VIII.
- BODNÁR, F., DE STEENHUIJSEN PITERS, B. & KRANEN, J., 2011. Improving Food Security: A systematic review of the impact of interventions in agricultural production, value chains, market regulation and land security. *Ministry of Foreign Affairs of the Netherlands*, (363), pp.1–190.
- VAN DEN BRINK, M. & MEIJERINK, S., 2005. *Implementing policy innovations Resource dependence, struggle for discursive hegemony and institutional inertia in the Dutch river policy domain*, Nijmegen. Available at: <http://hdl.handle.net/2066/45540>.
- BUĆ, S. & DIVJAK, B., 2016. Environmental factors in the diffusion of innovation model : diffusion of e-learning in a higher education. *Central European Conference on Information and Intelligent Systems*, pp.99–106. Available at: [https://bib.irb.hr/datoteka/863764.Buc\\_Divjak\\_CECIIS\\_2016.pdf](https://bib.irb.hr/datoteka/863764.Buc_Divjak_CECIIS_2016.pdf).
- CARR, L.T., 1994. The strengths and weaknesses of quantitative and qualitative research: what method for nursing? *Journal of Advanced Nursing*, 20(4), p.716–721 6p. Available at: <https://lopes.idm.oclc.org/login?url=http://search.ebscohost.com/login.aspx?>
- CHANG, H., 2009. Rethinking public policy in agriculture: lessons from history, distant and recent. *Journal of Peasant Studies*, 36(3), pp.477–515.
- CHIPUNGAHELO, M.S., 2015. Knowledge sharing strategies on traditional vegetables for supporting food security in Kilosa District, Tanzania. *Library Review*, 64(3), pp.229–247. Available at: [10.1108/LR-10-2014-0105%5Cnhttp://search.ebscohost.com/l](http://dx.doi.org/10.1108/LR-10-2014-0105%5Cnhttp://search.ebscohost.com/l).
- CHOR, K.H.B. ET AL., 2015. Measures of Predictors of Innovation Adoption. *Adm Policy Ment Health*, 42(5), pp.165–187.

- COHEN, D. & CRABTREE, B., 2006. Semi-structured Interviews Recording Semi-Structured interviews. *Qualitative Research Guidelines Project*, p.2. Available at: <http://www.qualres.org/HomeSemi-3629.html>.
- COWAN, R. & JONARD, N., 2004. Network structure and the diffusion of knowledge. *Journal of Economic Dynamics and Control*, 28(8), pp.1557–1575.
- CRESWELL, J.W., 2009. Mixed Methods Procedures. In V. Knight et al., eds. *Research Design: Qualitative, Quantitative and Mixed Method Approaches*. New Dehli: SAGE Publications Ltd, pp. 203–223. Available at: <http://libproxy.unm.edu/login?url=http://search.ebscohost.com/login.aspx?>
- CRESWELL, J.W., 2007. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* 2nd Editio. L. C. Shaw et al., eds., New Dehli: Thousand Oaks.
- CRONQUIST, B., JOHANSSON, L. & KJELLIN, H., 2006. *Communication Enabling the Implementation of Innovation*, Kristianstad.
- CROWE, S. ET AL., 2011. The case study approach. *BMC Medical Research Methodology*, 11(1), pp.1–9. Available at: <http://www.biomedcentral.com/1471-2288/11/100>.
- DAMANPOUR, F. & SCHNEIDER, M., 2006. Phases of the adoption of innovation in organizations: Effects of environment, organization and top managers. *British Journal of Management*, 17(3), pp.215–236.
- DASGUPTA, P. & SERAGELDIN, I., 2000. *Social Capital: A Multifaceted Perspective* 1st Edition., Washington D.C: The World Bank.
- DAWSON. C., 2008. *Practical research methods: A user-friendly guide to mastering research* 1st Edit., D. Brueton, ed., Oxford: How to Books.
- DEARING, J.W., 2010. Applying Diffusion of Innovation Theory to Intervention Development. *PMC*, 19(5), pp.503–518.
- DENZAU, A.T. & NORTH, D.C., 1994. Shared Mental Models: Ideologies and Institutions. *Kyklos*, 47(1), pp.3–31.
- DERESSA, T.T., HASSAN, R.M. & RINGLER, C., 2011. Perception of and adaptation to climate change by farmers in the Nile basin of Ethiopia. *The Journal of Agricultural Science*, 149(May), pp.23–31.
- DERO, F. & DEROIAN, F., 2002. Formation of social networks and diffusion of innovations. *Research Policy*, 31(5), pp.835–846. Available at: <http://www.sciencedirect.com/science/article/B6V77-45KNJGD-B/2/>.
- DIEDEREN, P. ET AL., 2003. Innovation Adoption in Agriculture : Innovators , Early Adopters and Laggards. *Cahiers d'économie et sociologie rurales*, 67, pp.1–22.
- Dolberg, F., 2007. Poultry production for livelihood improvement and poverty alleviation. *Poultry in the 21st Century: Avian Influenza and Beyond. Proceedings of the International Poultry Conference, held. 2007., (2005)*, pp.1–26.
- DOLBERG, F., 2003. Review of Household Poultry Production as a Tool in Poverty Reduction with Focus on Bangladesh and India. *Animal Production*, (6), p.40.
- ELIA, E.F., MUTULA, S. & STILWELL, C., 2014. Indigenous Knowledge use in seasonal weather forecasting in Tanzania: the case of semi-arid central Tanzania. *South African Journal of Libraries & Information Science*, 80(1), pp.18–27. Available at: [10.7553/80-1-180%5Cnhttp://search.ebscohost.com/login.aspx?](http://search.ebscohost.com/login.aspx?)

- ERCC & RCI, 2010. Methodology of Qualitative Research for Consumers Organizations. , pp.1–23. Available at: [http://www.europeansharedwww.zemgalei.lv/fetch\\_54767\\_ZmlsZV9](http://www.europeansharedwww.zemgalei.lv/fetch_54767_ZmlsZV9).
- FAO, 2014a. Country fact sheet on food and agriculture policy trends - United Republic of Tanzania. , (September), pp.1–5.
- FAO, 2014b. FAO`s Strategic Objective 3 Reduce rural poverty. , (November), pp.1–2.
- FAO, 2014c. FAO Statistics. *The Food and Agriculture Organization of the United Nations*. Available at: <http://faostat3.fao.org/home/E%5Cnhttp://faostat3.fao.org/faostat-gateway/go/to/download/Q/QC/E%5Cnhttp://faostat3.fao.org/> [Accessed June 20, 2017].
- FAO, 2015. *The State of Food and Agriculture 2015 (SOFA): Social Protection and Agriculture: Breaking the Cycle of Rural Poverty*, Available at: <http://www.fao.org/3/a-i4910e.pdf>.
- FIXSEN, D.L. ET AL., 2005. Implementation Research: A Synthesis of the Literature. , p.125. Available at: <http://nirn.fmhi.usf.edu>.
- FREEMAN, K. & MUBICHI, F., 2017. ICT use by smallholder farmers in rural Mozambique: A case study of two villages in central Mozambique. *Journal of Rural Social Sciences*, 32(2), pp.1–19.
- FRIIS-HANSEN, E., 2005. Agricultural development among poor farmers in Soroti district, Uganda: Impact assessment of agricultural technology, farmer empowerment and changes in opportunity structures. In *Impact assessment workshop*. Mexico, pp. 1–26.
- GALHENA, D. ET AL., 2013. Home gardens: a promising approach to enhance household food security and wellbeing. *Agriculture & Food Security*, 2(1), p.8. Available at: <http://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/2048-7010-2-8>.
- GEELS, F.W., 2004. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6–7), pp.897–920.
- GEVORGYAN, E. ET AL., 2013. Connecting Innovators, Making Pro-Poor Solutions Work The Innovation System of African Leafy Vegetables in Kenya. , pp.1–165.
- GHANE, F. ET AL., 2011. The role of social influence and innovation characteristics in the adoption of Integrated Pest Management ( IPM ) practices by paddy farmers in Iran. *2011 International Conference on Social Science and Humanity*, 5, pp.217–220. Available at: <http://www.ipedr.com/vol5/no2/48-H10150.pdf>.
- GHAZOUANI, W. ET AL., 2009. Farmers' perceptions and engineering approach in the modernization of a community-managed irrigation scheme. A case study from an oasis of the Nefzawa (South of Tunisia). *Irrigation and Drainage*, 58(3 SUPPL. 3).
- GRAEF, F. ET AL., 2014. Framework for participatory food security research in rural food value chains. *Global Food Security*, 3(1), pp.8–15. Available at: <http://dx.doi.org/10.1016/j.gfs.2014.01.001>.
- GUÈYE, E.F., 2002. Employment and income generation through family poultry in low-income food-deficit countries. *World's Poultry Science Journal*, 58(4), pp.541–557. Available at: [http://www.journals.cambridge.org/abstract\\_S0043933902000399](http://www.journals.cambridge.org/abstract_S0043933902000399).
- HARRIS, R. & PATERSON, A., 2016. Exploring the research domain of consultant practice: Perceptions and opinions of consultant radiographers. *Radiography*, 22(1), pp.12–20. Available at: <http://dx.doi.org/10.1016/j.radi.2015.03.002>.
- HART, A., 2001. Mann-Whitney test is not just a test of medians: differences in spread can be important. *BMJ*, 323(7309), pp.391–393. Available at: <http://www.bmj.com/cgi/doi/10.1136/bmj.323.7309.391>.

- HASHMI, F.K. ET AL., 2016. A qualitative study exploring perception and attitudes of community pharmacists about extended pharmacy services in Lahore, Pakistan. *Value in Health*, 19(7), p.A631. Available at: <http://www.embase.com/search/>.
- HERMANS, F., KLERKX, L. & ROEP, D., 2015. Structural Conditions for Collaboration and Learning in Innovation Networks: Using an Innovation System Performance Lens to Analyse Agricultural Knowledge Systems. *The Journal of Agricultural Education and Extension*, 21(1), pp.35–54. Available at: <http://dx.doi.org/10.1080/1389224X.2014.991113>.
- HERNANDEZ, L.A.E., 2016. *Impact Assessment of Upgrading Strategies for food security: a case study, Tanzania*. Ghent & Humbolt zu Berlin.
- HERNANDEZ, L.E., , GRAEF, F. & KÖNIG, H., 2016. Expectations and Reality check. Evaluation of Impact Assessments of Upgrading Strategies for Food Security: case study Tanzania. In *Tropentag*. pp. 18–21.
- HOFFMANN, V., GERSTER-BENTAYA, M. & CHRISTINCK, A., 2009. *Handbook : Rural Extension Volume 1 Edited by 3rd edit., V. Hoffmann et al., eds., Weikersheim: Margraf*.
- HULSCHER, M.E., LAURANT, M.G. & GROL, R.P., 2003. Process evaluation on quality improvement interventions. *Qual.Saf Health Care*, 12(1475–3898), pp.40–46.
- ILUKOR, J. ET AL., 2015. the Provision of Veterinary Services: Who Are the Influential Actors and What Are the Governance Challenges? a Case Study of Uganda. *Experimental Agriculture*, 51(3), pp.408–434. Available at: [http://www.journals.cambridge.org/abstract\\_S0014479714000398](http://www.journals.cambridge.org/abstract_S0014479714000398).
- INGRAM, J., FRY, P. & MATHIEU, A., 2010. Revealing different understandings of soil held by scientists and farmers in the context of soil protection and management. *Land Use Policy*, 27(1), pp.51–60.
- JOAO, A.R.B., LUZARDO, F. & VANDERSON, T.X., 2015. An interdisciplinary framework to study farmers decisions on adoption of innovation: Insights from Expected Utility Theory and Theory of Planned Behavior. *African Journal of Agricultural Research*, 10(29), pp.2814–2825. Available at: <http://academicjournals.org/journal/AJAR/article-abstract/118107A54194>.
- JOHNSON, J.D., 2001. Success in innovation implementation. *Journal of Communication Management*, 5(4), pp.341–359. Available at: <https://doi.org/10.1108/13632540110806875>.
- JONES, K. ET AL., 2005. Nutrition knowledge and practices, and consumption of vitamin A rich plants by rural Nepali participants and nonparticipants in a kitchen garden program. *Food & Nutrition Bulletin*, 26(2), pp.198–208.
- KABANZA, A.K. & RWEHUMBIZA, F.B.R., 2007. Assessment of the contribution of tied ridges and farmyard manure application to sorghum production in semi-arid areas of Tanzania. In A. Bationo et al., eds. *Advances in Integrated Soil Fertility Management in Sub-Saharan Africa: Challenges and Opportunities*. Dordrecht, Netherlands: Springer, pp. 723–724. Available at: [https://link.springer.com/chapter/10.1007/978-1-4020-5760-1\\_67#citeas](https://link.springer.com/chapter/10.1007/978-1-4020-5760-1_67#citeas).
- KABISAMA, M.M., SWENYA, A. & KIPOBOTA, C., 2007. Stuck in poverty. , pp.10–11. Available at: <http://www.socialwatch.org/node/14027>.
- KAGAN, C., BURTON, M. & SIDDIQUEE, A., 2006. Definitions, Goals and Principles of Participatory Action Research. *Handbook of qualitative research methods in psychology*, (1998), pp.1–2.
- KAHIMBA, F.C. ET AL., 2015. *Title : Analysing the current situation regarding biophysical conditions and rainfed crop, livestock and agroforestry systems (Baseline)*,
- KIELEN, N., 1996. *Farmers' Perceptions on Salinity and Sodidity A Case Study into farmers' Knowledge of salinity and sodicity, and their strategies and practices to deal with salinity and sodicity in their*

*farm systems*, Lahore.

- KIM, J.S., 2000. Students' attitudes and perceptions toward technology. *Retrospective Theses and Dissertations*, 13909, pp.1–172. Available at: <http://libdir.iastate.edu/rtd/13909>.
- KLEIN, K.J. ET AL., 2016. Innovation Implementation Overcoming the Challenge. , 14(5), pp.243–246.
- KLEIN, K.J. & SPEER, S.J., 1996. The Challenge of Innovation Implementation Author ( s ): Katherine J . Klein and Joann Speer Sorra. *The Academy of Management*, 21(4), pp.1055–1080.
- KNICKEL, K. ET AL., 2009. Towards a Better Conceptual Framework for Innovation Processes in Agriculture and Rural Development: From Linear Models to Systemic Approaches. *The Journal of Agricultural Education and Extension*, 15(July), pp.131–146.
- KNUPFER, N.N. & MCLELLAN, H., 1996. Descriptive Research Methodologies. In D. H. Jonassen, ed. *Handbook of Research for Educational Communications and Technology*. Bloomington: Earlbaum, Lawrence, pp. 1196–1212. Available at: <http://www.aect.org/edtech/ed1/pdf/41.pdf>.
- KREIN, S.L. ET AL., 2006. Translating infection prevention evidence into practice using quantitative and qualitative research. *American Journal of Infection Control*, 34(8), pp.507–512.
- KUYIAH, J.W. ET AL., 2015. Agriculture, Income Risks and Rural Poverty Dynamics: Strategies of Smallholder Producers in Kenya. In *International Association of Agricultural Economists Conference*. Gold Coast, pp. 1–22.
- LEAVENS, K., GUGERTY, M.K. & ANDERSON, L., 2011. *Gender and Agriculture in Tanzania*, Washington.
- LEE, S.H., 2008. The effect of employee trust and commitment on innovative behaviour in the public sector: An empirical study. *International Review of Public Administration*, 13(1), pp.27–46.
- LEEUWIS, C., 2004. *Communication for Rural Development: Rethinking Agricultural Extension* Third Edit., Blackwell. Available at: <http://www.fao.org/3/a-i3492e.pdf>.
- LU, J., YAO, J.E. & YU, C.S., 2005. Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology. *The Journal of Strategic Information Systems*, 14(3), pp.245–268. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0963868705000399>.
- LWELAMIRA, J., KIFARO, G.C. & GWAKISA, P.S., 2009. Genetic parameters for body weights, egg traits and antibody response against Newcastle Disease Virus (NDV) vaccine among two Tanzania chicken ecotypes. *Tropical Animal Health and Production*, 41(1), pp.51–59.
- MACK, S., HOFFMANN, D. & OTTE, J., 2013. The contribution of poultry to rural development. *World's Poultry Science Journal*, 61(1), pp.7–14. Available at: [http://www.journals.cambridge.org/abstract\\_S0043933905000012](http://www.journals.cambridge.org/abstract_S0043933905000012).
- MAHADEVAN, R. & HOANG, V., 2016. Is There a Link Between Poverty and Food Security? *Social Indicators Research*, 128(1), pp.179–199.
- MAHARJAN, K. & JOSHI, N., 2009. Relationship between income-poverty and food insecurity in rural Far-western Mid-hills of Nepal. In *International Association of Agricultural Economists Conference*. Beijing, pp. 1–15.
- MAKOKO, B. ET AL., 2017. Workpackage 2 ; Month 46, Year 2017 Approach, design and implementation of on-field Participatory Action Research of biophysical and other UPS. , pp.1–14.
- MANNAN, S. & NORDIN, S., 2014. The Influence of Innovation Attributes on New Technologies Adoption by Paddy Farmers. *The International Review of Management and Business Research*,

- 3(3), pp.1379–1384.
- MARO, F. ET AL., 2011. *Agricultural growth and poverty reduction in Tanzania 2000-2010: where has agriculture worked for the poor and what can we learn from this?*, Available at: <http://www.chronicpoverty.org>.
- MARTIN, A. & SHERINGTON, J., 1997. Participatory research methods—Implementation, effectiveness and institutional context. *Agricultural Systems*, 55(2), pp.195–216.
- MASON, J., 2002. *Qualitative Researching* Second Edition., New Dehli: Thousand Oaks. Available at: <http://www.wallacefoundation.org/knowledge-center/after-school/collecting-and-using-data/Documents/>.
- MATHEWS, J. & CHRISTOPHER, D.A., 2016. Action Research for Rural Development. *SSRN Electronic Journal*, (August), pp.1–13.
- MAY, C. & FINCH, T., 2009. Implementing, Embedding, and Integrating Practices: An Outline of Normalization Process Theory. *Sociology*, 43(3), pp.535–554. Available at: <http://journals.sagepub.com/doi/10.1177/0038038509103208>.
- MAYER, R.C., DAVIS, J.H. & SCHOORMAN, F.D., 1995. An integrative model of organizational trust. *Academy of Management Review*, 20(3), pp.709–734. Available at: <http://www.jstor.org/stable/10.2307/258792>.
- MBWANA, H.A., LAMBERT, C. & KINABO, JOYCE BIESALSKIB, H.K., 2015. Tackling food and nutrition insecurity in rural Tanzania: Farmers perspectives on kitchen gardening as a sustainable solution. *Tropentag 2015, Berlin, Germany September 16-18, 2015*, (October).
- MCNIFF, J. & WHITEHEAD, J., 2010. *You and Your Action Research Project* Third Edition., New York: Routledge. Available at: <https://books.google.com/books?id=vfs3d9phsJ4C&pgis=1>.
- MCTAGGART, R., 1994. Participatory Action Research: issues in theory and practice. *Educational Action Research*, 2(3), pp.313–337.
- MEIJER, S.S. ET AL., 2015. The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability*, 13(1), pp.40–54. Available at: <http://dx.doi.org/10.1080/14735903.2014.912493>.
- MELOROSE, J., PERROY, R. & CAREAS, S., 2015. *Food security and Nutrition: A case study from Tanzania*. Available at: <https://www.uclouvain.be/cps/ucl/doc/ecru/documents/TF5M4D07.pdf>.
- MENSAH-BONSU, A. ET AL., 2009A. Investigating the role of poultry and the impact of HPAI on livelihoods in Ethiopia. *HPAI Research Brief, No 10*, (10), p.6.
- MENSAH-BONSU, A. ET AL., 2009B. Investigating the role of poultry and the impact of HPAI on livelihoods in Nigeria. *HPAI Research Brief, No 10*, (10), p.6.
- MEYERS, D.C., DURLAK, J.A. & WANDERSMAN, A., 2012. The Quality Implementation Framework: A Synthesis of Critical Steps in the Implementation Process. *American Journal of Community Psychology*, 50(3–4), pp.462–480.
- MICHIE, S., VAN STRALEN, M.M. & WEST, R., 2011. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(1), p.42. Available at: <http://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-6-42>.
- MISRA, S. ET AL., 2008. Wild leafy vegetables: a study of their subsistence dietetic support to the inhabitants of Nanda Devi Biosphere Reserve, India. *Journal of Ethnobiology and ethnomedicine*, 4, p.15. Available at: <http://www.pubmedcentral.nih.gov/articler>.

- MISSELHORN, A.A., 2005. What drives food insecurity in southern Africa? a meta-analysis of household economy studies. *Global Environmental Change*, 15(1), pp.33–43.
- MNENWA, B.R. & MALITI, E., 2010. *A Comparative Analysis of Poverty Incidence in Farming Systems of Tanzania*, Dar es Salaam.
- MOAFC, 2006. *United Republic of Tanzania. Follow-up of the implementation of the world food summit plan of action*,
- MOHSIN, M. ET AL., 2017. Assessing the role and effectiveness of kitchen gardening toward food security in Punjab, Pakistan: a case of district Bahawalpur. *International Journal of Urban Sustainable Development*, 9(1), pp.64–78. Available at: <https://www.scopus.com/inward/record>.
- MOLINA-AZORÍN, J.F., HERAS, I. & GERMAN, A., 2007. Motivations and benefits for implementing the Green Global Standard. , pp.1–12.
- MOORE, G. & BENBASAT, I., 1991. Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information systems research*, 2(3), pp.192–222.
- MORRIS, J. ET AL., 2012. Theories and models of behaviour and behaviour change. *Forestry, sustainable behaviours and behaviour change: Theories*, pp.1–27.
- MOSS, H., DONNELLAN, C. & O'NEILL, D., 2012. A review of qualitative methodologies used to explore patient perceptions of arts and healthcare. *Medical Humanities*, (June 2014), pp.106–109.
- MOUSTAKAS, C., 1994. *Phenomenological research methods* Sixth Edition., California: Thousand Oaks. Available at: <http://books.google.com/books?>
- MRICA, W., ADESINA, A.A. & BAIDU-FORSON, J., 1995. Farmers' perceptions and adoption of new agricultural technology : evidence from analysis in Burkina Paso. *Agricultural Economics*, 13, pp.1–9.
- MSANYA, B.M. ET AL., 2004. Pedological characteristics, general fertility and classification of some benchmark soils of Morogoro District, Tanzania. *African Journal of Science and Technology*, 4(2), pp.101–111.
- MUTABAZI, D.K., 2016. *Scaling- Up Nutrition : Implementing Potentials of nutrition-sensitive and diversified agriculture to increase food security*, Morogoro.
- NAIR, K.M. ET AL., 2008. It's all about relationships: a qualitative study of health researchers' perspectives of conducting interdisciplinary health research. *BMC health services research*, 8, p.110. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?>
- NBS, 2013. *2012 Population and Housing Census Population Distribution by Administrative areas* 2013th ed., Dar es Salaam.
- NBS, 2014. *Basic Demographic and Socio-Economic Profile Report Tanzania Mainland*, Dar es Salaam.
- NGUYEN, M.H., PHAN, A.C. & MATSUI, Y., 2018. Contribution of quality management practices to sustainability performance of Vietnamese firms. *Sustainability (Switzerland)*, 10(2), pp.1–31.
- NIKUSEKELA, N.E., MGALE, Y.J. & MSAKI, M.M., 2016. Farming Related Factors Contributing To Agricultural Productivity In Smallholder Farmers In Dodoma Municipality. A Factor Analysis Approach. *Imperial Journal of Interdisciplinary Research*, 2(6), pp.62–71.
- NILSEN, P., 2015. Making sense of implementation theories, models and frameworks. *Implementation Science*, 10(1), p.53. Available at: <http://implementationscience.biomedcentral.com/articles/10.1186/s13012-015-0242-0>.

- NYAMADZAWO, G. ET AL., 2013. Opportunities for optimization of in-field water harvesting to cope with changing climate in semi-arid smallholder farming areas of Zimbabwe. *SpringerOpen Journal*, 2050(Conway 1997), pp.1–9.
- OCED, 2012. *Farmer Behaviour, Agricultural Management and Climate Change*, Available at: <http://dx.doi.org/10.1787/9789264167650-en>.
- OECD, 2013. “Open innovations.” In *OECD Science, Technology and Industry Scoreboard 2013: innovation for Growth*. Paris: OECD Publishing, pp. 1–9. Available at: [http://dx.doi.org/10.17877sti\\_scoreboard-2013-19-eng](http://dx.doi.org/10.17877sti_scoreboard-2013-19-eng).
- OKENO, T.O. ET AL., 2012. Breeding objectives for indigenous chicken: model development and application to different production systems. *Tropical animal health and production*, 45(1), pp.193–203.
- ORMSTON, R. ET AL., 2013. The Foundation of Qualitative Research. In *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. pp. 0–25.
- OTTO-BANASZAK, I. ET AL., 2011. Different perceptions of adaptation to climate change: A mental model approach applied to the evidence from expert interviews. *Regional Environmental Change*, 11(2), pp.217–228.
- PALE, S., MASON, S.C. & TAONDA, S.J.B., 2009. Water and fertilizer influence on yield of grain sorghum varieties produced in Burkina Faso. *South African Journal of Plant and Soil*, 26(2), pp.91–97. Available at: <http://www.scopus.com/inward/record.url?eid=2-s2.0-68149137601>.
- PANGARIBOWO, E.H., GERBER, N. & TORERO, M., 2013. *Food and Nutrition Security Indicators: A Review*,
- PATTERSON, F., KERRIN, M. & GATTO-ROISSARD, G., 2009. Characteristics & Behaviours of Innovative People in Organisations. *Education*, pp.1–63. Available at: <http://www.nesta.org.uk/library/documents/characteristics-behaviours-interim-summary.pdf>.
- PAUW, K. & THURLOW, J., 2011. *Agricultural growth, poverty, and nutrition in Tanzania*, Washington DC. Available at: <http://www.ifipri.org/category/publications-type/discussion-papers>.
- PERKINS, A.R., 2011. Using Rogers’ Theory of Perceived Attributes as a Framework for Understanding the Challenges of Adoption of Open Educational Resources. *International Journal of Humanities and Social Science*, 1(18), pp.59–66. Available at: [http://www.ijhssnet.com/journals/Vol\\_1\\_No\\_18\\_Special\\_Issue/8.pdf](http://www.ijhssnet.com/journals/Vol_1_No_18_Special_Issue/8.pdf).
- PERMIN, A., PEDERSEN, G. & RIISE, J.C., 1998. Poultry as a Tool for Poverty Alleviation : Opportunities and Problems Related to Poultry Production at Village Level. , (Pandey 1992), pp.143–147.
- POKU, A., BIRNER, R. & GUPTA, S., 2018. Why do maize farmers in Ghana have a limited choice of improved seed varieties ? An assessment of the governance challenges in seed supply. *Food Security*, pp.1–20. Available at: <https://link.springer.com/content/pdf/10.1007%2Fs12571-017-0749-0.pdf>.
- PONNIAH, A. ET AL., 2008. Concepts and practices in agricultural extension in developing countries: A sourcebook. *International Livestock Research Institute, Addis Ababa, Ethiopia, ISBN*, pp.92–9146.
- POPA, I.L., PREDĂ, G. & BOLDEA, M., 1996. *A Theoretical Approach of the Concept of Innovation*, Timisoara.
- POPE, C., ZIEBLAND, S. & MAYS, N., 2000. Qualitative research in health care Analysing qualitative data. *Bmj*, 320(January), pp.114–116.
- REINHARDT, N. & HERRMANN, L., 2017. Fusion of indigenous knowledge and gamma spectrometry for



- soil mapping to support knowledge-based extension in Tanzania. *Food Security*, (2010), pp.1–14.
- RIISE, J.C. ET AL., 2005. Impact of smallholder poultry production in Bangladesh – 12 years experience with Danida supported livestock projects in Bangladesh. Copenhagen, Danida, Ministry of Foreign Affairs.
- RIVERA, W.M., 2003. *Agricultural Extension, Rural Development and the Food Security Challenge* by,
- ROGERS, E.M., 1995. *Diffusion of innovations* Third Edit., New York: Macmillan Publishing Co., Inc. Available at: <http://hollis.harvard.edu/?itemid=%7Clibrary/m/aleph%7C006256656>.
- ROTHMAN, A.J., 2006. Initiatives to Motivate Change: A Review of Theory and Practice and Their Implications for Older Adults. In C. LL & Hartel CR, eds. *When I am 64: Committee on ageing frontiers in social psychology, personality and Adult development psychology*. Washington D.C: National Academies Press (US), pp. 1–280. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK83765/>.
- SAHIN, I., 2006. Detailed Review of Rogers’ Diffusion of Innovations Theory and Educational Technology: Related Studies Based on Rogers’ Theory. *The Turkish Online Journal of Educational Technology*, 5(April 2006), pp.14–23.
- SAMBO, E. ET AL., 2015. Participatory evaluation of chicken health and production constraints in Ethiopia. *Preventive Veterinary Medicine*, 118(1), pp.117–127. Available at: <http://dx.doi.org/10.1016/j.prevetmed.2014.10.014>.
- SARRIS, A., SAVASTANO, S. & CHRISTIAENSEN, L., 2006. *The role of agriculture in reducing poverty in Tanzania: A household perspective from rural Kilimanjaro and Ruvuma*, Rome. Available at: <http://www.fao.org/3/a-ah468e.pdf>.
- SCHIFFER, E., 2007. Manual: Net-map toolbox influence mapping of social networks. In *Sunbelt conference of the international network of social network analysis*. pp. 1–6.
- SCHINDLER, J., GRAEF, F. & KÖNIG, H.J., 2016. Participatory impact assessment: Bridging the gap between scientists’ theory and farmers’ practice. *Agricultural Systems*, 148, pp.38–43. Available at: <http://dx.doi.org/10.1016/j.agsy.2016.07.002>.
- SCHNEIDER, L., 2014. *Potential and feasibility for implementing upgrading strategies to improve rural poor food value chains - An ex-ante expert assessment for two Tanzanian focus regions*. Eberswalde University for Sustainable Development.
- SCHWARZER, R. & RENNER, B., 2000. Social-cognitive predictors of health behaviour: Action self-efficacy and coping self-efficacy. *Health Psychology*, 19(5), pp.487–495.
- SCOTT, S.D. ET AL., 2008. Factors influencing the adoption of an innovation: an examination of the uptake of the Canadian Heart Health Kit (HHK). *Implement Sci*, 3(41), p.41. Available at: <http://www.worldcat.org/title/>.
- SEIDMAN, I., 2006. *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences* Third Edit., New York: Teachers College.
- SEMBOJA, H., SELEJIO, O. & SILAS, S., 2006. Partnerships for Economic Development & Poverty Reduction. The Mwadui Community Diamond Partnership in Tanzania. , pp.1–14. Available at: <https://www.unglobalcompact.org/system/attachments/367/origina>.
- SENKORO, C.J. ET AL., 2017. 14. Optimizing Fertilizer Use within the Context of Integrated Soil Fertility Management in Tanzania. , pp.1–17.
- SHAZI, R., 2014. *Trust in Innovation Networks*. University of Queensland.

- SHIFERAW, B.A., OKELLO, J. & REDDY, R. V., 2009. Adoption and adaptation of natural resource management innovations in smallholder agriculture: Reflections on key lessons and best practices. *Environment, Development and Sustainability*, 11(3), pp.601–619.
- SHIFERAW, B., OKELLO, J. & REDDY, V.R., 2009. Challenges of Adoption and Adaptation of Land and Water Management Options in Smallholder Agriculture : Synthesis of Lessons and Experiences. , pp.1–18.
- SIEBER, C.S. & GRAEF, F., *BMBF Framework Program Funding initiative “ Securing the Global Food Supply – Globe ” Proposal title : Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer : A people-centred Approach Proposal acronym :*
- SMITH, D., 2005. Chapter 2 Types of Innovation. *Exploring Innovation*, pp.38–79.
- SNIEHOTTA, F.F., SCHOLZ, U. & SCHWARZER, R., 2005. Bridging the intention-behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology and Health*, 20(2), pp.143–160.
- STARKS, H. & TRINIDAD, S.B., 2007. Choose your method: a comparison of phenomenology, discourse analysis, and grounded theory. *Qualitative health research*, 17(10), pp.1372–1380.
- STARMAN, A. B., 2013. The case study as a type of qualitative research. *Journal of Contemporary Educational Studies*, pp.28–43.
- SUTTON, J. & AUSTIN, Z., 2015. Qualitative Research: Data Collection, Analysis, and Management. *The Canadian journal of hospital pharmacy*, 68(3), pp.226–31. Available at: <http://www.pubmedcentral.nih.gov/>.
- SWAI, O., MBWAMBO, J. & MAGAYANE, F., 2012. Perceived Effects of Climate Change on Agricultural Production: A Gendered Analysis Done in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Research on Humanities and ...*, 2(9), p.11. Available at: <http://iiste.org/Journals/index.php/RHSS/>.
- SWANSON, B.E., BENTZ, R.P. & SOFRANKO, A.J., 2007. *Improving agricultural extension. A reference manual*, Available at: <http://www.fao.org/docrep/w5830e/w5830e00.htm>.
- TALENI, V., NYONI, P. & GODUKA, N., 2012. People’s Perceptions on Indigenous Leafy Vegetables: A Case Study of Mantusini Location of the Port St Johns Local Municipality, in the Eastern Cape, South Africa. *Strategies to Overcome Poverty and Inequality “Towards Carnegie III”*, p.17.
- TALUKDER, M., 2012. Factors affecting the adoption of technological innovation by individual employees: An Australian study. *Procedia - Social and Behavioral Sciences*, 40, pp.52–57. Available at: <http://dx.doi.org/10.1016/j.sbspro.2012.03.160>.
- TEY, Y.S. ET AL., 2011. Explaining the Adoption of Sustainable Agricultural Practices: An Improved Integrative Agent-Based Framework. In *The Asian Conference on Sustainability, Energy and the Environment Official Conference Proceedings 2011*. Osaka, pp. 378–395.
- TORNATZKY, L. & KLEIN, K., 1982. Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, 29(1), pp.28–43. Available at: [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6447463](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6447463).
- TORNATZKY, L.G., FLEISCHER, M. & CHAKRABARTI, A.K., 1990. *Processes of technological innovation*, Lexington, Mass.: Lexington Books.
- TRIPP, D., 2005. Action research: a methodological introduction. *Educação e Pesquisa*, 31, pp.443–466.
- URASSA, J. ET AL., 2017. Gendered Impact Assessment on Food Securing Upgrading Strategies : Results from Three Methodological ... Gendered Impact Assessment on Food Securing Upgrading

- Strategies : Results from Three Methodological Approaches. *Researchgate.Net*, (May).
- URT, 2012. *The Office of the Vice President of Tanzania: National Climate Change Strategy.*, Dar es Salaam.
- VOGEL, C. ET AL., 2007. Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global Environmental Change*, 17(3–4), pp.349–364.
- VORSTER, H.. & KRUGER, A., 2007. Poverty, malnutrition, underdevelopment and cardiovascular disease: A South African perspective. *Cardiovascular Journal of Africa*, 18(5), pp.321–324. Available at: <http://www.scopus.com/inward/record.url?>
- WANG, P., 2009. An Integrative Framework for Understanding the Innovation Ecosystem. *Advancing the Study of Innovation and Globalization in Organizations*, pp.301–314.
- WEIGEL, F.K. ET AL., 2014. Diffusion of Innovations and the Theory of Planned Behavior in Information Systems Research: A Metaanalysis. *Communications of the Association for Information Systems*, 34(31), pp.619–636. Available at: <http://aisel.aisnet.org/cais%250>.
- WEJNERT, B., 2002. Integrating Models of Diffusion of innovations: A Conceptual Framework. *Annual Reviews Sociology*, 28. 297-32, pp.297–326.
- WEST, M.A., 2002. Sparkling Fountains or Stagnant Ponds:\nAn Integrative Model of Creativity and Innovation Implementation in Work Groups. *Applied Psychology: An International Review*, 51(3), pp.355–424. Available at: <http://lehre.psych.uni-potsdam.de/moodle/file.php/>.
- WHEELER, T. & VON BRAUN, J., 2013. Climate change impacts on global food security. *Science (New York, N.Y.)*, 341(6145), pp.508–13. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23908229>.
- WILLIS, J., 2007. *Foundations of Qualitative Research: Interpretive and Critical Approaches* Second edition. J. Ritchie & J. Lewis, eds., New Dehli: Thousand Oaks. Available at: <http://methods.sagepub.com/book/foundations-of-qualitative-research>.
- WONG, J.T. ET AL., 2016. Small-scale poultry and food security in resource-poor settings: A review. *Global Food Security*, (March).
- WORLD BANK, 2015. *Tanzania - Mainland Poverty Assessment (vol.2): Main report (English)*, Washington. Available at: <http://www.worldbank.org/content/dam/Worldbank/document/Africa/Tanzania/Report/tanzania-poverty-assessment-05.2015.pdf>
- YIN, R.K., 2011. Case study research: design and methods. *Evaluation & Research in Education*, 24(3), pp.221–222. Available at: <https://books.google.co.za/books?hl=en&lr=&id=OgyqBAAAQBAJ&o>.
- ZHANG, X. ET AL., 2015. Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic. *BMC Health Services Research*, 15(1), p.71. Available at: <http://bmchealthservres.biomedcentral.com/articles/10.1186/>

## Web references

<https://cgspace.cgiar.org> accessed 11.09.17 10:57

<https://ruralpovertyportal.org> accessed 31/10/17 08:39

<http://www.qualitative-research.net/index.php/fqs/article/view/75/153> accessed 07/11/17 12:12

<https://netmap.wordpress.com/2010/04/01/catching-the-devil-in-the-detail-process-net-map/> accessed 09/01/2018 11:52

Source: <http://www.nationsonline.org/oneworld/map> accessed 09/01/2018 11:52

<http://www.nationsonline.org/oneworld/map> accessed 06/01/2018 11.30 am

<http://www.hortinlea.org/research-areas/natural-sciences/increasing-water-use-efficiency.html> accessed 26/01/2018 01:22 am

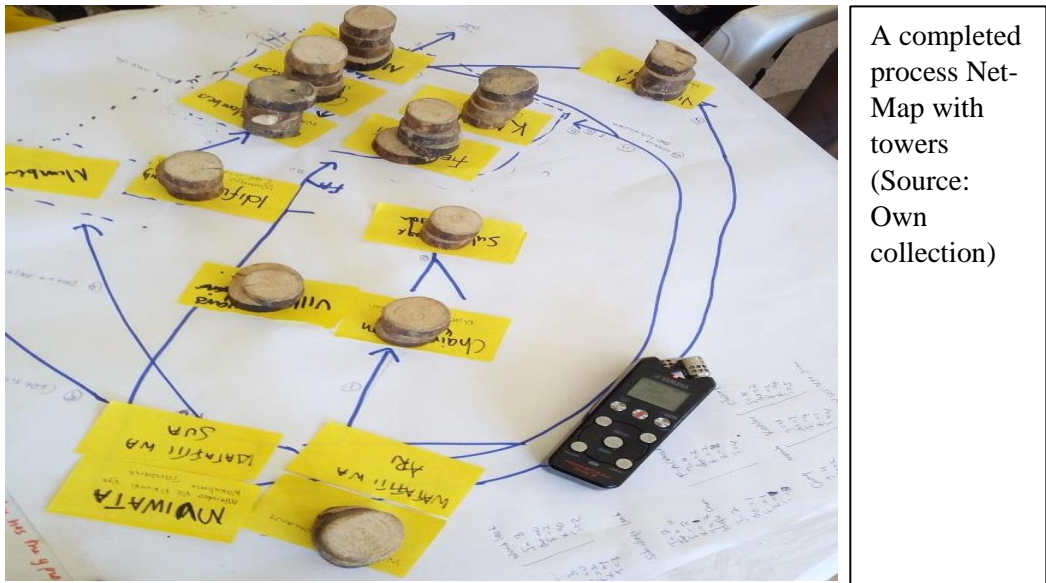
<https://statistics.laerd.com/spss-tutorials/mann-whitney-u-test-using-spss-statistics.php> accessed 11/02/2018 09:21 am

<http://astatsa.com/WilcoxonTest/> accessed 11/02/2018 09:28 am

<http://www.fao.org/docrep/004/T0706E/T0706E06.htm> accessed 17/03/2018 05:45am

# 8. Annexe

## 8.1 Annexe of figures and tables



A completed process Net-Map with towers  
(Source: Own collection)

Figure 18: An example of process Net-Map

**Enter your two columns of unpaired numerical data below:**

A	B	Additional parameters and options: Defaults are pre-selected, change as necessary.	
0.80	1.15	Alternative hypothesis	Null hypothesis
0.83	0.88	<input checked="" type="radio"/> two sided, estimated location shift	location shift (me
1.89	0.90	$\hat{\mu} \neq \mu_0$	<input type="text" value="0"/> R
1.04	0.74	<input type="radio"/> greater, $\hat{\mu} > \mu_0$	default
1.45	1.21	<input type="radio"/> lesser, $\hat{\mu} < \mu_0$	Continuit
1.38		Calculate exact p-value	<input checked="" type="radio"/> True,
1.91		<input checked="" type="radio"/> exact	<input type="radio"/> False,
1.64		<input type="radio"/> approximate, for large samples	
0.73			
1.46			

Clear

Proceed to calculate results ← Click here to view the results.

Figure 19: The online Mann Whitney U test calculator used

(Source: astatsa.com)

**Table 8: Farmers’ perceptions on whether they individually gain from implementing the innovations**

Innovation	Number of farmers per Village	% of farmers giving perception on benefits per criteria			
		Criteria	No gains perceived	Perceived to be gaining	Not sure (hard to tell)
Kitchen Garden	Changarawe (6)	Income	33.33	66.67	-
		Food	-	100	-
		Knowledge	-	100	-
	Idifu (6)	Income	16.67	83.33	-
		Food	16.67	66.67	16.67
		Knowledge	-	100	-
Tied Ridges farmers	Changarawe (7)	Income	83.33	16.67	-
		food	33.33	66.67	-
		Knowledge	-	100	-
	Idifu (6)	Income	42.86	57.14	-
		Food	14.29	85.71	-
		Knowledge	16.67	83.33	-
PCI farmers	Changarawe (6)	Income	16.70	83.33	-
		Food	16.70	83.33	-
		Knowledge	0.00	100	-

*Number of farmers is the number of farmers giving perceptions per village (source: own compilation)*

**Table 9: Implementation Challenges per innovation in each case study site**

Challenge faced	Number of farmers facing it per innovation		
	KG	TR	PCI
Water/rain shortage	5(Id.)	4 (Ch), 5 (Id)	-
Floods	2(Ch)	3(Ch)	-
Pests and diseases	5(Ch), 5(Id)	4(Ch),	6(Ch)
Non-germination of seeds	1(Id),1(Ch)	-	-
High costs	1(Ch), 1(Id.)	1 (Ch)	2(Ch)
Low prices for farm products	-	-	5(CH)
Lack of adequate knowledge /misinformation	-	-	6 (Ch)
Incompatibility with market	-	-	3(Ch)
Low profit margin	-	-	1 (Ch)
Difficult to install and maintain		1(Ch), 5(Id.)	1(Ch)
Late delivery of seeds	-	1(Ch), 1(Id)	-
Difficult when old to use	-	2 (Id)	-
Too many weeds hamper use		4 (Ch)	

Ch- Changarawe, Id.- Idifu (Source: Own compilation)

**Table 10 influential actors and their perceived levels of influence:**

a) In the implementation of the Kitchen Garden

	Farmer-farmer rating						Expert- farmer rating					
	Farmers in Changarawe			Farmers in Idifu			Experts			Farmers in both villages		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	24	4.00	1.55	30	5.00	0.00	30	2.29	1.80	54	4.50	1.17
ARI	24	4.83	0.41	30	5.00	0.00	38	2.25	1.17	59	4.92	0.29
SUA	23	4.67	0.82	30	5.00	0.00	38	2.25	1.49	58	4.83	0.58
Field Assistant	25	5.00	0.00	29	4.83	0.37	26	2.25	1.28	59	4.92 <sup>a</sup>	0.29
MVIWATA	24	4.83	0.41	17	3.40	1.86	12	2.67	0.58	46	4.18 <sup>c</sup>	1.54
village chairman	04	0.67	0.82	23	4.60	0.80	10	1.40	1.34	27	2.45	2.21
Sub village leader	05	2.67	1.53	20	4.00	1.10	16	2.00	2.45	28	3.50	1.41
Village Community	08	1.33	1.21	18	3.00	1.73	23	1.13	1.00	26	2.17	1.75
Group Members(KG)	21	4.33	1.03	29	4.83	0.37	35	2.75	1.67	55	4.58	0.80
Group Chairperson(KG)	20	4.17	0.98	29	4.83	0.37	33	3.13	1.46	54	4.50	0.80
Group secretary(KG)	19	4.20	1.10	29	4.83	0.37	26	2.63	1.69	53	4.55 <sup>a</sup>	0.82
Group treasurer (KG)	16	4.00	1.10	29	4.83	0.37	20	3.25	1.49	50	4.42 <sup>a</sup>	0.90
Village Extension Officer							11	2.20	1.10			
Neighbouring villages							15	2.14	1.78			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

b) In the implementation of Tied Ridges

Actors being rated	Farmer-farmer rating						Expert-farmer rating					
	Farmers in Changarawe			Farmers in Idifu			Experts' rating			rating by farmers in both villages		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	30	5.00	0.00	30	4.29	1.11	21	3.00	2.00	60	4.62	0.87
ARI	31	4.43	0.98	28	4.00	1.92	31	4.43	1.13	59	4.21	1.48
SUA	32	4.57	0.79	30	4.29	1.90	26	3.71	1.98	62	4.38	1.45
Field assistant	35	5.00	0.00	21	4.43	1.00	29	4.14	1.07	66	4.64	1.34
MVIWATA	32	4.57	0.79	17	3.40	2.30	18	2.40	1.27	49	4.50 <sup>b</sup>	0.86
Village Chairperson	04	1.00	1.41	13	3.25	1.26		3.00	1.14	17	2.67	1.37
Sub Village Leader	03	1.50	0.71	19	3.80	1.10				22	2.00	1.86
Village exec. Committee							12	2.40	1.14			
Village community	05	0.71	0.95	19	2.71	1.80	18	2.57	0.98	24	3.07	1.49
Group Members (TR)	22	3.14	1.68	32	4.57	0.54	31	4.43 <sup>b</sup>	0.79	54	3.64	1.50
Chairperson (TR)	24	3.43	1.27	31	4.43	0.98	27	3.86 <sup>a</sup>	1.21	55	3.79	1.42
Group secretary	24	3.43	1.27	28	4.00	1.29	26	3.71	1.70	52	3.71 <sup>b</sup>	1.27
Group treasurer	22			21	3.50	1.23	08			43	3.57	1.22
Village Extension officer							17	2.86	1.77 <sup>ö</sup>			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)



c) In the PCI Implementation

Actors being rated	Farmers in Changarawe			Experts		
	N	Mean	SD	N	Mean	SD
ZALF	20	4.00	1.23	13	2.60	1.49
ARI	24	4.00	0.90	19	3.17	0.98
SUA	26	4.33	1.21	20	3.33	1.03
Field assistant	26	4.33	0.82	13	3.25	1.71
MVIWATA	27	4.50	0.55	20	3.33	1.21
Changarawe community	16	2.67	1.86	08	1.33	1.75
Group Members PCI	30	5.00	0.00	26	4.33	0.82
Chairperson (PCI)	26	4.33	0.82	21	3.50	1.38
Group secretary (PCI)	25	4.17	0.75	18	3.00	1.27
Group treasurer (PCI)	22	3.67	1.21	16	2.67	1.63
Village Livestock Officer	22	4.40	0.89	04	2.00	2.83
Village Extension officer				11	2.75	1.08
Neighbouring villages	07	1.40	1.95			
Chick suppliers	27	4.50	0.84	13	3.25	1.71
Feeds and drugs sellers	17	3.40	2.30	06	1.33	1.53
Poultry traders	14	3.50	1.00	13	3.25	1.71

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).

**Table 11: Actors perceived to be gaining more income**

a) Which actors gain most income in the kitchen garden implementation process?

Actors identified and rated	Farmer-farmer rating						Expert-farmer rating					
	Farmers in Changarawe			Farmers in Idifu			Experts in both villages			Farmers in both villages		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	13	3.25	2.36	9	1.50	2.35	16	2.29	1.80	22	2.20	2.39
ARI	18	4.50	1.00	11	1.83	2.04	18	2.25	1.17	29	2.90	2.13
SUA	18	4.50	1.00	12	2.00	2.19	18	2.25	1.49	30	3.00	2.16
Field assistant	18	4.50	1.00	9	1.50	1.76	18	2.25	1.28	27	2.70	2.11
MVIWATA	14	3.50	1.29	11	1.83	2.28	8	2.65	0.58	25	2.78	1.92
Village community	03	0.50	1.23	13	2.17 <sup>c</sup>	1.33	9	1.33	1.00	12	1.33	1.50
Group Members (KG)	15	2.50	1.38	19	3.17	1.47	22	2.75	1.70	34	2.83	1.40
Chairperson (KG)	07	1.17	1.17	18	3.00	1.27	25	3.13	1.50	25	2.08	1.51
Group treasurer (KG)	03	0.60	0.90	18	3.00	1.55	21	3.25	1.49	21	2.08	1.62
Group secretary (KG)	07	1.17	1.17	17	2.83	1.17	26	2.63	1.69	24	1.82	1.54
Village Chairman	01	0.17	0.41	03	0.50			1.40	1.34	04	0.36	0.92
Sub-Village Leader				03	0.50	1.34	08	2.00	2.45	03	0.00	1.06
Village Extension Officer							10	1.67	0.82			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).

b) Which actor(s) gain most income in the Tied Ridges implementation process?

Actors rated gaining income	Farmer-farmer rating						Expert-farmer rating for both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts' rating			Farmers' rating		
	N	Mean	SD	N	Mean	SD	Mean		SD	N	Mean	SD
ZALF	15	2.50	2.74	10	1.43	2.44	12	1.71	1.98	25	3.08	2.53
ARI	14	2.00	2.58	10	1.43	2.44	10	1.43	1.51	24	2.93	2.37
SUA	14	2.00	2.58	10	1.43	2.44	10	1.43	1.51	24	3.00	2.39
Field assistant	10	1.43	1.86	20	2.86	2.67	17	2.43	1.62	30	3.93	2.13
MVIWATA	14	2.00	2.58	08	1.60	1.67	12	2.00	1.97	22	3.33	1.92
Village Exec. committee							08	1.60	1.14			
Village community	10	1.43	2.58	18	2.57	2.44	11	1.57	1.27	28	1.64	2.02
Group Members (TR)	09	1.29	1.03	14	2.00	2.52	25	3.57 <sup>c</sup>	1.27	23	2.57	2.14
Chairperson (TR)	02	0.29	0.52	12	1.71	2.36	23	3.29 <sup>a</sup>	1.11	14	2.57	2.03
Group secretary (TR)	06	0.86	0.89	18	2.57	2.52	24	3.43	1.13	24	2.86	2.03
Group treasurer (TR)	06	0.86	0.89	13	1.86	1.95	07	3.50	2.12	19	2.64	1.78
Village Extension officer							11	1.83	1.17			
Neighbouring villages							04	1.00	0.82			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

c) Which actors gains income in the Poultry crop integration implementation process?

Key actors rated	Expert-farmer rating					
	Farmers' rating in Changarawe			Experts' rating		
	N	Mean	SD	N	Mean	SD
ZALF	18	3.60 <sup>c</sup>	2.07	06	1.2	1.30
ARI	18	3.00	1.79	09	1.50	1.23
SUA	20	3.33 <sup>c</sup>	1.75	10	1.67	1.37
Field assistant	21	3.50	1.98	09	2.25	0.50
MVIWATA	21	3.50 <sup>c</sup>	1.87	09	1.50	1.23
Group Members PCI	16	2.67	2.25	18	3.00	1.14
Group secretary	20	3.33	1.86	16	2.67	1.37
chick suppliers	25	4.17	0.98	14	3.50	1.29
feeds and drugs sellers	19	3.80	1.30	06	3.00	0.00
Poultry traders	18	4.50	0.58	18	4.50	0.58

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test. SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).

**Table 12: Actors perceived to be gaining food in the implementation process**

*a) Which actors gains much more food in the kitchen garden implementation process?*

Key actors identified and rated	Farmer-farmer rating						Expert-farmer rating in both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts			Farmers		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	13	2.17	1.72	21	3.50	2.07	11	1.57	1.72	34	2.83	1.95
ARI	25	4.17	0.98	21	3.50	1.87	11	1.38	1.69	46	3.83 <sup>b</sup>	1.47
SUA	25	4.17	0.98	20	3.33	1.97	11	1.38	1.69	45	3.75 <sup>a</sup>	1.56
Field assistant	23	3.83	0.98	21	3.50	1.38	11	1.38	1.69	44	3.67 <sup>b</sup>	1.16
MVIWATA	23	3.83	1.17	16	3.20	2.17	07	2.33	2.08	39	3.55	1.64
Village community	14	2.33	1.63	13	2.67	1.82	20	2.25	1.71	30	2.50	1.68
Group Members (KG)	24	4.00	1.10	25	4.17	0.98	26	2.50	1.41	49	4.08	1.00
Chairperson (KG)	26	4.33	1.03	24	4.00	1.10	32	3.25	1.83	50	4.17	1.03
Group treasurer (KG)	23	4.60	0.89	23	3.83	0.98	31	3.88	1.55	49	4.18	0.98
Group secretary (KG)	26	4.33	1.03	23	3.83	0.75	25	3.13	1.96	46	4.08	0.90

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

b) Which actors are gaining most food in the Tied Ridge implementation process?

Key actor identified and rated	Farmer-farmer rating						Expert-farmer rating in both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts			Farmers		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	04	0.80	1.79	10	2.14	2.44	05	0.71	1.25	14	1.17	2.12
ARI	06	1.00	1.67	10	2.20	2.44	07	1.00	1.16	16	1.23	2.05
SUA	05	0.83	1.60	10	2.32	2.44	07	1.00	1.16	15	1.15	2.04
Field assistant	11	1.57	1.72	17	2.42	2.37	12	1.71	1.38	28	2.00	2.04
MVIWATA	05	0.83	1.60	09	2.42	2.35	05	0.83	1.33	14	1.17	1.95
Village Chairperson	01	0.25	0.50	12	2.53	2.16				13	1.63	2.07
Sub Village Leader	00			09	2.63	2.49				09	1.29	2.22
Village community	03	0.43	1.13	14	2.74 <sup>a</sup>	2.08	18	2.57	0.98	17	1.21	1.09
Group Members(TR)	10	1.43	1.27	17	2.90	2.37	26	3.71 <sup>b</sup>	1.11	27	1.93	1.90
Group Chairperson(TR)	11	1.57	1.13	26	3.04 <sup>b</sup>	1.89	24	3.43	1.25	37	2.64	1.87
Group secretary(TR)	10	1.43	1.27	22	2.76 <sup>c</sup>	1.77	08	3.71	1.25	32	2.29	1.73
Group treasurer(TR)	10	1.43	1.27	21	2.50 <sup>c</sup>	1.87	26	4.00	0.00	31	2.23	1.85
Village Extension Officer							11	1.83	0.75			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

c) Which actors gain most food in the Poultry- crop integration implementation process?

Key actors identified and rated	Expert- farmer rating in both villages					
	Farmers in Changarawe			Experts		
	N	Mean	SD	N		
ZALF	18	3.60 <sup>c</sup>	2.19	06	1.20	1.10
ARI	19	3.17 <sup>c</sup>	1.94	06	1.00	1.10
SUA	20	3.33 <sup>b</sup>	1.86	06	1.00	1.10
Field assistant	20	3.33	1.86	11	2.75	0.96
MVIWATA	24	4.00 <sup>a</sup>	0.89	06	1.00	1.10
Changarawe community		0.00	0.00	09	1.50	1.23
Group Members PCI	18	3.00	1.90	22	3.67	1.51
Group Chairperson	12	2.00	2.28	19	3.17	1.47
Group secretary	09	2.50	2.26	19	3.17	1.47
Group treasurer	15	1.50	2.07	19	3.17	1.47
Chick suppliers	18	3.00	2.45		1.75	2.06
Feeds and drugs sellers	16	3.20	1.30		2.50	0.71
Poultry traders	16	4.00	0.82		3.00	2.16

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

**Table 13: Actors perceived to be gaining food in the implementation process**

a) Which actors gain much more food in the kitchen garden implementation process?

Key actors identified and rated	Farmer-farmer rating						Expert-farmer rating in both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts			Farmers		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	13	2.17	1.72	21	3.50	2.07	11	1.57	1.72	34	2.83	1.95
ARI	25	4.17	0.98	21	3.50	1.87	11	1.38	1.69	46	3.83 <sup>b</sup>	1.47
SUA	25	4.17	0.98	20	3.33	1.97	11	1.38	1.69	45	3.75 <sup>a</sup>	1.56
Field assistant	23	3.83	0.98	21	3.50	1.38	11	1.38	1.69	44	3.67 <sup>b</sup>	1.16
MVIWATA	23	3.83	1.17	16	3.20	2.17	07	2.33	2.08	39	3.55	1.64
Village community	14	2.33	1.63	13	2.67	1.82	20	2.25	1.71	30	2.50	1.68
Group Members (KG)	24	4.00	1.10	25	4.17	0.98	26	2.50	1.41	49	4.08	1.00
Chairperson (KG)	26	4.33	1.03	24	4.00	1.10	32	3.25	1.83	50	4.17	1.03
Group treasurer (KG)	23	4.60	0.89	23	3.83	0.98	31	3.88	1.55	49	4.18	0.98
Group secretary (KG)	26	4.33	1.03	23	3.83	0.75	25	3.13	1.96	46	4.08	0.90

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)



b) Which actors gain most food in the Tied Ridge implementation process?

Key actor identified and rated	Farmer-farmer rating						Expert-farmer rating in both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts			Farmers		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	04	0.80	1.79	10	2.14	2.44	05	0.71	1.25	14	1.17	2.12
ARI	06	1.00	1.67	10	2.20	2.44	07	1.00	1.16	16	1.23	2.05
SUA	05	0.83	1.60	10	2.32	2.44	07	1.00	1.16	15	1.15	2.04
Field assistant	11	1.57	1.72	17	2.42	2.37	12	1.71	1.38	28	2.00	2.04
MVIWATA	05	0.83	1.60	09	2.42	2.35	05	0.83	1.33	14	1.17	1.95
Village Chairperson	01	0.25	0.50	12	2.53	2.16				13	1.63	2.07
Sub Village Leader	00			09	2.63	2.49				09	1.29	2.22
Village community	03	0.43	1.13	14	2.74 <sup>a</sup>	2.08	18	2.57	0.98	17	1.21	1.09
Group Members(TR)	10	1.43	1.27	17	2.90	2.37	26	3.71 <sup>b</sup>	1.11	27	1.93	1.90
Group Chairperson(TR)	11	1.57	1.13	26	3.04 <sup>b</sup>	1.89	24	3.43	1.25	37	2.64	1.87
Group secretary(TR)	10	1.43	1.27	22	2.76 <sup>c</sup>	1.77	08	3.71	1.25	32	2.29	1.73
Group treasurer(TR)	10	1.43	1.27	21	2.50 <sup>c</sup>	1.87	26	4.00	0.00	31	2.23	1.85
Village Extension Officer							11	1.83	0.75			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

c) Which actors gain most food in the Poultry- crop integration implementation process?

Key actors identified and rated	Expert- farmer rating in both villages					
	Farmers in Changarawe			Experts		
	N	Mean	SD	N		
ZALF	18	3.60 <sup>c</sup>	2.19	06	1.20	1.10
ARI	19	3.17 <sup>c</sup>	1.94	06	1.00	1.10
SUA	20	3.33 <sup>b</sup>	1.86	06	1.00	1.10
Field assistant	20	3.33	1.86	11	2.75	0.96
MVIWATA	24	4.00 <sup>a</sup>	0.89	06	1.00	1.10
Changarawe community		0.00	0.00	09	1.50	1.23
Group Members PCI	18	3.00	1.90	22	3.67	1.51
Group Chairperson	12	2.00	2.28	19	3.17	1.47
Group secretary	09	2.50	2.26	19	3.17	1.47
Group treasurer	15	1.50	2.07	19	3.17	1.47
Chick suppliers	18	3.00	2.45		1.75	2.06
Feeds and drugs sellers	16	3.20	1.30		2.50	0.71
Poultry traders	16	4.00	0.82		3.00	2.16

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

**Table 14. Actors perceived to be gaining much more knowledge out of the implementation process**

a) Which actors gain knowledge out of the kitchen garden implementation process?

Key actors identified and rated	Farmer-farmer rating						Expert-farmer rating					
	Farmers in Changarawe			Farmers rating in Idifu			Experts in both villages			Farmers in both villages		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	08	1.33	2.16	29	4.83 <sup>b</sup>	0.41	27	3.86	1.07	31	2.92	2.28
ARI	11	1.83	2.14	28	4.67 <sup>c</sup>	0.52	28	3.50	1.60	34	3.17	2.08
SUA	11	1.83	2.14	23	3.83 <sup>c</sup>	1.94	28	3.50	1.69	34	3.17	2.08
Field assistant	16	2.67	2.25	24	4.00	1.27	25	3.13	1.55	39	3.58	1.83
MVIWATA	19	3.17	1.84	16	3.20	1.92	10	3.33	1.16	37	3.73	1.51
Village community	09	1.50	1.38	16	2.67 <sup>b</sup>	1.03	23	2.88	1.13	26	2.42	1.51
Group Members (KG)	26	4.33	0.82	21	3.50	1.23	33	4.13	0.99	48	4.33	0.65
Group Chairperson (KG)	26	4.50	0.84	27	4.50	0.55	36	4.50	0.54	49	4.42	0.97
Group treasurer (KG)	24	4.80	0.45	25	4.33	0.82	33	4.38	0.74	45	4.45	0.69
Group secretary (KG)	26	4.50	0.84	26	4.17	1.17	35	4.13	0.99	48	4.33	0.78
Sub-Village Leader	03	1.00	1.73	08	1.60	1.82	10	2.33	2.08	23	2.75	1.98
Village chairperson	06	1.00	1.55	08	1.60	1.46	10	2.00	1.23	19	2.45	2.07
Neighbouring villages							16	2.29	1.60			
Village Extension							20	3.33	1.633			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

b) Which actors gain knowledge in the Tied Ridges Implementation process?

Key actors identified and rated	Farmer-farmer rating						Expert-farmer rating					
	Farmers in Changarawe			Farmers in Idifu			Experts in both villages			Farmer in both villages		
	N	Mean	SD		Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	01	0.17	0.41	10	1.43	2.44	21	3.00 <sup>c</sup>	2.00	11	0.85	1.86
ARI	08	1.14	1.95	04	0.57	1.51	24	3.43 <sup>a</sup>	1.51	12	0.86	1.70
SUA	08	1.14	2.04	05	0.71	1.89	26	3.71 <sup>a</sup>	1.50	13	0.93	1.90
Field assistant	09	1.29	1.60	17	2.43	2.51	27	3.86 <sup>c</sup>	1.07	26	1.86	2.12
MVIWATA	08	1.14	1.95	05	0.83	2.04	20	3.33 <sup>b</sup>	1.37	13	1.00	1.92
Village Exec. committee							13	3.33	1.37			
Village chairperson				08	2.00	2.31				08	1.11	1.76
Village community	09	1.29	1.38		2.29	2.14	20	2.86	1.07	25	1.79	1.81
Group Members (TR)	30	4.29	0.95	25	3.57	2.44	29	4.14	0.90	55	3.93	1.82
Group Chairperson (TR)	28	4.00	1.00	25	3.57	1.81	28	4.00	1.16	53	3.79	1.42
Group secretary (TR)	28	4.00	1.29	23	3.29	2.22	29	4.14	0.90	47	3.64	1.78
Group treasurer (TR)	28	4.00	1.29	19	3.17	1.94	08	4.00	0.00	51	1.67	2.88
Village Extension Officer				05	1.67	2.89	20	3.33	0.52	05	2.22	2.89
Neighbouring Villages							08	2.0	1.16			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).

c) Which actors gain most Knowledge in the Poultry-Crop Integration implementation process?

Key actors identified and rated	Farmer rating			Expert rating		
	N	Mean	SD	N	Mean	SD
ZALF	16	3.20	2.17	12	2.40	1.95
ARI	16	2.67	2.34	19	3.17	1.60
SUA	14	2.33	2.07	21	3.50	0.84
Field assistant	17	2.83	2.32	16	4.00	0.82
MVIWATA	19	3.17	1.84	16	2.67	1.03
Changarawe community	14	2.33	1.86	13	2.17	1.33
Group Members PCI	25	4.17	0.98	24	4.00	1.27
Group Chairperson	26	4.33	0.82	22	3.67	1.21
Group secretary	25	4.17	0.75	22	3.67	1.21
Group treasurer	24	4.00	0.89	22	3.67	1.21
Village Extension Officer				15	3.75	1.50
Village Livestock Officer	08	1.60	2.19	07	3.50	0.71
Neighbouring villages	16	3.20	0.84			
Chick suppliers	12	2.00	2.45	12	1.0	1.41
Feeds and drugs sellers	07	1.40	1.95			
Poultry traders	11	2.75	2.06	11	2.25	2.22

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test.  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation)

**Table 15: Actors perceived to be much more trustworthy in the implementation process**

a) Which actors are much more trustworthy in the kitchen garden implementation process?

Key actors identified and rated	Farmer-farmer rating						Expert-farmer rating in both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts			Farmers in both villages		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	22	3.67	1.63	27	4.50	0.84	30	4.29	0.76	47	4.08	1.31
ARI	26	4.33	1.03	27	4.50	0.84	35	4.38	0.74	50	4.42	0.90
SUA	30	5.00	0.00	27	4.50	0.84	35	4.38	0.74	49	4.75	0.62
Field assistant	27	4.50	0.84	27	4.50	0.55	32	4.00	0.76	47	4.50	0.67
MVIWATA	28	4.67	0.52	22	4.40	0.89	11	3.67	0.58	40	4.55	0.69
Changarawe community	13	2.17	1.72	20	3.33	1.03	19	2.38	0.74	26	2.75	1.49
Group Members(KG)	16	2.67	1.51	26	4.33	0.52	31	3.88	0.99	33	3.50	1.38
Group Chairperson(KG)	23	3.83	1.33	26	4.33	0.82	32	4.00	0.76	46	4.08	1.08
Group treasurer(KG)	18	3.60	1.34	25	4.17	0.75	32	4.00	0.76	39	3.91	1.04
Group secretary(KG)	23	3.83	1.33	25	4.17	0.76	31	3.88	0.99	45	4.00	1.04
Sub-Village Leader	04	1.33	1.53	19	3.80	1.30	09	2.25	0.96	12	2.88	1.09
Village chairperson	07	1.17	1.17	21	4.20	0.84	12	2.40	0.89	15	2.55	1.86
Neighbouring villages							13	1.86	1.07			
Village Extension officer	03	1.00	1.73	10	5	0.00	16	2.67	1.03	13	2.60	2.51

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).

b) Which actors are much more trustworthy in the Tied Ridge implementation process?

Key actors identified and rated	Farmer-farmer rating						Expert-farmer rating in both villages					
	Farmers in Changarawe			Farmers in Idifu			Experts' rating			Farmers' rating		
	N	Mean	SD		Mean	SD	N	Mean	SD	N	Mean	SD
ZALF	28	4.67	0.82	28	4.00	1.92	28	3.00	2.00	56	4.31	1.49
ARI	32	4.57	0.79	28	4.00	1.83	30	3.43	1.51	60	4.29	1.38
SUA	31	4.43	0.79	30	4.29	1.89	30	3.71	1.50	61	4.36	1.39
Field assistant	31	4.43	0.98	30	4.29	1.89	23	3.86	1.07	51	4.36	1.45
MVIWATA	31	4.43	0.79	23	3.83	2.04	13	3.33	1.37	54	4.15	1.46
Village Exec. committee							20	2.60	0.55			
Village Chairperson	04	1.00	0.82	09	2.25	2.63				13	1.63	1.92
Sub Village Leader	03	1.50	0.71	10	2.00	2.74				13	1.86	2.27
Changarawe community	11	1.57	1.27	21	3.00	2.24	20	2.86	1.07	32	2.29	1.90
Group Members(TR)	27	3.86	0.90	30	5.00	0.00	25	4.14	0.90	57	4.43	0.85
Group Chairperson(TR)	29	4.14	0.90	21	3.71	1.60	23	4.00	1.15	50	3.93	1.27
Group secretary(TR)	30	4.29	0.95	21	3.71	1.70	25	4.14	0.90	51	4.07	1.33
Group treasurer(TR)	31	4.43 <sup>c</sup>	0.79	16	2.67	1.86				57	3.54	1.61
Village Extension Officer				10	3.33	2.89	18	3.33	0.516			

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).

c) Which actors are much more trustworthy in the PCI Implementation process?

Key actors identified and rated	Farmers in Changarawe			Experts in both villages		
	N	Mean	SD	N	Mean	SD
Key actors identified						
ZALF	24	4.80	0.447	14	3.50	1.92
ARI	25	4.17	0.75	24	4.00	0.89
SUA	29	4.83	0.41	24	4.00	0.89
Field assistant	29	4.83 <sup>c</sup>	0.41	08	2.67	1.53
MVIWATA	27	4.50	0.55	24	4.00	0.89
Village Chairperson	13	3.25	2.06			
sub village leader	09	3.00	0.00			
Changarawe community	16	2.67	1.51	06	1.50	1.23
Group Members PCI	27	4.50	0.84	21	3.50	1.23
Group Chairperson	24	4.00	0.89	19	3.17	0.98
Group secretary	23	3.83	0.75	19	3.17	0.98
Group treasurer	24	4.00	0.89	19	3.17	0.98
Village Livestock Officer	18	3.60	0.55	05		
Neighbouring villages	11	2.20	2.17			
chick suppliers	27	4.50	0.55	09		
feeds and drugs sellers	22	4.40	0.89			
Poultry traders	15	3.75	0.96	06	2.00	1.00

a, b, and c ratings that are significantly different at 0.01, 0.05 and 0.10 levels of significance from Wilcoxon-Mann-Whitney test  
SD= Standard Deviation N= Total Number of towers assigned (Source: Own compilation).



## 8.2 The interview guide

### Trans-SEC Process Net Mapping Approach

#### Instructions /reminders before interview

*Ask for permission to interview the person and ask for consent to record the interview.*

- Use papers sheets of the same colour (using different colour can be confusing and cause bias)
- Use the same colours in the construction of the process
- Interviews with experts (from ZALF and SUA) are slightly different from interviews with the other stakeholders. Experts might be consulted for create process maps in more than one village. In this case, the interview should be conducted for both the villages selected. After the interview with the expert about village A, we should:

#### **Introduction**

*Small Talk. (check with assistant about proper greetings), thank them for taking time off to participate in the interview)*

*Beginning of Net-Map: There is no wrong or right answer. U may interrupt occasionally. It will be recorded and used only for the desired purpose. This is an anonymous interview.*

- Have you been involved in a previous net mapping exercise?
- We are here to look at the entire implementation processes of the UPS, together with you as an expert of this process.

#### **Section A: Individual interviews with Process Net-Map**

##### **1. Individual interview introduction**

- a) Do you remember how it started? (Remind them about decision in 2014)
- b) Could you please tell me more about your role in the implementation process?
- c) In your opinion, has food security in the study regions changed since implementation of the UPS? (Access, availability, utilization)

##### **Section B: Process Net-Mapping**

##### **2. STEP ONE: Description of the journey of the UPS**

- a) **Leading question: In your opinion, who has been important from the onset to date in the implementation of UPS?**
  - *I have here actors' card, of actors from each UPS of the UPS, Do you agree with these cards?*
  - *Can you name any additional actors who, in your opinion have played an important role in the implementation process? (Use symbols to facilitate the interviewee)*

*(Let them choose among the prepared post-it (actor cards), and ask for other actors to be included. e.g. how did u pick your group leader).*

- b) **Please, describe each steps of the implementation process starting at the point when the decision was made by the villagers to adopt and implement these UPS (August 2014)**

*NB (Each step is a link between actors /actor groups, each link is numbered and the legend on the map describes the meaning of each number)*

Note: Can you describe steps after implementation/ next steps in the process? What could be the next step after now?

### **3. STEP 2: building influence towers). Towers:**

#### **I.e. Influence, Food availability, Knowledge & Income**

Explain to them they should build a tower for each actor/ actor group (the limit is 5 with 5 being the maximum). *I would like to compare now the actors regarding influencing the implementation. Could you build a tower for every actor regarding the influence you think they have regarding to the UPS implementation)*

**First tower:** How **strong is the influence** of each actor on the implementation? How strongly do you feel the chicken keeper influences the UPS implementation?

-in your opinion, who do you think is **most influential actor** in the implementation or who has the most influence,

**(How can you rate influence of each actor on a scale of 0-5?)**

#### **2<sup>nd</sup> tower: Income:**

Has there been an impact on your income since you started implementing the UPS asked farmers only).

What is your perception about other actors? In your opinion, how much more income does each actor gets from implementation of UPS? (E.g. *who do you think is getting the most income out of the UPS implementation; rating on a scale of 0-5 using towers*)

#### **3<sup>rd</sup> tower: Food:**

Has there been an impact on food security (**in terms of access, availability, utilization and stability**) since you started implementing the UPS; if **yes, how.**

*Do you think other actors have had a change/no change of food security? If yes how?*

- In your opinion, which actors gain **much more food** out of the implementation of this UPS? How much more food do they gain, compared to other actors in your opinion?
- E.g. (Does the leader get more food out of the implementation?)

#### **4<sup>th</sup> tower: Learning and Knowledge**

- a) *How many trainings do you remember taking part of? How did you find them, were they of use to your implementation of UPS or not*
- b) *Do you think other actors learnt from the trainings and the implementation of Ups?*

**NB Tower question: in your opinion, who gets the most knowledge or who learns the most out of the implementation of the UPS?**

**5<sup>th</sup> tower** (Final tower of Trust):Using Innovation trust as point of reference:

Do you think there is trust among the implementation of the UPS?

Which actor groups or actors do you think are most trusted in the implementation of UPS?

### Section C:

#### (Identify possible implementation hurdles/ entry points for problems)

. As an actor, do you have any recollection of challenges that have cropped up at any stage of the UPS implementation? If yes, what were they?

If yes:

- a) Can you please indicate where in the process implementation challenges have occurred? (real)
- b) How did they affect the UPS implementation?
- c) Where are the potential entry points of these problems in the process of implementation?
- d) What do you think could be the cause of these challenges?
- e) How do you have any idea of how the challenges have been mitigated or addressed
- f) Whom did you go to when faced with any challenge to get a solution in case the problem was beyond you
- g) In your opinion, what could be the potential challenges in the UPS implementation?
  - When a respondent gives very many challenges, ask them to identify the most important ones.
  - Give help reading the process steps again.

**CAUTION: Reminder: - use different colours for the real and potential challenges and indicate them on the map**

*Take a picture of the map. And ask if something in the process map is different for village B*

#### **5. Ask to construct towers for village B (we can place back the towers as they were and ask if something has changed).**

*Ask if challenges are different in village B. Real challenges?*

*Take a picture of the completed task as well:*

### **SECTION E:**

#### **Information AIV: Kitchen garden extra (mainly from KG farmers)**

- 1 What are the commonest vegetables grown for home consumption and for sale?
- 2 Which African indigenous vegetables do you know of?
- 3 How often do you consume AIVs in comparison with the other vegetables grown on your bag?
- 4 Do you grow any African indigenous vegetables? If yes, which ones do you grow?
- 5 How do you grow the AIVs you consume? On the bag or ground?
- 6 If ground only, what is your perception (*Maoni*) about incorporating the AIV in the KG?
- 7 How big is the area dedicated to growing AIVs compared to other crops?

#### **Section F: Demographic information**

Region:            Village    Role of actor

Name of respondent    Age

Marital Status:        Level of education:

Size of farm

HH size          primary employment

Other employment

Thank you for your time and answers given

***SECTION D***

**6. Additional questions after net-map (during the feedback sessions)**

- Has your involvement in the process changed your daily life, habits and attitude or not? If yes, how? If Not why? Has it changed something else?
- Has the role played by stakeholders changed over time or not? If yes, how has their importance involved in the process changed over time
- Would you like to modify anything about the UPS in the future? E.g. in the way it was run and managed and the way things are done?
- What is your view of the process in terms of fairness? rate on a scale of 0-5
- Do you think something could be improved within implementation process?
- In your opinion, do you think there should be someone within the village who should be included in the implementation process? If yes, who?
- Do you think someone from outside the village should be included in the UPS implementation?
- After the implementation, how are you going to continue the UPS? What are the plans for your UP?

## Declaration

I, hereby declare that I, Naikoba, Diana born on 23<sup>rd</sup>, Nov. 1985 completed the Master's thesis attached to this declaration independently and solely using the sources listed in the references and that it has not been submitted anywhere else. All passages of the thesis that were taken word-for-word or paraphrased from publications or other sources are marked appropriately.

Supervisor: Prof. Dr Andrea Knierim

Second supervisor: Dr Frieder Graef

“Farmers’ perceptions and opinions of the implementation of food  
Securing innovations in rural Tanzania”

Semester: 6

I furthermore declare that the supervisor has been given encrypted document (in one of the formats \*.doc, \*.docx, \*.odt, \*.pdf, \*.rtf) of the thesis which exactly and without exception corresponds to the wording of the printed copy. I am aware that the printed version can be checked for plagiarism by software analysis.

I consent to this thesis being placed and available for borrowing in the institute's library as well as an abstract of this thesis being presented on the institute's website.

Place, Date \_\_\_\_\_ Signature\_\_\_\_\_