Hidden Talents:
Mapping Innovations and Knowledge Management competencies in the Sunflower Value Chain in Lira District - Uganda

A Research Project submitted to Van Hall Larenstein University of Applied Sciences in partial fulfilment of the requirements for the award of
Professional Master Degree in Management of Development with specialization:
Training, Rural Extension and Transformation

OREMO Moses

September 2008

© Copyright Moses Oremo Opio, 2008. All rights reserved

Van Hall Larenstein, Part of Wageningen UR,

The Netherlands

Permission to Use

In identifying this research project in partial fulfilment of the requirements for a Postgraduate degree, I agree that the library of this university may make freely available for inspection. I further agree that permission for copying of this research project in any manner, in whole or in part, for scholarly purposes may be granted by Larenstein Director of Research. It is understood that any copying or publication or use of this research project or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the university in any scholarly use which may be made of any material in my research project.

Requests for permission to copy or to make other use of material in this research project in whole or part should be addressed to

Director of Research
Larenstein University of Applied Sciences
Part of Wageningen UR
Director of Research
P.O. Box 9001
6880 GB, Velp
The Netherlands
Fax: 0031 26 3615287

Dedication

In memory of my late brothers George Odongo Opio & Francis Agea (RIP)

&

To all Orphans in my care

Acknowledgement

I wish to express my sincere appreciation the following whose contributions led to the success of this work

First of all I appreciate Nuffic and the host institution, Van Hall Larenstein University of Applied Sciences for financing and facilitating my study programme respectively.

I have the honour to recognize Dr. Adnan Koucher who supervised my research. His ever jovial, Parental and Technical guidance was a distinguished role in ensuring that the work was accomplished. I also present gratitude to specialization TREAT Specialization Coordinator for TREAT, Madam Loes Witteveen and all lecturers whose efforts were instrumental during the study.

I fully recognize the support of my course mates and Ugandan colleagues for making it always homely and cohesive during the year.

I appreciate the contribution of Michael Otim and Jimmy Lamo. Your inputs to review the proposal and constant encouragement made me reach this end. I thank you for taking care of my premise and family while I am away. I further extend great appreciation to Peter Abong who provided me literatures and other information related to the vegetable oilseeds in Uganda.

To all my family members I do greatly appreciate your endurance during my absence. It had been difficult both ways but the end has come.

Finally, to all whose efforts could not be mentioned individually here, kindly take my heartily appreciation for your support and cooperation. I am with you in mind and spirit.

Stay Blessed & Keep healthy!

Adieu

"FOR GOD & MY COUNTRY, UGANDA"

Table of Contents

List of Tables

List of Figures

Acronyms

AT- Uganda	Appropriate technology Uganda
COMESA	Common Market for East and Southern Africa
FAO	Food and Agricultural Research Organization
IFAD	International Fund for Agricultural development
LDLG	Lira District Local Government
LOFP	Lango Organic Farming Promotion
MAAIF	Ministry of Agriculture Animal Industries and Fisheries
MFPED	Ministry of Finance Planning and Economic Development
NGO	Non Governmental Organization
SNV	Netherlands Development Organization
UBOS	Uganda Bureau of statistics
UNADA	Uganda National Agro-input Dealers Association
UNBS	Uganda National Bureau of Standards
UOSPA	Uganda Oilseed Producers and Processors Association
VODP	Vegetable Oil Development Project
ZARDI	Zonal Agricultural Research and Development Institute

Abstract

A study was undertaken on the sunflower value chain in Lira district of Uganda. The objective of the study was twofold: First to catalogue innovations that have been developed or introduced in the value chain over a 10 year trajectory (1998-2007). The second objective was to map the knowledge management capabilities of the stakeholders involved in the chain.

The study adopted a qualitative approach in which primary data was gathered through group discussion with the largely subsistence sunflower farmers in the district. Eight farmer groups were selected for the study. Key informant interviews were also conducted for the respondents selected from amongst the Millers, Input Stockist, NGOs, Produce Buyers as well as Private and Public Extension Workers. A preset interview /discussion check list was used to guide the data collection processes.

Collected data was analyzed through discussion along major themes such source/origin of innovation, networking/linkages and flow of communication and information amongst different stakeholders.

The result of the study showed a number of stakeholders involved in a complex relation in the value chain. The stakeholders were identified to include Farmers as producers, Millers as private entrepreneurs, Produce buyers, Input Stockist and Agents, Government agency, NGOs and Extension Workers. The actions of each stakeholder were found to directly affect or indirectly influence the actions of another.

There was low rate and level of innovation amongst the stakeholders. Developed innovations were dotted among the stakeholders with only minimal spread to others in the chain. The innovations identified were categorised into four groups namely: Product innovations, Management/Organizational Innovations, Process innovations and Service innovation defined by the form in which such innovation were found.

Local innovations generated from the national research programme was lacking as the only case was an improved seed released into the production system in 1991. Since then no other technologies or innovations was release into the value chain from the national research system.

Product innovations were mainly developed by Millers and imported. The Management/ organizational forms varied across all stakeholders but more strongly exhibited with farmers. Extension providers however, showed no new form of organizations / Management.

Communication and knowledge sharing amongst stakeholders were found incomplete, sporadic and near absent in some cases. However, internal communication was strong and informal amongst farmers and enhanced by formation of clusters of mobilized groups.

In conclusion I recommend the establishment of platform for coordination amongst extension workers, and this should be guided by management of the various providers of extension services.

The noble innovations should be up scaled by extension workers and should be used as bench mark for building the social network to develop an innovation system appropriate for the oilseed subsector under a Joint coordination by the Vegetable Oil development project and the recently formed Uganda Oilseed subsector Plat form

The recently formed oilseed subsector platform to link up with VODP and Districts in consultation with Millers and other stakeholder for capacity building programmes for all stakeholders to stimulate the innovation system. There district as an authority should initiate dialogue amongst Millers to strengthen the already initiated association to be responsive to needs of all.

1.0 CHAPTER ONE: INTRODUCTION

1.1 Background to the study

The vegetable oilseed subsector in Uganda was once a vibrant subsector with self sufficiency in edible oils. The subsector however, collapsed following decades of political impasse that distorted the supply of inputs and other services from responding to the farm level demand for related goods and services (Laker-Ojok, 1996).

In its strategic plan for recovery the government of Uganda with donor support identified the vegetable Oilseed subsector as one of the key entry points for transforming agriculture from the currently subsistence to a more vibrant commercial status (SNV, 2007). Through a number of stakeholders the growing of vegetable oilseed crops mainly sunflower has for over a decade been promoted to prominence and is now one of the leading sustainers of economic growth being realized. The subsector has realized an annual growth rate of 3%, with increases in number of households (14,000 – 75,000) growing oilseeds, reduced importation of raw materials to 60-65% and reduction in reliance on imported edible oil from over 95% to 75% of the national demand during the period 1995-2001 (MFPED, 2003; VODP, 2002). The growth of the subsector is in part due to the strategic diversification into non-traditional cash crops. For instance, unlike in the past where cotton seeds used to dominate, sunflower has now taken the lead as the main source of locally available raw material for edible oil production in Uganda (Collinson, *et al*., 2005; VODP, 2007).

The relative boost of sunflower is enhanced by its relatively low labour requirements; short production cycle; being less prone to biophysical factors such as drought, pests and diseases; general local preference for its oil; introduction of village level technologies for crushing and availability of improved seeds. Its soft testa makes it easily crushed and thus more economically suitable for milling in terms of energy requirements and durability of machines/spares. Currently the contribution of sunflower in the oilseed industry as a local source of raw material in Uganda stands at 86%, compared to cotton at 1% (Comesa, n.d). The decline in cotton production followed past political turmoil, poor operationalization of the trade liberalization policies that left producers unsupported technically and eventual collapse of the cooperatives. Efforts to improve cotton production have been thwarted with the often unpredictable changes in world market that is not linked to farmers' situation. These factors compounded, forced cotton to insignificance as a source of raw materials for edible oils.

Other oilseed crops promoted but could not be used for edible oil production include groundnuts, soybeans, Simsim, Sheanut. With the exception of Sheanut from which kernels are gathered in natural settings, these crops are traditionally grown as food crops with rich sources of edible oils. Extraction of oils from these crops is still carried out using rudimentary traditional practices at household levels for domestic purposes. Their potentials for use as raw materials for commercial edible oil production is low due to a number of reasons: the cost of extraction of oils far exceeds the going market prices for vegetable oils, the high cost of raw materials to be crushed and lack of equipments and machinery to extract oils from them. Groundnut in particular highly valued as whole nuts for direct consumption and when in surplus for export (IFAD, 1997).These situations compounded together make sunflower undoubtedly the candidate oilseed crop with most of the activities considered under the vegetable oilseed subsector sector. Subsequently for the purpose of this document all information following below will focused on the sunflower as the main component.

As mentioned earlier many stakeholders are taking part in the redevelopment of the subsector focusing more on sunflower and dealing in various aspects based on their differed interests.

These include producers (mainly subsistence farmers), government agencies, private entrepreneurs (Millers) of various capacities and non-governmental organizations, Associations, Business community (produce and input dealers) and individuals (VODP, 2007). The stakeholders operates in an interlocking pattern, performing tasks such as coordinating development of rural farmers into producer organizations, seeds and input distribution and increased capacity for processing. Farmer training and education to: increase production, bargain for fair terms of trade. Improved diets and increased saving for investments are also other functions undertaken variously by the stakeholders.

Generally, the stakeholders are formally independent and uncoordinated although they all have good interest contributing to the subsector development (Agricord, 2005). The un-coordination quite often interferes in this vibrant oilseed subsector chain by indirectly or directly influencing decisions, actions and market conditions. This is manifested by duplication of services, lack of transparency and conflicts among stakeholders. New innovations in the form of knowledge and technologies from various sources are irregularly disseminated to farmers while own initiatives remain locked up within sections or are limitedly disseminated exclusive of other stakeholders' interests. In addition, several infrastructural shortcomings such as institutional capacity to create harmony hinder development, causing unfair distribution of profits within the subsector functional value chain (Agricord, 2005). The above situation constraints farmers in their freedom of choice and the entire chain which are essential components for a properly functioning market. Without self-regulatory mechanisms such as clear rules in place and adequate capacity of stakeholders in the chain to create a fair market game and proper track of events and actions, the seemingly vibrant sunflower chain might backslide into ruins. Informed choices should be made to balance the interest of all stakeholders involved in the chain.

Owing to the economic liberalization and decentralization strategy, agricultural services to farmers in Uganda have been decentralized and partly privatised. This has attracted different individuals, organizations, associations and entrepreneurs in the oilseed industries. There is continued influx of several and different actors in the oil seed subsector more especially in the processing, input distribution and production components. The department in collaboration with a recently formed national oilseed subsector platform intends to coordinate and align the various activities to prevent duplication of efforts, minimise contradicting policies measures and safeguard national social and economic goals. One of the strategies to improve coordination and alignment is to upscale and promote adapted innovations amongst stakeholders but is hindered by lack of information. This research is developed in response to the challenges described above in order to generation data required to bring forth and strengthen an all inclusive subsector performance and competitiveness.

1.2 Problem Statement

The apparent lack of coordination and flow of information amongst stakeholders in the sunflower value chain in Lira district of Uganda is contributing to the decline in performance of the subsector. The technological innovations and knowledge generated or introduced by the largely independent stakeholders tend to be obscured and inadequately shared amongst stakeholders. This hinders and restricts free circulation and freedom of choice by stakeholders especially farmers and other small scale operators along the value chain. Apparently better adapted innovations and knowledge or practices are in individual hands and not shared by stakeholders. There is however a need to up-scaled adapted innovations to the benefit of all stakeholders through collective actions and sharing amongst stakeholders in order to contribute to a self sustaining sector. There is currently inadequate information on the innovations to carry

on the desires and provide effective coordination. Lira district department of production and marketing and the recently formed oilseed subsector platform are desirous of streamline the subsector operation. They aimed to generate adequate information to support the up-scaling of good practices, technical innovations and knowledge by promoting coordination and coherence. This study was conducted to support such initiatives.

1.3 Study Objectives

The overall objective is to contribute to the development of a framework for improving coordination of the flow of innovations and knowledge in the oilseed subsector in Uganda. There were two specific objectives.

a) To catalogue innovations in the sunflower production value chain in Lira district of Uganda.

b) To assess and map out the knowledge and information management systems of the stakeholders in the sunflower value chain in Lira district.

1.4 Research Questions

Main Question

1. What innovations have the stakeholders of the sunflower value chain in Lira district?
2. What knowledge and information management practices exist amongst stakeholders in the sunflower value chain in Lira district?

Sub questions

i. What are the sources and origin of the innovations and knowledge systems are use by the stakeholders of the sunflower value chain?

ii. How do the stakeholders in the oilseed subsector get information and knowledge?

iii. What challenges do stakeholders face in managing, knowledge and information in the sunflower production chain?

iv. What opportunities exist to improve the dissemination and management of services amongst stakeholders?

1.5 Methodology

1.5.1 Selection of Study Area

This study was conducted in Lira district located in Northern Uganda. The district was used for the study because of a number of reasons: The intensity of sunflower production, level of development in agro-processing services in terms of number of Millers and marketing. The district is a regional hub and national reference point on matters related to sunflower chains. Lira district is amongst the first six districts where sunflower production was actively promoted to pioneer diversification and up scaling of the oilseed subsector performance; the other districts being Apac, Katakwi, Kumi, Palisa and Soroti. Due to the high production of sunflower grains there has been created various organizations and projects providing services. The growing of sunflower and other oilseeds is not only a result of the promotional efforts but has also been a

traditional crop for the local people in the region. The crop is highly suitable to climatic conditions in the district and has then been substituted for cotton as a cash crop.

1.5.2 Study Strategy

The study was qualitatively conducted as a case study on sunflower value chain in Lira district. It involved field work and desk study of literatures from various organizations engaged in sunflower production. The field work was an interactive process used to generate primary data that was supplemented with secondary data in literatures.

The key considerations that were put in mind during data collection included the identity source of innovation or idea, how they were developed into useful products or idea and how or whether the prototypes have been transferred for use by stakeholders. There was also a look into the capabilities of stakeholders to share strategies and the networks through which they get information and knowledge. The study followed a trajectory over a ten year period (1998-2007) during which sunflower production had taken shape with many stakeholders openly identifiable within the district.

1.5.3 Respondents and Sampling

There were two key categories of respondents during this study. The first category of respondents consisted of farmers in small farming groups engaged in sunflower production. A generic list of all farmers' groups in Lira district was got from District Agriculture and OUSPA offices from which eight were randomly selected for the study. During the sampling, some groups were found to be having special affiliation to other organizations. Based on such situations four groups with special affiliations were selected alongside four other non affiliated groups to constitute the total of eight groups as the sample (Table 1.1).

Table 1.1 Sampled farmer groups for the study

Farmer Group	Form of Affiliation	Affiliated organization	Location / Subcounty
Alito Joint Christian	Seed multiplication / technology development centre	UOSPA / FAO / ZARDI	Alito
Can mii diro	Proximity to formal research station	ZARDI - Ngetta	Ngetta, Lira
Abadi munu	Contract with Mukwano	Mukwano Oil Mills	Iwal - Adekokwok
Omwododyel/Giniyero	Seed multiplication	UOSPA	Ateri, Amach
Cam kwoki	No affiliation	-	Akia - Adekokwok
Coo pe lwor	No affiliation	-	Ongica
Acap young Farmers	No affiliation	-	Owalo - Abako
Obanga Atwero	No affiliation	-	Alito

Source: UOSPA & District Agriculture Office records, Lira

The second category of respondents consisted of representatives of five different stakeholders/organizations in the chain. They include five Millers selected randomly from a generic list while considering their milling capacities based on the records at the District Agriculture office. There was only one large mill with a capacity >80mt/day, 2 Millers were with the capacity of 20mt/day and two others have capacities of 5mt/day each.

One person representing the producer buyers (often called middle men) was selected as a key informant. These have an association which regulates their operations as a common unit.

There were also four extension workers two of whom from the government department and two (2) from UOSPA. Other respondents were representatives of two NGOs (AT-Uganda and LOFP) dealing with oilseeds in general. AT- Uganda has in addition developed a stream of stockists whom operate under their commercial division UNADA.

Finally five stockists were interviewed. Four of the stockists are affiliated to UNADA as mentioned above. The fifth stockist operates as a sole proprietor business and links with other input dealers outside the district.

1.5.4 Data Collection

The data was gathered from the various respondents using two approaches. Focus group discussions were held with farmers in their villages. The discussions gave the elaboration on the existence of locally generated and adapted innovations over the 10 year period (1998-2007). The discussion focused on generation of innovations and knowledge used in production, organization, service delivery and inputs related to sunflower. The modes of knowledge and information transfer were also discussed with the group.

The second approach was by use of guided interviews conducted to representatives of organizations providing services to farmers as mentioned in the sample continuum above. The interviews focused on the development and assemblage of local innovations as well as sourcing and transfer of externally generated innovations, knowledge and information. The dissemination, networks, and management of information and knowledge amongst them was also considered. The interviews also sought out whether the various organizations/individuals had specific innovations either developed or adapted and disseminated to other stakeholders.

During both the interviews and focus group discussion check lists to guide the interviewing were prepared for the different categories of respondents. Open ended questions were used throughout the study period to provide an in depth understanding of every emerging issue.

1.5.5 Data Analysis

The data collected was entirely qualitatively analyzed by summarizing and describing the finding from the respondents. The descriptions anchored along four thematic areas namely:-

- Source/origin and type of innovation
- Capability of stakeholders in terms of strategies and networks of access to innovations, procedures of linking products to demand and use of new information via stakeholders in the chain.
- Mechanisms of strategic collaborations amongst stakeholders to visualize mapping and propose recommendations to be undertaken.

- Finally stakeholders and their roles in the sector

1.6 Limitations of the study

This study was conducted within a limited time as such it could not be able to make broad coverage in terms of respondents and the territorial scope of the entire district. Further, more the study period occurred at the time when most of the respondents were at peak of their activities. The respondents were then followed up to their different premises while others were met very late in their residences.

1.7 Operational Definitions of Terms/Concepts for this Research

The following operational definitions were used in the study as a frame of reference

Innovation

A novel idea, practice, or object that is successfully introduced into economic or social processes. It will thus include new knowledge or technologies related to primary production, processing, and commercialization all of which is seen to affect the productivity, competitiveness, and livelihoods of farmers and others in the sunflower and oilseed subsector chains.

Stakeholder

The agent, farmer, processor, or some other private actor who introduces, promotes and adopts or transforms knowledge of the innovation. This therefore will include farmers, extension workers, NGOs, input stockist and business communities involved in the dissemination, promotion, processing and trade in sunflower growing in the two districts.

Innovation process:

The process by which, knowledge and technology are used in order to respond to social needs and market-articulated and technological demands and opportunities. Agents acquire technology and tacit and codified knowledge in complex processes of competence building, such as learning by doing, learning by using, and learning by interacting.

Innovation system

The whole set of stakeholders and practices that constitute, perform, and participate in innovation processes, their interactions, and the structure and rules that guide their actions within the subsector, including spill over from other innovation systems.

Agricultural Knowledge and information management systems

Knowledge management and information system involves ways of exchanging knowledge among those who can develop it and those who can use it. It is also include efforts and practices used by organizations and individuals to identify, create, accumulate, re-use, apply and distribute knowledge.

2.0 CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL CONCEPTS

This chapter presents reviews of theoretical concepts and approaches that explain aspects of innovation development and diffusion. It starts by looking at innovation, and the innovation system perspective and transfer of innovations. The value chain and knowledge management and information systems which are constituent elements of innovation in the context of the study are also explained.

2.1 Innovation

Science and technology are critical for development and economic growth strategies for any country. Scientific and technological knowledge and information add value to existing resources, skills, knowledge, and processes, leading to novel products, processes and strategies. These have direct links to the improvements in economic and social conditions and environmental sustainability as embodied dimensions. The generation of knowledge, ideas, practices and resources for sustainability constitutes innovation.

The concept of innovation in agriculture has traditionally been associated with science and technology and linearly taken as panacea to economic crises (AfDB/OECD, 2006). On the same reasoning there has always been emphasis put on external but neglecting the local inputs and processes leading to generation of innovations that are adaptable to particular farming systems (Waters-Bayer and Van Veldhuizen, 2005). A more broadened view of innovation has been made by many authors. For instance, The World Bank (2006) viewed innovation to be encompassing the stakeholders and factors affecting demand for and use of knowledge in novel and useful ways. Based on same line of thought, Mytleka (2000) had earlier indicated that the process by which organizations master and implements the design and production of goods and services that are new to them irrespective of their competitors, country or the world constitutes the key elements of innovation. Lopez (2004) further linked innovation to learning processes and to the information and knowledge management capabilities of actors or agents involve. The views expressed above point out to the inherent realisation that innovation is constituted by processes, stakeholders, institutions, individuals and skills as well as the interactions between them as critical components. Accordingly, Lopez (2004) stated that the nature and form of innovations generated depends on several actors and agents because they do not emerge in a vacuum and the configuration is not linear.

Leeuwis and Van den Ban (2004) argued that innovations should be considered complete only if an approximate mix and balance exists between technical devices and social organizational arrangements associated with new forms of coordination within networks of interrelated stakeholders and practices. This view owes great attention to including stakeholders and making organizations, and policies sensitive to stakeholder agendas and demands as essential components in the innovation processes. Stakeholder demand shapes the focus and direction of innovation as it is not articulated simply by the market, but includes non-market drivers such as collaborative relationships between the users and producers of knowledge (Hall *et al*., 2005). Demand for certain kinds of innovation can also be stimulated by policy, for instance by providing incentives to adopt a certain technology or management practice. This is especially important when key stakeholders are poor and have limited social and economic power or when the negative environmental impact of development needs to be addressed (World Bank, 2006; Hall *et al*., 2005).

In the case of the oilseed subsector in Uganda, there are many uncoordinated stakeholders pursuing different goals and interests (Agricord, 2005; VODP, 2007). In a bid to foster favourable competition in the market, the stakeholders have introduced alternative approaches and practices in the chain. This is in form of seeds, equipment, other inputs and practices.

As pointed out by (Bozeman, 2000), introduction of technologies do not come as concrete commodities but rather in it there are associated knowledge and skills and other services which together constitutes innovation. The stakeholders of the sunflower value chain have provided different services (VODP, 2007) which have been creatively modified either by farmers or the service providers to fit the existing situation. However, because of the lack of clear coordination novel improvements have met conflicts and unproductive competition rather than development thereby locking out certain knowledge and innovative potential from the economically less competitive stakeholders such as poor farmers and small scale entrepreneurs.

2.1.1 Innovation Initiation and Development Processes

The process of innovation is shaped in very different ways, depending on the particular context in which innovation systems emerge and how this context changes over time. First, the pivotal actors that start the process are different broadly speaking, they are either public or private actors. Second, the factors that trigger innovation are also quite different and they can either be policy or market triggers (World Bank, 2006).

Oyelaran-Oyeyinka and Sampath (2007) furthered this view and reasoned that an innovation process can be triggered in many ways and not always by a deliberate formulation of a scientific research programme in a laboratory or research centres. Waters-Bayer *et al.* (2006) noted that before formal research and extension, farmers conducted their own experiments allowing them adapt farming systems and activities to local conditions the outcome of which were disseminated to other farmers. At farm level, waters-Bayer and associates identified bottlenecks in production, curiosity of farmers or sometimes accidents to have caused farmers to create new ways of improving their farming practices.

At a macro level Oyelaran-Oyeyinka and Sampath, (2007) identified changes in technology, competitive conditions, international rules; domestic regulations, environmental or health crises and even wars as factors that have often stimulated innovation processes. Over the past decades, a number of changes in the pattern of production and competition have put pressure on firms everywhere to engage in a continuous process of learning and innovation. Two of these stand out in particular: the growing knowledge intensity of production and its extension beyond the high technology sectors to reshape a broad spectrum of traditional industries and the emergence of innovation-based competition (World Bank, 2006).

Modern agricultural systems and development projects are associated with integration of both public and private actors who have competitively created and facilitate innovative processes. These present a dynamic and complex situation than the linear assumption along technical lines that innovations processes were conventionally viewed.

The capacity to innovate can no longer be thought of in terms of the creation of human and physical scientific and technological resources alone. Instead, it must be thought of in terms of the policies and practices that promote learning and innovation in networks of organizations. While agricultural research organizations remain important players, they are not sufficient on their own, policies and practices must be put in place to promote the flexibility and adaptability of innovation systems (Hall, *et al*., 2005, World Bank, 2006, Leeuwis and Van den Ban, 2004).

2.1.2 Categorizing Innovations

The current focus on integrative processes along disciplines for instance the sociological or managerial economics; and perspectives such as user, producer or seller have made explicit description of particular innovations based on certain characteristics. Oyelaran-Oyeyinka and Sampath (2007) described innovations using uncertainty, interactive learning and degree of innovativeness by the broad range of users as follows.

- Radical changes of global significance (*radical innovation*);
- Small improvements in product design and quality, in production processes or the way in which production is organized
- Changes to maintenance routines that collectively, modify products and processes, to reduce costs, increase efficiency, enhance welfare and ensure environmental sustainability. This is referred to as *incremental innovation;* and Changes to management, and marketing brought about by new technologies (*institutional and organizational innovation*).

Leeuwis and Van den Ban (2004) characterised innovations into two categories depending on magnitude and scope of change effected. Accordingly, where innovation does not challenge the technological and social-organizational characteristic of a system they coined the term “regular” innovations. Examples of this grouping include slight adjustments in applications of farm inputs and other farm activities which occur as integral part of routine farming practices. This corresponds to the incremental innovation as categorized by Oyelaran-Oyeyinka and Sampath.

Referring to Abernathy and Clark (2005), the second category of innovations that Leeuwis and van den Ban coined was ‘architectural’ innovation which is defined by fundamental alteration in the logic of farm operation. This creates reorganization of the social relationships, technical principles and rules for instance abandoning a farming practice such as variety or a crop enterprise in favour of another completely. This they argued would fundamentally alter the logic of farm operations. There are often overlaps in characterization of innovations and differences only come in when separation is made between practices and decisions at different levels and times. Leeuwis and van den Ban (2004) reasoned: For “architectural” innovation to occur there is always a strategic decision taken than when in consideration of operational or tactical issues.

2.2 Systems of Innovation

Innovation system can be looked at as a regional, country or industry specific elements which support development and marketing of products and services (Herstatt *et al*., 2008). The evolution of the concept of innovation systems stem from the theory that research and development is immersed in a complex of process produced by networks of stakeholders that co-evolve with technologies and processes they generate (World Bank, 2006). In the context of agriculture innovation systems concept values the capacities and processes emphasized in research and knowledge and information system frameworks, including channels that give farmers access to information, and well-resourced and up-to-date scientific research and training organizations. It’s now understood that on historical grounds innovation processes have been a linear sequence of activities between public research institutes whose roles were to introduce new practices or technologies to farmers who should in turn adopt the inventions through extension workers (Leeuwis and Van den Ban 2004). As the context of agricultural development changes, a framework that incorporates different aspects of innovations came into force in two ways: First by looking into the institutional dynamics

between users and providers of knowledge and secondly by considering the individual capacities of public and private actors as elements composing a whole system of innovations (Vellema and Danse, 2007). The institutional dynamics is based on an all encompassing and broadened network of firms and other economic agents who, together with the institutions and policies that influence their innovative behaviour and performance, bring new products, new processes and new forms of organization into economic use (Oyelaran-Oyeyinka and Sampath, 2007). The emphasis on the process of interaction by considering existing market structures, social institutions also bringing about an inherent distribution of technical knowledge which broadens the scope from individual technologies and organizations to systems and networks (Vellema and Danse, 2007). The strength of a system of innovation therefore links directly with its institutional foundation of science, technology and production.

Innovation systems analysis recognizes that creating an enabling environment to support the use of knowledge is as important as making that knowledge available through research and dissemination mechanisms (World Bank 2006). In the same way, as innovation system encompasses a wider set of activities, there is potential for supporting innovations by including such processes as the creative adaptation and financing of innovation. It also potentially offers a framework for embedding innovation capacities in the rapidly changing market, technological, social, and political environment of contemporary agriculture because of the this broader set of relationships between actors and contexts.

From the value chain perspective, innovation systems have many shared partners, and although they respond to different principles, they are highly complementary. The key challenge is to link supply and demand in the most effective way, and information sharing is very important for enabling the producer-consumer linkages (Lopez, 2004, World Bank, 2006, Herstatt *et al*., 2008). Organizations that help to link producers, transporters, and distributors to consumer markets are vital if value chains are to function effectively. When participants in a value chain pass along information on demand characteristics, for example, or on standards and regulations affecting the market, at the same time they are providing important information to shape the direction of the innovation process. If, in addition to well functioning value chain, an effective innovation capacity exists, this market information will be combined with new and existing knowledge on technological opportunities and information, such as farming techniques, postharvest processes and marketing to innovate in response to these market signals. One of the innovation challenges with respect to sustainable agriculture is to expand opportunities and means for resource-poor farmers to become stakeholders in the innovation systems.

2.2.1 Approaches of systems of innovation

In discussions about innovation systems two forms of institutional frameworks future strongly both of which emphasises the interaction between users and providers of knowledge and technological innovations. Vellema and Danse (2007), explains the complementary approaches in the context of national innovation system (NSI) and the Base of Pyramid (BoP) system of innovation. The national innovation system seems rather embodied more with macro level interaction of stakeholders with specific interest in market structures and social intuitions that bring about endogenously determined technological opportunities. According to Hall *et al*. (2005), National system of innovation provide an important framework which attempts to shift agricultural development policies to processes of research and development than on fixed technological packages. This they argued would construct a viable and flexible institutional environment, in which technological opportunities will evolve rather than supporting predefined search for sustainable systems produced by research and

development organizations disconnected from their environment and actual users. Accordingly more attention is being given to innovation system to guide the demand for research and technology and to the development of wider competencies, linkages, enabling attitudes, practices, governance structures, and policies that allow this knowledge to be put into productive use (World Bank 2006).

The BoP approach on the other hand put more emphasis on the local level institutions, by recognising them as resilient and creative entrepreneurs and value-conscious consumers (Vellema and Danse, 2007). Vellema and colleague explained that the BoP approach proposes to make endeavours to compete against untapped consumption. In this way development often create capacity to consume by balancing access, affordability and availability.

The BoP approach typical relates very closely with the situation of the oilseed subsector in Uganda. There is continued influx of different actors in the subsector but tapping on particular market niches remains largely uncoordinated inclined towards particular groups which could be contributing to the locking of innovative capacities.

2.3 Transfer of Innovations

Throughout the world, development professionals are engaged in transferring innovations in the form of technologies, knowledge and information to farmers with the view of benefiting the farmers. The execution of such services takes on various approaches within the domain of extension services and is based on the perceived appropriateness of the approach (Hakiza *et al*., 2004). In the conventional thinking, extension is regarded as a system that functions to transfer knowledge, information and technologies from research stations to farmers (Leeuwis and van den Ban, 2004). In reference to Rolling (1982), Hakiza *et al*, (2004) and Leeuwis and Van den Ban, (2004) underscored the inadequacy of the view as it follows a liner sequence or pattern, that neglect the contribution of the “recipient” farmer and having partnerlistic division of task. Recently the role of farmers have been recognized in the transfer of innovations and has led to the emphasis on participation of farmers in the set up of knowledge, information and technology transfer system (Asiabka, 2002). Owing to diversity and variability amongst farmers a suitable mechanism that facilitates transfer of innovations has to be defined. Recent discourses have seen the development of Farmer groups as a means to empower communities to generate and disseminate innovations for their own good. Even then under this circumstance, the generation and transfer of innovation is based on the mindset associated with division of responsibility in the context that innovations are generated from public institutions and adapted to farmers’ situation (Leeuwis and Van den Ban, 2004; IFAD, 2007). Along this school of thought the innovation activities neglect the traditional knowledge and innovative capacity of the poor farmers themselves. This subsequently is biased in the functioning of extension services and delimits the transfer of technology by assuming a top-down, standardized, approach based on one-way communication process (IFAD, 2007).

In the case of Uganda a variety of extension approaches have been used to transfer innovations and have since accumulated experiences both in structural set up and the approaches itself. The approaches include regulatory extension services, extension through economy of effort, non directional extension (the economic war and political crisis error) and presently the recovery approach associated with advisory/education services (Semana, 2000; Mubiru and Ojacor, 2001). The approaches before the advisory /education utilized varying levels of participation involving coercive authorities such as chiefs; progressive farmers; young farmers of Uganda and Information aids. The approaches largely neglect farmers’ knowledge, ideas, circumstances and needs, rendering them non responsive (Semana, 2000).

The advent of advisory/education approach, which is directly linked to formation of farmer groups, is by far the latest. This is being use to facilitate higher and broader levels of farmer participation in generation and transfer of innovations more especially amongst the subsistence farmers (MAAIF, 2000). According to the World Bank (2006), rural farmers in developing countries are being organized by Agricultural Research &Development service providers and/or rural producer organizations in community-based groups in order to tap in local networks, and thereby enhance diffusion of technologies and reducing transaction costs services.

The agricultural extension services in Uganda are currently functioning along the farmer group approach. The introduction of the(National Agricultural Advisory services (NAADS) programme has resulted into the formation of functional groups to receive advisory and information services and for facilitating technology transfers (Hakiza *et al,* 2004; MAAIF, 2000).

As the country stride through the path of liberalization, the claim for open market for farmers and rural entrepreneurs is considered key to sustainable economic development. This has had a direct influence on the transfer of innovations along the chain of the vegetable oilseed subsector. The involvement of private alongside public service operators has resulted into introduction of different operational approaches. These include the participatory engagement of farmers in development, generation and transfer of innovation (VODP, 2007; Agricord, 2005). In developing chains or those that are being upgraded for accessing new markets, innovation is much more institutional and organizational (managerial).

The relationship between chain actors often developed to produce knowledge of market demands and operation and information flows between chain actors. This generates a system that makes innovation a co-managed process during which transfer of innovation take place. Under this circumstances change in modalities for collaboration between chain actors would occur change according to the challenges that are being faced. In the case of general issue-oriented and multi-tiered farmer groups and organizations that focus on farmer-led technology development, which emphasizes organizing grassroots groups and networking between groups and with rural service providers, innovation is often embedded in participatory approaches for resolving problems. Agricultural innovation is driven by farmers' needs and concerns general issues that are common to most farm households (Friis -Hansen *et al.*, 2004).

2.4 Value Chain and Innovation

Most agricultural production is increasingly integrated in value chains with forward (marketing) and backward (input supply) linkages. Urban markets often cause supply chains to grow longer; in turn, shelf-life, handling requirements, and other market requirements assume greater importance for agricultural products. Before reaching the consumer, traditional staples may pass through the hands of several agents (assembly agent, miller, wholesaler, retailer, and baker), and more value may be added in the food processing stage than in production. Agricultural production is increasingly based on a wider range of purchased (or free) inputs: seed, fertilizer, pesticides, machinery and water that must be combined and used judiciously to arrive at sustainable production systems. Each of the links in these "production-to-consumption" systems constitutes a value chain and provides new opportunities for innovation (World Bank, 2006).

A value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production, delivery to final consumers, and final disposal after use (Kaplinsky and Morris 2000 as quoted by Ponniah *et al*., 2008). The logic of reference in value chains is a sequence of production-processing –retailing of products. According to Ponniah *et al*. (2008) a value

chain has four basic links (figure 2.1) but in actual sense is much more complex than such simple depiction.

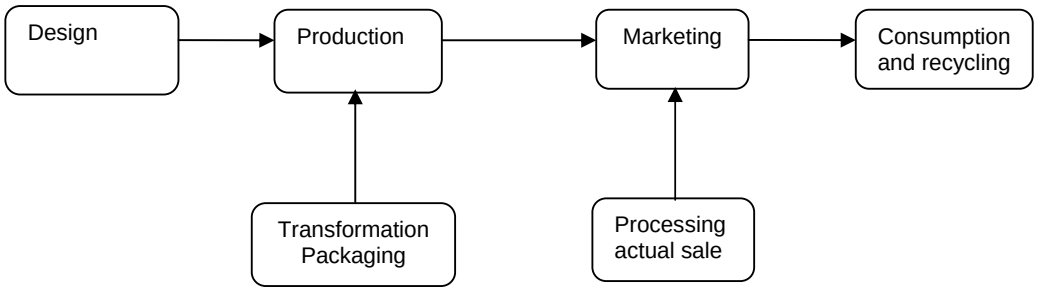


Figure 2.1: The basic links of a Value chain, adopted from Ponniah *et al*. (2008)

According to Vellema and Danse (2007), the concepts of value chain development and market access have come to the fore as ways to encourage entrepreneurship by linking smallholder producers to agribusiness and food industry as well as promising markets. The chain approach holds promise in terms of secured markets and value addition for rural communities (Peppelenbos and Verkuijl, 2007).

The value chain operators handle the material flow of the products through different links in the chain characterised by production activities of farmers, sale of products to agro processors who in turn may add value and sell as a finished or semi finished product further downstream. To this end it is assumed that the formation of linkages amongst actors enhances the technological capacities of smallholder producers or manufacturers by way of cost efficient technologies trickling down through the value chain or by quality requirements inducing best practices in performance. In many circumstances, the intermediary producers in a particular value chain may feed into a number of value chains. It is also important to note that the share of sales may obscure the crucial role that a particular individual/group controlling a key core technology or input has on the rest of the value chain.

Many stakeholders work to support the value chain operators in general and farmers in particular providing services such as credit, information, training and market regulations (Ton and Jansen, 2007). The interaction of these stakeholders often differ according to the services they offer but it is however, being realized that sustainability is only achievable if such actions are adapted to already established social capital. It is now well recognized that value chains often exclude the poor (Peppelenbos and Verkuijl, 2007) and certainly would not openly unpack the innovations and knowledge developed in the course of experience by farmers.

Rural farmers do participate in value chains in many ways but most important for this work is their involvement in technology identification and development or improvement of skills to improve performance and quality. Peppelenbos and Verkuijl (2007) vividly argued that once appropriate technologies have been identified and adapted for use in the value chain activities, there is need for regular maintenance and updating. Actions as such make concerns for technological innovations a permanent factor in development and involve creative modification in the otherwise formal scientific research. This works against the largely perceived view that particular technologies would provide more or less a one stop right solution to particular problems.

According to Waters-Bayers *et al (*2006), many innovations are not often technical in nature but rather socioeconomic and institutional including within the rural farmstead but are seldom recognized. Often, it is thought that innovations are steered from above, brought to farmers through extension officers but the reverse has always been true. The

farmers have detailed knowledge in what works best in their situations and share experiences amongst themselves, identifying best practices in their situation.

2.5 Agricultural Knowledge and information Management Systems

Knowledge management involves ways of exchanging knowledge among those who can develop it and those who can use it. It can also be taken to include efforts and practices used by organizations and individuals to identify, create, accumulate, re-use, apply and distribute knowledge (Hartwich, *et al.,* 2007). The lack of exchange of knowledge among and between farmers, and producers of farm-relevant knowledge, has often been regarded as the key issue in agricultural development. The traditional practices in agricultural extension and development programmes, often focused on transfer of knowledge to farmers who, in turn, were expected to gain from applying this knowledge in their production practices. This resulted in an inadequate and inapplicable messages and technologies due to the limited focus on extension agents and farmers. Coherent innovations could not be realised without the merger between the multiple actors to influence the bringing about of knowledge technologies and cooperation to improve collective performance (Leeuwis and Van den Ban, 2004).

Contextually Knowledge can be taken to mean both information and skills that are acquired through individual experience and trial and error, within an organization or a learning community, or from outsiders adapting it to local contexts. A distinction in knowledge management is often made between explicit knowledge (that can be codified and articulated in formal language) and tacit knowledge (personal knowledge embedded in experience) (Leeuwis and Van den ban 2004). Knowledge management programmes, based on traditional approaches often impinge on the innovative capacities by focusing only on the process of information exchange between groups of specialists, companies, and research and development (R&D) organizations who for certain reasons have more developed explicit knowledge in particular fields. It is often common mistake that explicit knowledge assumes superiority over tacit knowledge and in many cases, indigenous knowledge which form the bulk of tacit knowledge are rendered insignificant, sometimes even by farmers (Waters-Bayer, 2006).

Most knowledge management programmes have been studied in the corporate sector and are focused on programmes that relate to ideas of the knowledge economy, organizational efficiency, structural and cultural change, learning organizations, and financial profit (Hovland 2003). Consequently, recommendations focus on organizational practices such as information technology, communities of practice, expert systems, and intranets and other networking tools and communication technologies (Hartwich, *et al.,* 2007).

Knowledge management in developing country agriculture, however, has a distinct connotation in that farmers often require knowledge that can improve their livelihoods. Extension and development agencies try to assist farmers to access this type of knowledge but they are often biased to a certain trajectory of development, e.g. new plant varieties or processing technologies, where they have comparative advantages and can leverage funding. Poor farmers, however, would not feel comfortable to absorb one type of knowledge promoted by a certain technology provider if they have not cross-checked its usefulness with other farmers, community members and authorities, other development agents and even with product buyers (Leeuwis and van den Ban, 2007).

3.0 CHAPTER THREE: PROFILES OF THE STUDY AREA

This section provides general overview of the geographical, demography, economic and rural agricultural systems in the Uganda; Specific reference is made to Lira district where the study was conducted. The production of vegetable oilseed crops and sunflower in particular is emphasize in the discussion

3.1 Geography

This study was conducted in the Ugandan district of Lira. Uganda is a landlocked country located astride the equator in the Eastern region of Africa. It is bordered by Kenya to the East, Tanzania and Rwanda to the South, Democratic Republic of Congo to the West and Sudan to the North. The total area covered is approximately 241,039 km^2, 81% of which is suitable for agriculture. The remaining 19% is constituted by lakes, rivers, swamps and forests. Uganda exhibits an equatorial climate with mean annual temperatures ranging from 18-30^{0}C. The precipitation is fairly reliable varying between 650mm in the semi arid North-east to over 1800mm per year along the shores of Lake Victoria in the south, the highland areas in the west and east, the mid west and parts of the northern regions. There is a bimodal rainfall pattern in the southern part with peaks occurring between March-May and around August to early November with no pronounced dry season. The Northern and Eastern part however, is punctuated with a marked dry season from mid November to early March and protracted rainy period with only mild interruptions around July (MLWE, 2002). The climate over the broader part of the country, promotes the production of a variety of tropical and subtropical agricultural products throughout the year. Some temperate crops however also do flourish in the highland areas. The soils and climate permit low in put low output farming characteristics of subsistence smallholder farmers who dominate the farming sector.

Lira District which is the study area is located in Northern Uganda and is bordered by the districts of Oyam in the north- east, Pader in the North, Moroto, Abim and Amuria in the East, Dokolo in the South and Apac in the West. Physically, the district lies between Latitudes 1^o 21'N, 2^o 42"N and Longitudes 32^0 51"E, 34^0 15"E, covering approximately a total area of 4,581.52 km^2. The district generally has flat terrain (900-1000masl); the highest point is at the peak of Mt. Otuke (1,600 m above sea level) in the extreme northeast of the district.

The climate is continental, modified by the large swamp areas surrounding the southern part of the district. The rainfall in the district is bimodal with one peak during April-May and the other in August-October. The average annual rainfall in the district varies between 1200-1600 mm decreasing northwards. The rainfall is mainly convectional and normally comes in the afternoons and evenings. The average minimum and maximum temperatures are 22.5^{0}C and 25.5^{0}C, respectively. Absolute maximum temperature hardly goes beyond 36^{0}C, and absolute minimum hardly falls below 13^{0}C.

The Equatorial Trough which brings rainfalls passes over the district. The South easterly which also brings rains to the district passes over Lira. Land and sea breezes are common in the district. Wind run is low (1-4m/sec) during the rainy season and moderate (4-8m/sec) during the dry season.

3.2 Demography

The national population and housing census of Uganda in 2002, revealed 24.2 million inhabitants living in the country. The current projection however stands at 29.8 million inhabitants stemming from a growth rate of 3.4% recorded at that time. An estimated

87% of the population are rural dwellers, unevenly distributed geographically and earning their livelihood mainly through Agriculture. The urban minority (13%) live mostly around Kampala the capital city and other up country municipalities and towns (UBOS, 2008). According to AfDF (2006), Uganda's population growth of 3.4% pa, is the third highest rate of population increase in the World, with each Ugandan woman giving birth to an average of seven children. The high population growth rate is currently undermining developmental efforts to boost economic growth, achieve universal education, reduce mortality and improve health. The national average population density is 127persons/km^2 with average holding of 0.7ha of arable land per person. The rural population density is highest in the Eastern Region with 226 persons per km^2 (UBOS, 2008). If the population continues to grow at the current rate, the average available arable land will shrink to only 0.26 ha per person by the year 2030 (AfDF, 2006).There is however no land constraints in any part of the country and there is scope for expansion in area for prevailing agricultural practices.

Northern Uganda where the study area (Lira district) is located has the lowest population density with about 49persons/km^2 and average land holding of 3.5ha/household. The population of the district is estimated at 530, 342 people with 50.1and 49.9% being females and males respectively. The rural population constitutes 83.1% (440,561) while 16.9% live in the urban area. The population growth here is however highest estimated at 3.7% compared to the national average of 3.4% (Concuss 2002)

3.3 Economy and Livelihood

Uganda has in the recent times been recognized by donors and governments working together as a successful story for providing conducieve environment for economic growth and poverty reduction (Ellis and Bahiigwa, 2003). In spite of the decades of protracted civil and political unrest in the aftermath of independence, Uganda's economy has since 1990s been undergoing rejuvenation through both direct and indirect investment. The government has facilitated foreign investment with attractive incentives such as tax holidays, reduction on export duties and removal of trade barriers and have as well streamlined import and export procedures. The economy has been liberalised, with Government implementing measures to take control for running businesses out of public sector and giving control to the private sector. Karuhanga (2008) notes that real gross domestic product (GDP) grew by an average rate of 6.9 percent per annum during the period 1991 to 1999. During the same period Ellis and Bahiigwa (2003) wrote that the improvement in economic performance resulted in a drop in the proportion of the population living below poverty line from 56% in 1991 to 35% by 1999 and recently the trend has continued to improve with about 31.1% of the national population living below poverty line (UBOS, 2008).

While these figures provide an impressive economic performance, it does not reflect the actual situation especially in terms of food security and the distribution of income and resources within the national territory. There is a gross imbalance in regional distribution and between rural and urban areas. The lowest income groups are concentrated in rural areas and in the northern and eastern parts of the country (UBOS 2006). Many of the rural poor have not benefited from economic growth and remain outside the monetary economy, mainly producing both food and traditional cash crops for subsistence. Food crops still accounts for at least 65% of the agricultural GDP and agriculture continues to be characterized by low productivity (MAAIF, 2000). Despite agriculture being a major economic contributor the inequality in income distribution further transcend into the sector forcing it to lag behind all other sectors in development (UBOS, 2006). For over a decade the annual national budget allocation in the agricultural sector stagnated at a meagre 2-4% which is the lowest amongst the sectors. This situation retarded rural

development as means of production remains rudimentary and with limited capacity for investment in agriculture by the rural population.

In the case of Lira district where the study took place, the economy is basically subsistence with 81% of the population engaged in subsistence farming. Industrialisation is very low with only 3.1% of the population involved in cottage industries. Poverty levels are high in Lira with 53% of the population living below the poverty line, (hard core poor) compared to 31.1% of the national average (Lira District Local Government, 2007). Cottage industries and subsistence agriculture are key economic activities and main source of livelihood. Commercial farming, property income and formal employment are also alternatives upon which small proportion of the populations derive their livelihoods (table 3.1).

Table 3.1: Major Economic activities and Sources of Livelihood of household in Lira district

Distribution of Main Economic activities by households & Population				Major sources of livelihood by households and population			
Activities	No.	Pop'n	%	Activities	No.	Pop'n	%
Carpentry	760	3441	0.6	Subsistence Farming	86478	402322	81.8
Metal works	185	781	0.1	Commercial Farming	373	1880	0.4
Leather Products	339	1208	0.2	Petty Trade	2343	10775	2.0
Mechanical repairs	723	3419	0.6	Formal trade	503	2387	0.5
Clay works	971	4121	0.8	Cottage Industry	3290	15670	3.0
Food processing	36778	167915	31.7	Property Income	487	2089	0.4
Embroidery crafts	1895	8833	1.7	Employment Income	8258	33386	6.3
None	65737	292959	61.1	Family support	6309	20713	3.9
Others	2113	9905	1.9	Others	1916	6079	1.1
Not Stated	2482	6680	1.2	Not stated	1981	3611	0.7
Total	111983	530342	100		111938	530,342	100

Source: Three year rolling district development Plan 2005/06-2007/2008, Lira district Local Government, adopted from the national housing and population census 2002

Pop'n = Population Clay works = Bricks, tiles and pottery

3.4 Agriculture and Rural Development

Agriculture in Uganda is described as the backbone of the economy because of its direct influence on economic performance. It employs over 80% of the population mostly in rural areas and constitutes up to 85% of the national export earnings. During the fiscal year 2005/06, agriculture contributed up to 36.1% of the GDP (UBOS, 2006). It is also the main source of raw materials to the mainly agro-based industrial sector

comprising of cotton ginning, coffee hulling, tea processing, grain milling, meat processing, tea processing, sugar production, textile mills soap industries, edible oil industries, cigarette manufacturing, diary and leather products manufacturing (MAAIF and MFPED, 2000).

Overall agricultural sector in Uganda is characterized by a dual pattern of non-marketed food production for local consumption, dominated by banana, maize, finger-millet, sorghum and beans, and marketed cash crops (coffee, cotton, tea, sugar, tobacco, including some traded food crops), and livestock products. Tea, sugar and coffee are supported by large plantations that provide continuity of supply of a known quality. Table 3.2 and also appendix 2 shows the areas planted and production of selected key crops in Uganda.

Traditional low-input cultivation, with minimal fertilizer and agro-chemical use and no soil and water conservation techniques, is common practice. High input/improved management systems yield very good returns, but are affected by the high costs of inputs itself and labour. The demand for labour is high (243 person days) and the costs are likely to be beyond the means of the average subsistence farmer (AfDF, 2007). Most rural production is labour-intensive, with labour costs accounting for 52% of the value added in agriculture.

Little value addition takes place at the primary production level, contributing less than 2% of the total value addition in the economy. There is great potential for producing various crops in response to markets, observing required standards and adding value before exporting commodities. There are therefore opportunities of accessing better prices and creating employment from local interventions in the value chain through agro processing, storage, packaging and labelling, branding and marketing. Presently most of the traded commodities are unprocessed and fetching low prices for farmers and exporters.

In Lira district, the traditional economic (cash) crop has been cotton which, in recent years had shown marked decline both in area planted and production. The decline is attributed to uncertainty of prices largely determined by the ever fluctuating world market. Some hitherto non-traditional economic crops have taken over the role of cotton. They are sunflower, simsim, rice, maize, beans and groundnuts. These crops are in high demand and have taken both the traditional food as well as the cash crop roles. Other crops that are coming up as economic crops include, soybeans, cassava, potatoes, fruits mainly citrus and mangoes. The major crop production for the district

Cattle used to be a big source of wealth as well, but this has totally been eroded by rustling of 1987- 1992 and 2002-2003. The rustling activities done by the Karamojong tribes in the North-eastern Uganda virtually depleted the stock of animals from 316,000 in 1983 to about 3,700 in 1990. The combined activities of LRA rebels and Karamojong escalated the loss of livestock and chicken which are part and parcel of the livelihood of the rural communities in Lira. Cattle are used for traction, source of food (milk and Beef), and cash through live and carcass sales as well as for cultural values. Agriculture as the backbone of the Lira economy is generally changing from subsistence way of life to a commercial one.

Table 3.2: Area Planted ('000 Hectares) and Production ('000 Metric tonnes) of Selected Crops of Uganda (1998-2007)

Crop	1998		2001		2004		2007	
	Area	Prod'n	Area	Prod'n	Area	Prod'n	Area	Prod'n
Beans, Dry	645	387	731	511	812	455	870	435
Cassava	356	3,204	390	5,265	407	5,500	371	4,456
Coffee, Green	265	205	264	197.4	264	170.1	265	168
Groundnuts	200	140	208	146	221	155	235	165
Maize	616	924	652	1,174	750	1,080	844	1,262
Millet	401	642	389	584	412	659	437	732
Seed Cotton	175	45.1	250	60	180	78	155	75
Simsim Seed	179	77	203	102	255	125	280	168
Sorghum	280	420	282	423	285	399	314	456
Soybeans	80	92	127	144	144	158	147	176
Sunflower seeds	66	57	78	76	149	164	173	190
Sweet Potatoes	544	2,176	572	2,515	602	2,650	578	2,602

Source FAO statistics, available at www.fao.org

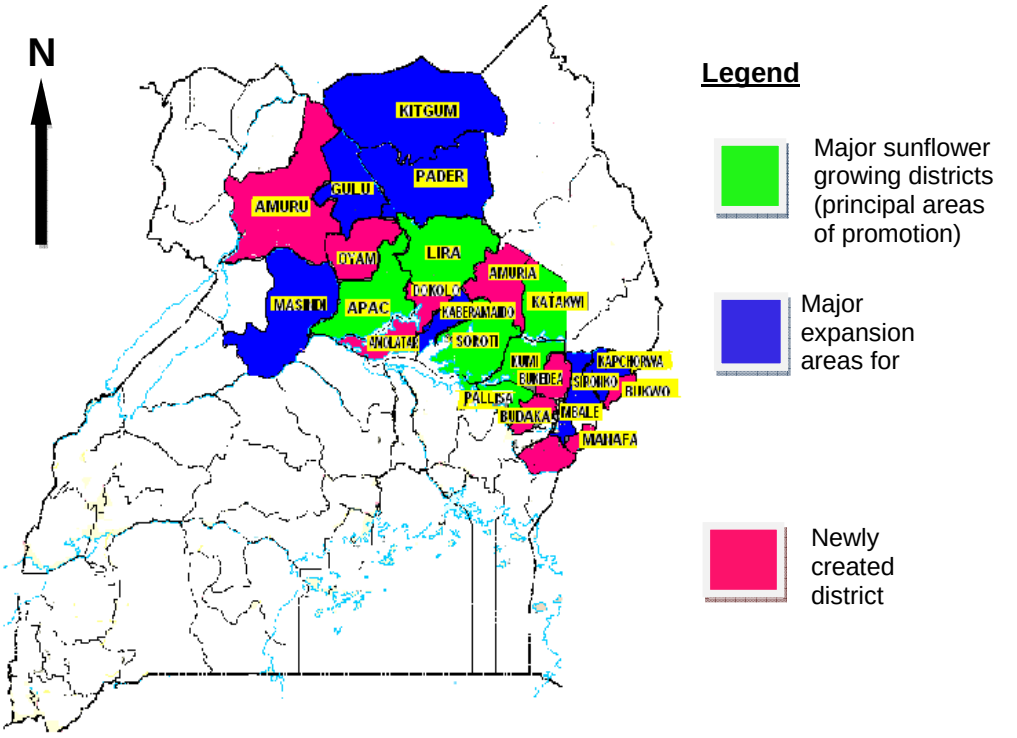
3.5 Vegetable Oil crops subsector

Historically, the oilseed subsector in Uganda has been dominated by groundnut and simsim and subsequently cottonseed. Cottonseed has generally been the major raw material crushed for edible oil and for use in soap manufacture. The production of cotton however, declined in the mid 1970s (periods of political and economic crisis) and reduced the cottonseed available for crushing to negligible quantities. Groundnuts however have never been used as major source of vegetable Oil for reasons that it is too valuable as whole nuts for direct consumption and export when in surplus. Similarly, simsim has seldom been processed for oil commercially as the high price for whole grain generally rules out crushing (IFAD, 1997). With the exception of the Sheanut-butter, vegetable oilseeds are currently being derived mainly from sunflower and soybeans.

Production of oilseed crops is mainly concentrated in the northern and eastern districts although the crops can be grown throughout Uganda (figure 3.1). This is partly due to the more suitable agro-climate for the crops as well as being a major component of the daily diet of the local population in the two regions. The production of oil crops is generally characterised by extremely low levels of management especially simsim in which 75% is intercropped usually with millet, sorghum, cassava and pigeon peas. Groundnut and soybean production generally involve relative use of inputs usually in the form of improved varieties and *rhizobium* especially for soybeans. Sheanut occurs naturally and largely uncultivated. The fruits are usually collected after falling from trees, dried and the edible oils extracted. The collection and extraction oil from Sheanut provide an economic and nutritional buffer especially during the periods of drought and crop failures. The Sheanut oil is also used natural as an important skin ointment.

Production of raw material in the vegetable Oil industry has shown an upward trend since 1997 when intensive promotion of sunflower production. By 2001, importation of

raw material had dropped to 60 – 65% from a level of 95% in 1995. In 2001, 160,000 MT of locally available oilseeds mainly from sunflower were crushed and have continued to show a positive trend. This trend has reduced the reliance on imports to meet the national edible vegetable oil requirements.



Source: Vegetable Oil development Project, Kampala

Figure 3.1: Map of Uganda showing major oil seed production areas

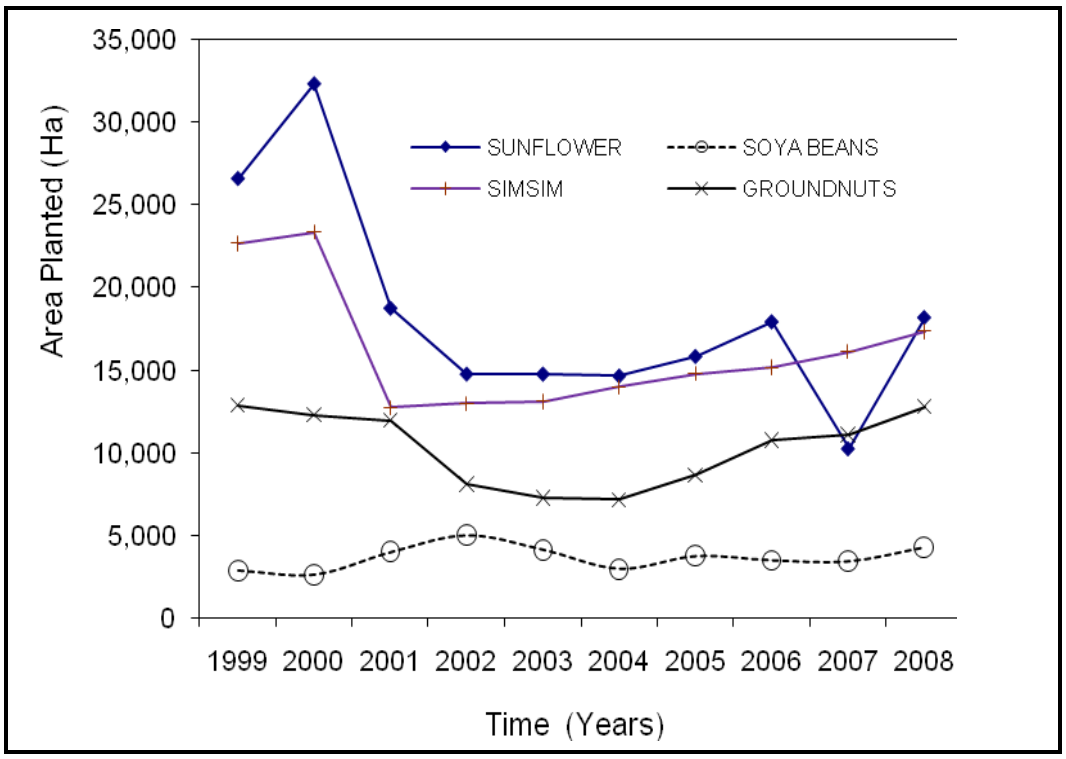
3.6 Sunflower production in Uganda

Sunflower is recognized as a non-native crop in Uganda. Although its production dates back to unrecorded dates, it is assumed to have been introduced by early missionaries with official involvement during 1940s. Sunflower was revitalized by Catholic Church groups in Gulu and Kitgum districts with the installation of two oil presses in 1983 and the importation of seeds from Kenya (IFAD, 1997). At this time the production remained limited and informally conducted as an intercrop with a minor role. The significance of sunflower remained obscured as there was no means or knowledge for utilization of the crop and sometimes the crop was left in the field unharvested as a result.

Interest in sunflower production has risen rapidly in recent years after the decline in cotton that caused the lack of seeds from which to extract oils. With the support of USAID and the US NGO ACDI/VOCA, a program of oilseed development based on the sale of imported sunflower and soybean oil was initiated in 1994. At that time about 95% of the oil consumed in Uganda was imported; 7 years later only about 60% was imported and the figure continues to drop (Dorsey and Wagubi, 2002). This change is largely a result of the efforts of a number of actors. The major ones are the government of Uganda through the Vegetable Oil Development Project (VODP). The overall goal of the VODP is to expand production of oil bearing crops in Uganda, with particular emphasis put on reaching out to smallholder farmers and organized private sector processors. The other key actor is the Uganda Oilseed Producers and Processors Association (UOSPA). UOSPA was formed as an association of farmers and private oil

Millers that acts as a platform through which private members can collectively voice their concerns and promote their issues of interest. VODP and UOSPA aggressively promoted sunflower growing through various activities which eventually show the number of farmers engage in sunflower production and area put under sunflower rapidly increased.

The area of sunflower production is not well documented, however estimates suggests that sunflower has increased from less than 5000ha in the 1980s to about 57,000ha in 1996. A more recent figure estimates the total acreage of sunflower production country wide at 298,642 Ha (VODP, 2007). Data from the agriculture department Lira district local government shows that a total of 10,200ha of land was devoted to sunflower cultivation in 2007 and taking the lead position amongst all oilseed crops (figure1). There has however been some decline compared to previous years the cause of which being twofold: The displacement of person stagnated production in that the farmers were temporarily settled in internally displaced persons camps where they could not access their lands to cultivate. Secondly there were two new districts curved out of Lira, which means production figures in these new districts have to be left out during computation. The decline is how ever not restricted to sunflower but rather affected all crops as shown in figure 3.1.



Source: District Agriculture Office Lira

Note: Data for 2007 & 2008 is partial covering only the first seasons in each year

Figure 3.2: Trends in Area Planted with major oilseed crops in Lira district (1999-2008)

4.0 CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter presents findings of the study. It starts by discussing the stakeholders of the value chain in the district and proceeds to point out particular innovations that have been developed or is in the process of being developed by various stakeholders. The chapter conclude with a discussion of linkages/networking and the sharing of knowledge and information amongst stakeholders.

4.1 The Value Chain Stakeholders

Quite a number of actors were found playing different roles in the sunflower value chain in Lira. The conduct and behaviour of these actors influences the overall performance of the value chain. A detailed examination of the conduct and behaviour of each actor is highlighted below:

a) Farmers

Small-scale farmers dominate the chain producing over 98% of the marketed grains; the balance of 2% being met by large Millers and progressive farmers combined. The farmers produce sunflower as the principal cash crop alongside the otherwise food crop traded for cash. The methods of production are rudimentary using simple tools such as hand hoes and in some cases ox-ploughs. The practices are generally labour intensive and productivity is low. In most cases they work in small groups to access extension and other support services and sometimes in exchange of labour for production. Recently some farming groups started collective marketing of sunflower and mobilizing other smaller groups to follow suit. There is the merger of these groups into a cluster under aimed at forming an umbrella association or cooperative to strengthen their position as producers in the chain. They informally have their network upon which new knowledge ideas and information passes.

b) Agents/stockist

These were mainly found to be rural traders in various locations within the district. In some cases the agents are leaders of specific farmer groups or individual farmers whose production level is relatively higher or opinion leader in given localities. Given their proximity to the farmers and access to storage facilities, they are often chosen by urban traders to act as agents during crop procurements. They are a direct link between produce dealers, Millers and sometimes input dealers who are mainly based in urban areas. The urban traders provide these agents with funds at the peak harvest seasons. The agents then traverse villages on bicycles making arrangements with farmers to deliver at particular storage points and sometimes procuring from the rural periodic markets. The agents operate on a commission basis, although discussion with farmers showed that the agents actually collude to drive down farm gate prices and often cheat the traders (diversion of funds and produce) as well as farmers (underweight). The agents used both approved and unapproved weights and measures. The rampant usage of unapproved weights and measures results in the exploitation of farmers due to loses in terms of quantity.

The stockist handle mainly inputs but a few at times double as agents for procurement of produce for the urban based Produce dealer or Miller. Two categories of stockist were identified. Those affiliated to UNADA and individuals engage in the sales of input. The stockists affiliated to UNADA are advanced inputs of known quantities upon payment of 10% deposit on quantity to UNADA. They sell the inputs to farmers and pay the cost equivalence to the organization at an agreed phase. The input stockist has to

generate factual information of farmers' needs which he or she presents to the urban based input dealer before the inputs could be advanced. UNADA in addition provides training to stockist on handling and management of inputs especially seeds and agrochemicals. Individual traders however, have direct negotiations seed companies in most cases as agents. They are advanced inputs based on assed demand from the community; as such they make contact with farmers on regular basis. No specific stockist or input dealer is specialized in sunflower related inputs only.

c) Urban Traders/ Middle men (Produce buyers)

Urban traders mainly based in Lira town, upcoming trading centres within the district and from neighbouring districts procure crops mainly through the agents. Although most of the urban traders handle a variety of crops a few are specialized in one or two of the crops. Sunflower was found to occupy a special case because of the always assured market. Lira urban-based traders on the whole handle much bigger volumes because they have established extensive networks of agents in and around Lira and all the neighbouring districts.

The prices for produce offered by the urban traders to farmers are largely influenced by the supply and demand conditions as well as prices at which they would sell the products to the Millers. The prices payable vary between the peak and off–peak harvest season and crop with better prices being offered during the off-peaks. However, stiff competition amongst the traders during the marketing seasons exists especially when traders from distant places including those from neighbouring countries come in to purchase the grains. Premium prices for quality products are nonexistence a fact often attributed to the poor quality of grains. Whereas Millers and produce buyers attributes poor grain quality to farmers, it was revealed by the both farmers and extension workers that Produce Buyers and Millers do not care about quality. They instead use issues of poor quality to cheat farmers by offering lower prices and as such some farmers indulge in adulterating the grains in order to compensate the loss.

> Produce buyers and Millers are the same. They encourage poor quality by sometimes paying better prices for bad quality grains while deliberately making false claim of poor quality. They don't check as it is their cheating tricks.

The most common crop quality problems reported were the rotting due to moisture, grits, sand and inclusion of surf. The concern for quality of produce from farmers was documented by Dorsey and Wagubi (2002) who attributed the problem to the limited knowledge and resource capacity of farmers to take quality measures seriously.

d) Large Scale Trading Companies

Mukwano Oil industry (AK Oils ltd) is the largest trading company promoting production and marketing of sunflower and other oil crops in Lira and the surrounding areas. Mukwano carry out milling and Extension services provision on sunflower and as such is a major buyer of grains from farmers. Recently they initiated the importation and marketing of improved seeds (PAN 7351) hybrid from South Africa and have continued to do so for now three years running. The company work directly with farmers and guarantee markets for their crops under contractual arrangements. They provide extension services and sometimes transport for farmers that have bulked their produce. The contract arrangement is however skewed in favour of the company. Other locally based companies have engaged in procurement and purchase of grains. A few like

Akonykori and Gurunanak Oil Mills have championed the distribution of seeds to farmers though without formation of any contractual arrangements. Gurunanak in particular injects funds in seeds through stockists based on the understanding that the stockists have to pay the cost of investment costs on the seeds without interest. This is aimed at ensuring that farmers have increased access to seeds in order to increase production of sunflower grains to meet the demands of the milling industries.

e) The Non Governmental Organizations (NGOs)

Sunflower has not been directly supported by many NGOs like other crops. Other than the Uganda Oilseed Producers and Processors Association (UOSPA), no other NGO has specialized in sunflower activities. UOSPA is engaged in provision of extension services, seed multiplication and distribution as well as in farmer group mobilization and development. UOSPA work in consultation with the government controlled Vegetable Oil Development Project (VODP) at national level and the government Extension system at district level. AT- Uganda, the NGO which once championed the promotion of sunflower production and distribution of seeds and village level oil processing technologies has broadened its operation. They now handle the wider spectrum of input supply through their commercial unit (Uganda National Agro-Input dealers Association (UNADA). Other NGOs like Lira District Framers' Federation (LIDFA), Lango Organic Farming Promotion (LOFP) handles sunflower only if an opportunity to do so occurs or even by coincidence.

f) Extension Service Providers

These exist in three categories according to the authority responsible for deployment. The public extension workers who are employees of the District Local Government continue to perform in general extension services required for all other crops alongside sunflower. They are posted at subcounty levels and have to deal with all categories of farmers. In the case of sunflower they are facilitated specifically under the vegetable oil development project to carry promotional training, mobilization and group development, to farmers at community level.

The second category of extension service providers is that provided by an NGO, the Uganda Oilseeds Producers and Processors Association (UOSPA). UOSPA has a secretariat that is supported by representatives and extension staff who carry out the day-to-day implementation and monitoring of activities in the district. The extension staffs are a pool at the district working with specific farmer groups in rural communities. UOSPA also undertakes seed multiplication and distribution. It conducts Trainings of Trainers (TOT) for the local extension staff in seed production technologies, trains seed multipliers, supervises oil seed multiplication, follows up seed certification, as well as cleaning and packaging seeds prior to distribution.

The third group of extension providers are those deployed by the private companies especially Mukwano. The extension workers in this category are specialized in sunflower with current emphasis on hybrid (PAN 7351) variety. These also work with specific farmers irrespective of groups but in small target areas than either of the UOSPA or local government structures. The deployment of this category of extension workers do not follow the administrative structure of government and do not consult with government extension agents. They work with agents in particular sites where they have contracts with farmers. Those without contracts or outside their site are not attended to. At each site there is established a coordinator who in essence monitors production and later on a purchase agent who is paid commission.

g) Vegetable Oil Development Project (VODP)

The government of Uganda with assistance from International Fund for Agricultural development (IFAD) established the vegetable Oil development Project (VODP) to oversee development in the oilseed subsector. The goal and objectives of the VODP have concentrated on expanding production of oil bearing crops in Uganda, with particular emphasis on reaching out to smallholder farmers and organizing private sector processors. The project implementation involved the establishment of the Vegetable Oil Development Council (VODC) chaired by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) to oversee and guide project implementation. The VODP Secretariat was also set-up in the MAAIF for the day-day management and implementation of the project. VODP collaborates with the local governments for targeted extension services; NARO for research in high yielding and drought resistant varieties and production technologies; UOSPA to ensure seeds availability, distribution and market outlets; AT Uganda for value addition through the provision of the ram press; and UNBS for the improvement of oil quality at the milling level.

4.2 Innovations in the Sunflower Value Chain

Owing to the fact that sunflower does a relatively new enterprise that has gained prominence in Uganda; there are reasonably some innovations in its value chain. The innovations identified were categorized into Product innovation, Process innovation, Management or Organizational and Service innovations. The categorization is defined by the general form, process of development and application of the innovation. In most cases the innovations were locally developed by different stakeholders in the value chain. There were also technological innovations imported by various Millers. The different innovations are discussed into the various categories as below.

4.2.1 Product Innovations

These constitute novel products that have been passed into economic or social networks of the value chain and are being used in the process, to improve the wellbeing of the stakeholders. A number of innovative products were identified during this study, some of which are yet at infant stages in development, while others have been passed into social and economic system of the value chain. The notables ones include

A. Oil Milling and Processing Facilities

i. Power Operated Oil mills

There were a total of 26 mills in the district imported mainly from Italy, India and china during the period starting 1989 to 2006. The install capacities of these mills range between 5-100mt per day and are concentrated within the town. Only one mill of 2mt/day capacity was introduced by FAO as donation in the rural area and is yet under installation. The biggest mill with capacity of 100mt/day is owned by Mukwano Oil Company which also has a refinery plant in the district. The introduction of motorized mills improved on the milling output but there has emerged stiff competition for grains to be crushed amongst Millers. Subsequently all the mills were found to be operating below their installed capacities and sometimes close down due to total lack of crushing materials.

ii. Ram presses

These were imported and introduced in the 1990s as a village level oil processing equipments to create option for value addition and increase production of oil for domestic consumption. Three models, first the U-press, then Ram 32 and recently

CAPU which are subsequent modifications of each preceding models were identified but with limited spread in communities. The use of these manual Oil press has actually become obsolete as they are out competed by the motorised mills. They were reported to be less efficient with low rate of output, strenuous to operate, lacking maintenance services and spares. The farmers could not wait to get cash from the slow operating equipments to settle their various needs. The subsequently opted to sell their produce without any value addition. Efforts to hire labour could not work as the labour costs are high. The individuals willing to offer labour for money were not readily available.

B. Seeds and other Production Enhancing Technologies

A number of sunflower varieties have been introduced into the production system (table 4.1). As a non native enterprise the early sunflower varieties were more ornamental and are believed to have been introduced by Italian missionaries in the 1940s. By 1989 these varieties had become adapted to the local environment and are now referred to as local varieties. Four of such local varieties were identified with farmers and were describe by the extension workers, Millers as well as famers as white, zebra (black with whites stripes), the dull black and the shiny black varieties. These varieties were of low oil content and have hard testa that was caused rapid ware and tear in oil pressing equipments (IFAD, 1997).

In 1991, the National research programme (NARO) released a thin shelled open pollinated variety “Sunfola” in response to the need for better varieties in terms of oil content and soft testa to ease milling especially using village level oil processing equipments. Sunfola has an oil content of about 40% and the yields are 10-25% higher compared to the local (IFAD, 2007). Sunfola gain prominence and is by far the most widely grown variety in the district until recently.

The coming in of Mukwano Oil milling Company subsequently led to the introduction of a hybrid variety (PAN 7351) in 2004, imported from South Africa. PAN 7351 competes favourably owing to higher yields endowed generally in hybrids. Sunfola however maintains the values of softer testa and high oil contents which are basically at the same level with PAN 7351. Subsequently other private companies have also introduced other hybrid varieties. Mt. Elgon Seed Company introduced Hybrid 8998 in 2006 and is yet to gain acceptance like PAN hybrid into the production system. These hybrids have however been tested by the national research organization in Uganda and approved for suitability and use as adapted varieties.

Table 4.1: Generic list of available varieties of sunflower in Lira district

Variety	Source	Year of introductio	Current status
White	Local	unknown	Limited use
Striped (Zebra)	Local	unknown	Still in use
Dull Black	Local	unknown	Limited use
Shinny Black	Local	unknown	Limited use
Sunfola	NARO	1991	Wide spread and use
PAN 7351	Mukwano (Imported)	2004	Wide spread and use
Hybrid 8998	Elgon Seeds Company	2006	New product, not common

Source: Interviews and literature information

Other production enhancing innovations that have been developed consists of herbal pesticide (Bio-rational) developed in response to a pest problem using locally available plants and soap products. There were two sets of the herbal concoctions formulated with products of different plant species namely:

- Chilies, Garlic and white laundry soap
- *Lantana Camara*, pawpaw leaves and white laundry soap.

The Innovation was developed consultative by NGOs EPOPA and LOFP and established as trial by Lango Organic Farming Promotion (LOFP) in an attempt to control pests of cotton and simsim. The use of this chemical on sunflower became apparent when butterfly larvae attacked emerging of sunflower in farmers in areas where LOFP operate. LOFP tries to minimise use of inorganic chemicals as promotes organic agriculture in the district in particular zones. The bio-rational is however, claimed to be effective on larva of boll worms which attack sunflower seedlings, cotton and simsim. The pesticide is currently under further tests to standardize for cataloguing amongst the pesticides by the national research laboratories.

C. Consumer products

i. Poultry feeds

This formulation is in use by Akonykori Oil milling company to raise poultry as additional enterprise to generate income for the company. The feeds are locally formulated and have not gained commercial recognition with many poultry farmers. The company acquired a feed mixer which failed to satisfy the requirement for feed mixing processes. The mixer was locally constructed but was returned to the designer when it could satisfy the miller, who has never made followed it up again. The company now uses a procedure which it developed locally to mix the feeds for his poultry farm. The feed mixing process started in 2001 and has continued to serve the poultry farm which the company supply eggs to consumers in Lira town and the region.

ii. Body care Lotions, sprays and Perfumes

These consist of a number of products that have been developed by Gurunanak Miller from Sheanut oil. The initiative started in 2002, till then Sheanut oil was only extracted traditionally for home consumption by the natives without any value addition. The development aimed at diversifying into the locally available oilseed subsector commodities to keep in business throughout the year. Sample pictures of the products is shown figure 4.1

Sources of photo: Author during data collection

Figure 4.1: Labels of different skin care Products innovatively produced by Gurunanak Oil Mills in Lira

The body care products have gained entrance in to the market but with prospects of being exported to foreign markets especially to the United States of America and Canada. The product is a sole initiative of the miller who also owns an oil mill with crushing capacity of 20mt/per day. Mukwano Oil Company also manufactures body lotion and laundry soaps but uses Palm oil which the company imports into the country. No other Miller or stakeholder in the district was reported of doing the same or similar type of activities.

iii. Plastic containers manufacture

These products are currently being manufactured by Gurunanak Oil mills as containers for cooking oil and body care products that he manufactures. The production came about because of the poor quality of containers that he was buying from other manufacturers. These products are currently not in commercial circulation. The manufacture currently recycles plastic wastes from households. This is attracting communities to assemble and avoid careless disposal of used or broken plastic containers and is significantly contributing indirectly to improved management of the environment.

iv. Sunflower oil as fuel

This is also an initiative by Gurunanak oil mills. The idea was generated to find alternatives to the predominant power load shading experienced. The products however is at trial stage but has produced quite impressive results. There is however, some modification to make especially in the generators and possible dilution with other fuel source. Sunflower oil has higher viscosity than common fossil fuels thus reduced efficiency as alternative source of fuel.

v. Mango Butter

This is also a trial product being conducted by Mukwano Oil Company but with impressive results. The product is intended to exploit the available mangoes which locally grow wild in Lira. The aim of this trial product is also to diversify into generation of alternative sources oil. Mango butter can be a substitute for oil palm butter currently being imported into the country. Such venture would also reduce crumbling for sunflower grains of which is currently being stiffly competed for.

General discussion on product innovation

As mention in the opening sentences of this section the generation of all these innovative products have been the efforts of the various stakeholders most of whom operate outside the formal research circles. The findings are in line with an earlier documentation by Oyelaran-Oyeyinka and Sampath (2007) that innovation processes do not necessarily result from deliberate formulation of scientific research programmes in the laboratory or in formal research centres. The trigger of the various innovations also varied from time to time within stakeholders. While others came out of curiosity, most were driven by the competitive forces in the market place. Market forces have been identified to trigger innovation processes by creating competition (World Bank, 2006). It is apparent that the 26 mills in the district are subjected to stiff competition and diversifying through innovative overtures appears to be an option.

The efforts by LOFP stood peculiar, partly in response to a competitive position in the market but also to curtail the pest problem. Production constrain such as this has been captured amongst the leading triggers of innovation (Waters-Bayer *et al.,* 2006). Efforts by LOFP to have the pesticide tested by a formal research is explained by Leeuwis and Van den Ban (2004) who stated that formal research scientist have a role to explicate implicit assumptions, knowledge claims and questions as well as creating a joint fact

finding mission and uncertainty reduction. Approval of the products would open ways for generating environmentally friendly and cost effective pest management options and could improve crop production and productivity. However, whereas the product developed by LOFP swiftly moved to significantly involve more stakeholders, there is certainly engagement and development of knowledge towards improvement of the product to gain entrance into use with modification. The apparent lack of knowledge and information sharing among the other product originators seems to play significant role in the chain. This may continue to jeopardise further development of innovations as the social net upon which such innovation emerge still remain incomplete, uncoordinated and fragmented. Agricord (2005) had already reported the uncoordination and fragmented duplication in the oil seed subsector in the Uganda.

4.2.2 Process Innovation

This involves the development and use of procedures or modification of facilities used in the process to improve performance at a particular point of the chain. Quiet often process innovation is generated through experience and creativity or concerns over a particular problem that is not being clearly addressed by what is available at a given time. Most innovations in this category were found with farmers than all other stakeholders. Extension workers and a miller each identified one innovation developed in the process. The contribution of farmers in this type of innovation is spectacular in that they based a lot on their experience and are in constant experimentation in the process. This view had earlier been advanced by Waters-Bayer *et al*. (2006) who noted that farmers have often conducted own experiments ahead of formal research and extension to allow them adapt farming systems and activities to local conditions. The following innovations as processes developed in the value chain.

a) Development of crop rotation pattern for sunflower production

This was developed by farmers to address their concerns for soil fertility depletion. Sunflower being a heavy feeder had in the recent past attracted negative sentiments claimed to be responsible for rapid soil nutrient depletion. Due to the role of sunflower as a substitute for the hitherto traditional cash crop cotton, farmers have developed a particular rotation pattern that enables them harmonize production of sunflower without significant deterioration of soil. The cropping patterns were found to follow soil conditions in terms of perceived fertility. Three fertility levels (low, medium and high) were described by farmers each with derived corresponding rotation pattern as shown in the table 2.

Table 4.2: Farmer derived Cropping cycle for sunflower under different soil fertility perceptions

Fertility Perception	Rain Seasons					
	1st	2nd	1st	2nd	1st	2nd
Low Fertility Soils	Legume	Sunflower	Pigeon Peas/ Millet intercrop	Cassava/ Fallow	Fallow/ Cassava	Simsim/Beans Intercrop
Medium Fertility Soils	Maize/ Beans	Sunflower	Groundnut/ Beans	Simsim Sunflower	Millet/simsim intercrop	Beans/ Cassava or fallow
High Fertility Soils	Sunflower	Cereal/ Pigeon Peas Intercrop	Legume	Sunflower	Millet/Pigeon Peas Intercrop	Fallow or Sunflower or soybeans

Source: Discussion with various farming groups
Note: 1st season: March –June; 2nd Season: August – November

This findings is in line with the work of Hoffmann *et al*. (2007) who noted that Farmers all over the world have developed manifold agricultural production systems and are constantly experimenting with new cropping patterns, i.e., new combinations of crops, crop rotation, spacing, fertilization, to name a few. Using the examples as quoted from Rhoades (1989), Hoffmann and colleagues also cited as innovative example how pioneer farmers who came from the Peruvian highlands to the jungle of Yurimaguas developed a new irrigated rice production system without any external support, quicker than scientists in the same area who attempted to establish a new farming system as an alternative to shifting cultivation. In the case of the sunflower production in Lira there was no information got during the interviews which showed any attempt to address the question of soil nutrient depletion in the sunflower production system by formal research scientists. The farmers have continued to develop their own farming systems with sunflower as extension workers advocate for use of external inputs such as manure and inorganic fertilizers. The uniqueness in this case is the observance of the fallow period which vary according to the fertility regime and incorporation of legumes in at short intervals. Fertile soils take longer while the less fertile soils take shorter fallow periods. This give time for the soil to rejuvenate its productive potential coupled with the legumes which replaced fixes nitrogenous nutrients in the soil.

The external inputs (inorganic fertilizers and compost manures) was acknowledged by all stakeholders interviewed to increase productivity as shown by various trainings and demonstrations conducted by extension service providers. The farmers have however, not adopted the use of fertilizers due to:

- Cost implication which is associated with incomparable returns to investment
- Limited capacity (knowledge and equipments) to handle fertilizers
- Inadequate access and availability of fertilizers from commercial sources to farmers and
- There was also the question of additional labour requirements in the process of fertilizer application which increases the cost of production.

Currently AfDF (2007) noted that the demand for labour in Uganda is so high that the costs are likely beyond the means of the average subsistence farmers. The non use of fertilizers in Uganda had also been reported by Laker-Ojok (1996) to have occurred since the political disturbance that distorted the input distribution and supply that forced productivity enhancement technologies into disuse.

b) Management of grains and straws during harvest and drying

According to extension agents farmers were advised to harvest and thresh on site. They harvested and heaped the heads for a few days at a given point before threshing. This was associated with many challenges such as ensuring quality, rodents, scattering the residue after threshing as manure. With the realization that subsequent crops planted on sites of residue had better performance but were restricted to points that had residue heaps. Famers decided to harvest and leave the harvested stocks standing onsite to rot. The farmers themselves note that when the stocks after harvest are allowed to decompose on site, would avoid clogging of the soil around the roots and thus providing better soil formation for the next crop to be planted. After harvest the stocks are therefore not ploughed immediately to ensure complete rotting of roots to disentangled clogged soils. The practice gradually was developed with farmers and supported the development of crop rotation patterns mention in (a) above. To eliminate the burden of field pest and to help get a clean harvest and adequate drying, the farmers used the remains of the standing stock in the field to dry the harvest instead of being heaped on

the ground. In this case the stocks are cut at about a meter high and the harvested heads hanged upside down (figure1) to ensure better drying to get quality harvest. This practice is also seen as a way of avoiding the rotting of sunflower grains as opposed to when left in its parent position in the stock. In the parent position the head collects water due to its shape and causes rotting of seeds hence poor quality. Rotten grains due to water soaking have been identified as one of the elements of poor quality in farmer produce (Dorsey and Wagubi, 2002).

Figure 4.2: Innovative drying of grains and management of straws at harvest by farmers

c) Use of Tarpaulins in drying and cleaning

This has emerged from farmers to address concerns over grain quality. Quite often Millers and other Produce buyers have complained of the poor quality attributed to poor handling of by farmers who unconsciously or deliberately adulterate the produce. Traditionally farmers dried their crops on bare ground sometimes smeared with cow dung or on flat rock surfaces with the results that the crops become dirty and adulterated with moisture, dusts, soil, grits and other foreign particles. Recently with increased access to plastic sheets (tarpaulins) from commercial sources, farmers have generally resorted to its use as the ground surface cover during drying (figure 4.3). Extension workers advocated and trained farmers on quality measures but did not show them any particular technologies that could be used to reach the quality specification advocated for. Drying of produce on the tarpaulins have also spread amongst produce buyers and Millers but still has to be modified as dusts blown by wind still do contaminate the otherwise clean produce.

Some Millers have however, constructed raised concrete open air podium on which they the clean and dry the grains before crushing to expel oil.

Figure 4.3 Ensuring adequate drying and Cleaning by inspection committee of a farmer group at work

d) Development of solar drier

This was found to be an initiative by a miller (Akonykori Oil Millers). The Solar drier has been observed to provide clean quality product as it does not only dry faster but also helps protect the seeds from moisture, dust and domestic birds once the crop is brought home or to the factory. Minimal dust and moisture in the seeds reduce cost of power as well as additional labour requirements. As an innovation in the sunflower value chain, it is however at its early stage and requires further experimentation to perfect its efficiency and effectiveness. Preliminary trials by the miller have shown that white polythene sheets constructed just 3ft above the seeds spread in an open yard would take approximately 30 minutes – to- one hour to fully dry for crushing. Its use is still with the company. According to the company manager, the use of this prototype drier had reduced cost of operation and the level of drudgery that was always of routine nature in the mills. It is cheaper and easier to construct but we they have not fully evaluated to give concrete information on its precision.

The technology and its associated knowledge is not passed into commercial use and no other stakeholder of the value chain was found using this technology.

e) Planting Operations

In the course of growing sunflower farmers learnt through comparison and their experiences with other crops to adopt related practices in sunflower cultivation. Such practices have gained application with farmers and have become routine in the sunflower production processes. The innovative practices that were identified are as below:

i. Soaking of seeds over a 24 hour period to planting:

The idea is borrowed from practices in rice production. In the case of sunflower farmers aimed at ensuring maximum germination and reduce damage by mice which is a common problem. In this situation the seedling emergence period before the burrowing mice could detect is shortened from 7 to 3 days. They argued that the mice and some bird species could track the rows at planting and eat all the seeds up until germination starts. By soaking maximum germination and desired plant population is achieved as the sterile seeds are detected before planting. The soaking therefore serves dual test of viability measure as well as a pest control strategy. This practice was found limited amongst farmers and 4/8 groups visited acknowledged they have no idea of the practice. The extension workers were equally not aware but one of them hasten to mention that it's because they often take such practices for granted and bears not much in the knowledge they require to disseminate to the farmers.

ii. Planting using ox-ploughs

The use of ox-ploughs is a replica of trainings conducted in the sixties on maize and groundnuts. It has resurfaced with sunflower system as a means of reducing labour needed, speeding up the work and minimising the destruction at planting by burrowing mice and birds. Using the ploughs, the furrows created by ploughs confuse the mice and birds which only realised the emergence of the seedlings. The seeds are stealthily planted in rows along furrows spaced at every 3-4 successive furrowing intervals. This followed the discovery that for every 3-4 furrows the approximate distance created corresponds very closely to a desired row spacing of 75 cm as recommended by research and extension providers. The ploughing depth is adjusted such that the required planting depth is achieved while with experience spacing between plants is estimated by foot length during planting.

iii. Use of planting Pegs

The farmers developed the use of pegs designed to replicate the manual seed planter in which a chisel shaped end is drill into the soil and the process of pulling it out of the soil paves way for the seeds to be precisely dropped and buried in the soil. This practice has two advantages: first it ridicules the mice and birds which are a common problem and secondly it ensures correct planting depth due to minimal covering with light soil just enough to allow easy emergence of the seedlings is achieved. This practice was reported wide spread amongst the farmer groups and confirmed by extension workers as being their own initiatives in sunflower production.

f) Integration of sunflower with other farm enterprises

This idea originated from the extension service providers aimed at maximizing the productive capacities of farmers using the limited labour force and land owned. Notable was beekeeping alongside sunflower. This provide for labour saving and enhanced income. It has been observed that sunflower only supplement the forage bulk that bees take as many other trees exists to provide forage for bees. The only particular association considered unique between beekeeping and sunflower production is the improvement in the grain filling which was fully acknowledged by farmers engaged in the practice. Initial complaints that sunflower kills bees have been observed by many farmers to be incorrect as through extension services the life cycle of bees had been made apparent to the farmers.

The practice is however, not wide spread and adopted by farmers a fact they attribute to shortage of land, fear of bees stinging especially passersby and children and the community at large.

4.2.3 Management / Organizational Innovations

There were different forms of organization and management developed amongst different stakeholders in the value chain. These were found unique internal differences even where similar structures are in place. An elaboration of the situation is discussed below.

i. The farmers

The farmers have in particular been operating in small (15 -30 members) localized groups that were initially mobilized by extension workers and NGOs. These groups enabled improved service delivery and increased number of farmers attended to. However the conventional leadership system in which a single spine of management structures were introduced into the groups and adopted without a bearing of the actual needs of the farmers. This did not sort farmers need for being together.

At the time of this study most of such groups were reported to have or are in the process of coalescing into clusters with new management and functional elements. The clusters were formed and subcommittees established to operate independently of the main administrative structures of the broad group. The subcommittees are set according to group activities and interests such as:

- Collective marketing, in which 5/8 of the farmer groups visited have formed marketing cluster where they seek to market together and have set group rules and regulations and subcommittees that are responsive and supportive to the members.
- Labour exchange limited to the smaller group status as a new subcommittee
- Quality assurance. Inspects members produce from field operation through drying and storage
- Financial management. Responsible for auditing and ensuring accountability of members savings and subsequent borrowing
- Village savings and loan scheme: operate small saving and loan scheme, and overseer of members welfare
- Production management committee responsible for sourcing inputs and desired technologies.
- Training and knowledge, extension services and liaison. Facilitation and linkage to other organizations for support

The operationalization of this new management and organizational strategies was developed in response to various concerns and problems. Their participation is enhanced and their capacities are becoming explicit. This further is on the route to improving their capacity to manage their resources.

ii. Produce dealers

These have formed themselves into organizations Lira produce dealers association to help them win contract, do business together and link with others in similar businesses. There were 50 members in the association with 20 of them being active. The association do network within themselves but also with others in other towns and neighbouring countries. They have formed informal but specific bondage (pseudo contractual agreement) with farmers in various areas to help them procure the produce. They also have established procurement agents and hire stores though on individual basis to buy for them produce. Such agents are paid commissions. They provide information especially on market and prices to the farmers on regular basis through radio and agents. The association however maintains a single spine leadership and management structures with chairperson and executive elected. The chairperson does most of the administration and liaison work. However, the association's focus is limited

by their capacity to create opportunities. Their strength relies on the availability of produce but lack the initiatives to support production.

iii. The Millers

Formation of organizations amongst Millers was found weak. They have not made effort to address common problems as they continue to operate as individual companies. Attempts to form a Millers association have not been effective as members have proven less cooperative. Out of the 26 existing Millers in the district, only 13 have managed to come together but continue to operate as individual companies. Individual company management style remained top secretes to the companies as they strive to address their challenges and opportunities individually.

iv. Extension workers and NGOs

The extension providers and NGO do not have any form of organizations apart from whatever institutional forms in which they operate.

4.2.4 Service Innovations

i. Millers and Produce Buyers

There were a few innovative service delivery mechanisms in the chain. These were very peculiar amongst Millers, produce buyers and producers. The Millers and produce buyers have established buying centres (points) in the various communities. In such communities they establish agents based on trust. Such agents is either advanced money to buy produce from farmers or if he or she can raise money on his own then he/she will have to buy the seeds from farmers and sell to large scale buyers at a price with small margin. Agents are paid commission if the work is successfully done. The arrangement provides for competiveness amongst buyers from where farmers receive a lot of market information. A net work for communicating messages especially on market and prices in other places have been created as a result. Where a good net work is fully established particular buyers have subsidized farmers especially on the cost of seeds for of other sunflower and other crops such as maize, simsim and rice. The subsidy normally takes the form of discount on prices for bulk purchase, payment of airtime on radio programmes to communicate particular information. In a circumstance such as this the services are taken nearer to the farmers and principally the remote areas which are hard to reach becomes accessible. The produce buyers provide transport services as well to collect the bulked produced.

A unique case was found with Mukwano Oil Millers in which Mukwano sells the hybrid seeds (PAN 7351) to farmers at a fairly subsidized price (half price) under a contract not have to sell the grains harvested to other Millers or produce buyers. The service delivery approach involve establishment of site coordinators by Mukwano who acts as a stockist and agent to monitor production and purchase of grains from farmers of the sites they signed contracts. The contract was rigid with no room for negotiation especially with prices that keep fluctuating due to competition. The terms of the contracts was not clear and biased against the interest of the farmers and only favours Mukwano as the farmers reported. Because of the difficulty experienced in the arrangements, farmer group members were disintegrating and creating management problems. To maintain group cohesion members generally agreed to pulled out of the contract and also pressures from other Millers forced Mukwano to drop the contract arrangements and instead increase the price of seeds from previously Uganda shillings 7,500/= per kg under contract to shillings 11,000/= without contractual arrangements. The exchange rate for Uganda shillings to euro is 2500:1. Some of the difficulties were expressed by members in the quotes below

> It was because of the need for better seeds that Mukwano had to cheat us but now that we have acquired the seeds without their contracts we don't we sell profitably at the going market rates.

> "We had to hide most of the harvest and give them 2-3 bags because they cheat us when it comes to buying. The price they offer is always small with profit margins that could measure with those who sold in open market. We sell to others buyers with better prices after clearing convincing that we given all according to the contract terms. We give the two 2-3 sacks to keep us in good relationship so that we can

ii. Farmers

The farmers who have mobilized themselves have constructed or are in the process of constructing their own storage facilities. Of the eight groups visited, 4 have their own stores either rented or voluntarily donated by a member of the group. Two of the groups have procured land and moulded bricks to help make a construction of the produce store. This is aimed to help them stock and sell at the right time when prices and reasonable. In one of the groups interviewed, they plan to organize all other small groups within their neighbourhood to stock and for those who will urgently need money would have to sell their produce to the farmers' group from which it will be sold at a later date.

In one other case the farmers plan to acquire a milling equipment to enable them add value to their produce and sell as semi finished products to Millers who can do further processing. This was found in 2 of the eight groups visited and it's in these groups that have initiated a village saving and loan scheme and mobilized other small groups for a merger. They have however decried the use of ram presses which were supplied for being too slow with very low output, strenuous and lack spares to cater for ware and tare. The argued that hiring labourers to mill for the group is expensive and could not match the market demand. They preferred subsidy on motorised equipment as starting point to improve on their profit in sunflower production.

4.3 Linkages, Communication and Sharing of Knowledge and Information amongst Stakeholders

The different stakeholders of the chain provided different situations in formation of linkages, communication and modes of knowledge and information flow. The situation as per each stakeholder category is presented in proceeding sections. This is subsequently followed in discussion remark in view of the general situation.

4.3.1 Farmers

At farmer level the internal communication between groups and clusters is elaborate and frequent providing for mutual understanding of the needs for a particular technology, practice or knowledge. Knowledge circulation and management is informally conducted but is more enhanced and responsive with formation of farming groups and clustering of the already formed groups.

Farmer Linkages to other stakeholders are generally weak and sporadic targeting sales of grains or purchase of inputs from stockist or agents. The farmers reported that they

make telephone calls or send their representatives to produce buyers when they want to sell the grains. This observation was confirmed by the produce buyers and all the Millers interviewed.

Farmers significantly communicate with extension workers whenever the later visit them. The communication is only limited by the fact that extension visits are irregular and limited to particular farmer groups or clusters. Communication with extension workers is interactive and supportive to the technical needs of the farmers. The use of extension workers was reported effective but have tended towards farmer group development, and technical information regarding agronomic practices and post harvesting handling. This does not give room for farmers' experiences to be included in development of new knowledge. The extension workers interviewed confirmed having provided knowledge and information to farmers regarding production activities without considering the farmers' point of view.

4.3.2 Extension service Providers

Extension agents themselves have not realised the need for networking and formation of linkages in light of their work. The only attempt for collaboration was at the initial stages in which government extension workers were facilitated by an NGO (AT-Uganda) and currently by the vegetable oil development project (VODP) to train farmers on sunflower production practices and to promote village level Oil presses (ram presses). Though there are different extension organizations such as the conventional government, NGO (UOSPA), private (Mukwano Millers) and the semi private (NAADS), they all use the approach of regularly visiting and training of particular farmers normally in groups of 20-40 members and setting demonstration. The operations of these extension workers are in most cases independent of each other and biased in favour of the interest of their individual organizations. They often replicate their services and sometimes the flow of information is distorted leaving farmers at cross roads. This fact confirms an earlier observation by Agricord (2005) that the value chain actors are formally independent and uncoordinated and quite often duplicates and contradicts each other. The network amongst the actual extension workers is informal and weak to support farmers' interests. A quote from a government extension worker to illustrate the nature of linkage is indicated in the box below.

> We only share information and specific data with UOSPA but there is no particular linkage and coordination amongst us. It's difficult to work with Mukwano staff as their management do allow for collaboration; they rarely share information with us.

Extension workers were however recognized by Millers, farmers and produce buyers as being the best avenue to reach farmers. These they attributed to the extension workers being neutral and technical people who minimise or avoid conflict of interest and misinformation.

4.3.3 Millers

Linkages and communication is near absent amongst the Millers, it is just a competitive business atmosphere. Knowledge sharing and information flow is fragile, near absent and targeted at outcompeting others in the business. Their linkages only come in when particular nature of services or action directly affects their operations for instance with the quality assurance body; the Uganda National Bureau of Standards (UNBS) and local authorities for taxation. Their own efforts to form an association are weak as they could not be mobilized easily. Currently there is a relatively loose association which

tend to function only during crisis such as when they are over taxed or when new players tend to come in with approaches that undermined their profit margins.

Defined linkages are with farmers where they use agents and rented stores in remote areas to facilitate proximity of farmers to selling points. The network of agents provides market information to farmers according to what the miller intends to pay for the grains from farmers.

Mukwano, the largest miller tried to establishing contract farming with farmers but eventually collapsed as the terms of the contracts remained biased in favour of the Miller. According to a discussion with a group that had contract with Mukwano Millers, the farmers failed to cope up with the terms and the way the operation of contracts were being carried out (quote in the box below).

> Mukwano gives seeds and pays you with plastic utensils such as chairs, bathing basin, jericans and plates or cups from which they overcharge and nearly take all your produce and you get no income to invest. They lie in the contract secretly but because you have signed innocently you lose. We have this year refused the contract and we shall not allow because it was even making our group weak as members were running away from their homes in fear of Police.

However, such arrangements would have been an alternative way to ensure farmers get incentives and capital to invest in production provided it was for the common vision of the actors. Even the quality of produce would be guaranteed as farmers would be trained to respond to specific terms and conditions which they could understand.

4.3.4 Produce buyers

These have their own internal association and members also network individually through agents to farmers upon which knowledge and information is shared. Produce dealers are a member of the business body, Lira business forum formed purposely to build the capacity of all engaged in the different types of businesses in the district. The buyers through their association also have networks with Millers in other districts in Uganda and in neighbouring countries where they sell the grains. The use of agents has however formed critical linkages between farmers and produce buyers.

> We have agents just like Millers throughout the district and neighbouring areas. The agents are our links to farmers and are very critical in our business. We pass market information to farmers through the agents and that's why we can compete favourably against the Millers

The flow of communication is fairly articulated but periodic and bias in favour of the produce buyer. This communication also limited to market purposes and does not clearly explicate the innovative potentials amongst members.

4.3.5 Input dealers and stockist

In the case of stockists there are tendencies of linking farmers to Millers especially outside the district. The stockists sometimes form network with extension officers to set

demonstrations in an attempt to promote given technologies especially seeds. This was a case of Millers who do not have their mills within the district and would offer some fair prices compared to what other Millers within the district often offer. For stockist with affiliation to UNADA there are trainings as part of the memorandum binding them. The trainings provide knowledge on handling and management of inputs which message they pass to farmers during sale of inputs to the latter. Communication flow is stronger here with farmers and with input suppliers as they have to rely on farmers views to seek appropriate input.

There was no formal arrangement in which stockists communicate with each other. In fact under UNADA affiliation the stockists are stratified in a manner that each has a niche upon which to operate. Failure or success is a matter between respective stockist and UNADA.

General discussion on linkages

The activities of the various stakeholders are least linked to the national research programmes of Uganda. The information and knowledge process emerged exclusive of the input from national research organization. There is general weakness and sporadic linkage and communication amongst the stakeholders. Strong internal communication exists with farmers and within individual organizations. Wherever efforts to form an association are being constituted, the communication and linkages are still weak.

The scenarios presented under different categories of stakeholders as found in this study revealed minimal but targeted communication amongst the stakeholders. In all cases the main target were farmers as recipients and users of derived knowledge or technology. Significantly the traditional practices that focus on the transfer of knowledge and technologies to farmers appeared to dominate the mechanism of networking among stakeholders. This has the resultant effect that communication amongst stakeholders is less agile and sporadic, the contents of which inadequately attempts to consolidate or allow actions to be guided rightly into the chain to promote the innovative potentials. This observation is supported by Leeuwis and Van den Ban (2004), who argued that traditional practices of technology transfer undermines the realisation of coherent innovations because the multiple actors do not merge to influence or bring about knowledge, technologies and cooperation to improve performance. Similarly Waters-Bayer (2006) puts it rightly that knowledge management programmes based on traditional extension approaches often impinge on the innovative capacities by focusing only on the process of information exchange between groups with more developed specialized explicit knowledge. From the analysis of the value chain, institutional and organizational dilemma mars the entire set up in that the guiding policies do not stimulate team work or common knowledge amongst stakeholders.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The analysis of the value chain of sunflower subsector in Lira district revealed a relatively low level and rate of innovation amongst the stakeholders. The innovative potentials are however rich and promising but is hampered by apparent lack of coordination characterised by isolated creations without due consideration of the social networks necessary for effective innovation process. There is limited capacity of stakeholders especially in the form of technical knowledge and physical, financial as well as the desired support and institutional services and infrastructures to explicate their innovative potentials. The efforts by individual category of stakeholders to organize its members has not been fruitful except with farmers who have to move even further to initiate other service lines of their own.

There is a general lack of mechanisms and weakness in sharing knowledge, technologies and to take advantage of opportunities from amongst different stakeholders in the value chain. Majority of the chain stakeholders seemingly undertake efforts to focus on users (mainly rural farmers) of their products and services, with less consideration to the need for access and sharing of information and knowledge to contribute to the innovative changes required to make a competitive value chain. There is currently a very weak linkage and knowledge sharing amongst private entrepreneurs and with other stakeholders; this transcends to jeopardise the flow of knowledge, information and innovative ideas amongst the stakeholders.

The farmers however, showed a marked organizational ability and capacity to share knowledge and information with all stakeholders. The internal communication amongst farmer groups and clusters is frequent and more effective though informally conducted. The formation of groups and subsequently clusters has the potential to expand into stronger networks to stabilize the production and innovative activities at farm level. The farmers' initiative in response to the existing situation, especially by forming groups and clusters or association provides entry points for other services such as microfinance that would enhance their access to investment capital. This is also an opportunity for building the much lacking social capital and networks required to enhance innovation by linking local or indigenous knowledge to formal scientific knowledge in research organizations and private enterprises.

The extension services are uncoordinated at both field and management levels. Their service systems continue to be inclined towards the traditional/conventional technology transfer approaches with minor modifications inform of working with groups to increase participation. The impetus to generate or share knowledge and information within and amongst them is hampered partly by the lack of facilitates but also due to an inherent weakness in the system in which they work. All the extension organization involved in the chain lack the zeal and enthusiasm to innovate or incorporate locally developed innovations into their routines. The general atmosphere is that of fatigue due to continued repeat of same practices year in year out.

The innovations recorded were developed mainly by stakeholders and lacked any substantial linkage with the formal research and knowledge infrastructures in the country. The generation of innovations by the national research and knowledge infrastructures remained sporadic and incomplete. Their intervention is almost absent in spurring and leading innovation processes in the value chain of sunflower. The only output derived from the research system to date was the release of an improved open pollinated sunflower variety (Sunfola) in 1991. Since then no new product or services had been delivered into the social and economic chain of sunflower from the research set up of the country. Subsequently new products in the form of planting seeds and oil

processing equipments have been introduced through direct importation by private investors. The imported product especially the hybrid seeds (PAN 7351 and 8998) was however tested and verified by the national research body for suitability and adaptation to local conditions.

Innovations that were imported to add value at farm level (Ram Presses) have not diffused out to rural communities and seem to be gradually phasing out without any substitute. The lack of diffusion or adoption by the communities came about mainly due to the lack of repair and maintenance services, as well as spares. There Ram Presses are also less efficient, slow and tedious to operate which subjects the equipments to disregard by farmers. They are outcompeted by the heavy power driven Mills which have been imported into the district.

The heavy equipment used by private companies undermines the need for value addition at farm level thereby escalating protracted extortion of farmers produce because they have to sell cheaply to the manipulative Millers.

There were identified a number of promising innovations under developments in private hands and with the farming communities. Such innovations included solar driers system, feed mixing technologies, Bi-rational for pest control, trial of sunflower oil as fuel, ox-plough and planting pegs as well as farmer developed cropping cycle for sunflower. These innovations open opportunities for further investment, diversification and research and could build a good benchmark for creating an effective innovation systems with its social networks.

The multiple stakeholders continue to operate as individual entities often contradicting and duplicating each other. These actions go further to jeopardise the flow of information and knowledge as well as innovations. The most challenging result is the poor quality and low level of production as practices remain stagnant with no new initiatives that is shared amongst all those affected.

5.2 Recommendations from the study

In the course of these studies an upgraded understanding of the multiple and complex dimensions and opportunities existing in the value chain of sunflower has been provided. A number of recommendations can be drawn to different institutions or organizations or stakeholders. Due to the complexity realised a few have been drawn and I hope will help to invigorate the value chain towards stability and competitiveness. The following recommendations are:

- The stakeholders should be mobilized for orientation into the system networks for development. This should be a joined action undertaken by the recently formed oilseed subsector platform and the vegetable oilseed development council whose functions are amongst others to formulate guiding policies, operating strategies and oversees activities of all stakeholders in the chain. The district administration especially the department of Production and Marketing which is responsible for extension and agricultural services should take a lead in coordinating activities of stakeholders at local level. The Oilseed subsector platform should mobilized and support the stakeholders in their endeavours to form an association for better coordination.

- The vegetable oil development project as a lead agency should target to initiate capacity building programme for stakeholders targeted at understanding the social system that promote collaboration and working across systems. Stakeholders need the ability to understand and work in teams and learn skills to communicate in networks. The project should create a shift in the research

activities to focus on innovation by investing in people and organizations or institution that make up a system necessary for innovation rather than research per se.

- The promising innovations under development in private hands and with communities such as solar driers system, feed mixing technologies, Bi-rational for pest control, trial of sunflower oil as fuel, ox-plough and planting pegs as well as farmer developed cropping cycle for sunflower should be scaled up. The scaling up of these innovations should be conducted as joint ventures between extension providers under a common leadership as a coordination unit. The NARO should take the impetus to refine the innovations to local conditions as the innovations provide open opportunities for further investment, diversification and further research. These innovations should be used as benchmarks for building of the innovative network under local conditions.

- For organizations providing extension services such as Production and Marketing department, UOSPA and Mukwano the initiative to create a platform to coordinate planned execution of extension service provision to farmers. The impetuous to initiate and coordinate such options can be undertaken by either party in consultation with the management of the vegetable oil seed subsector platform and vegetable oil development project. Deliberate efforts should be targeted to invest in these organizations to build the capacities of their staff to effectively support knowledge management and development.

- The service providers should take advantage of the initiatives such as village loan saving and loan schemes that are already established and upscale it to the greater farmer communities. This should be developed as alternative way for accessing credit and production capital by farmers.

References

AfDB/OECD (2006). African Development Bank/ Organization for Economic Cooperation and Development. African Economic Outlook 2005/2006. African Economic Outlook. OECD. Paris, France, AfDB/OECD.

AfDF (2006). African Development Fund, Economic and Sector Work. Republic of Uganda Agriculture and Rural Development Sector Review, Final report for 2005.

Agricord, (2005). Agricord, the alliance of Agri-agencies. Weaving the food web for innovations in farming systems. Available at http://www.agricord.org/?menu_class_id=3&menu=missions&view=mission&mission_id=24340, accessed 15th May 2008

Asiabka, C. (2002). Promoting sustainable extension approaches: Farmer field schools and its role in sustainable agricultural development in Africa. http://www.codesria.org/links/conferences/IFS/Asiabka. 7pp: Accessed 2/7/2008

Bozeman, B. (2000). Technology transfer and Policy. A Review of Research and Theory. *Research Policy* 29: 627-655

Collinson, C., Kleih, U., Burnett, D., Muganga, A., Jagwe, J. and Ferris, R.S.B. (2005). Transaction Cost Analysis for Selected Crops with Export Potential in Uganda, prepared for the Plan for the Modernisation of Agriculture by the Natural Resources Institute, UK, and the International Institute of Tropical Agriculture, Nigeria. ASARECA/IITA Monograph 6, IITA, Ibadan, Nigeria. 168 pp.

COMESA (nd). Common Market for East and Central Africa. Uganda http://www.comesa.int/investment/regimes/investment_area/Appendix%20%20B%20-%20Uganda/view

Dorsey Jeff and Wagubi P. (2002). Potential Agricultural Market Opportunities and Enterprise Development for the Teso and Lango Regions, Uganda. Marketing study report DFID

Ellis, F. and Bahiigwa, A. (2003). *Livelihoods and rural Poverty reduction on Uganda*. World development Vol. 31 (36) pp 997-1013. Elsevier Science ltd

Friis -Hansen, E., C. Aben, and M. Kidoid, 2004. Smallholder agricultural technology development in Soroti district: Synergy between NAADS and farmer field schools. In: *Uganda Journal of Agricultural Sciences* 9: pp. 250 – 256.

Hakiza, J.J., Odogola, W., Mughisa, J., Semana, A.R., Nalukwago, J., Okoth, J. and Adipala Ekwamu (2004). Challenges and Prospects of disseminating technologies through farmer field schools: Lessons learnt based on experience from Uganda. *Uganda Journal of agricultural Sciences* 9 (1): 163-175

Hall, A., Mytleka, L. and Oyelaran-Oyeyinka, B. (2005). Innovation systems. Implications for Agricultural Policy and Practice. Internal Learning and Change. Brief 2.

Hartwich, F., M., Monge Pérez, L. Ampuero R. and Soto, J.L. (2007). Knowledge management for agricultural innovation: Lessons from networking efforts in the Bolivian Agricultural Technology System. *Knowledge Management for Development Journal* 3(2): 21-37 accessed at www.km4dev.org/journal on 24/6/2008

Herstatt, c., Tiwari, R., Ernst, D. and Buse, S. (2008). Indias's innovation systems: key elements and cooperate perspectives. Working paper 51. Homburg University of technology, Germany.

Hoffmann, V., Probst, K. and Christinck, A. (2007). Farmers and researchers: How can collaborative advantages be created in participatory research and technology development? *Agriculture and Human Values* 24:355–368

Hovland, I., (2003). Knowledge Management and Organisational Learning: An International Development Perspective - An Annotated Bibliography. ODI Working Paper No. 224, Overseas Development Institute, London

IFAD (1997). International Fund for Agricultural Development. Appraisal report for Vegetable Oil development project Republic of Uganda. Working paper 2 (2).

IFAD (2007). International Fund for Agricultural Development. Technology Generation and Diffusion through an Active Partnership between Research and Extension Institutions, NGOs and Rural Communities available at: http://www.ifad.org/events/past/hunger/tec.html. Accessed 4/07/2008

Karuhanga, M.B. (2008). *Living with Aids in Uganda*. *Impacts on banana-farming households in two districts.* PhD Thesis. Wageningen Academic Press

Laker-Ojok, R., (1996). Returns to Oilseed and Maize research in Uganda. USAID Bureau for Africa, Office of sustainable development. *Policy Synthesis* 27: 1-4.

Leeuwis, C. and Van den Ban, A. (2004). *Communication for Rural Innovation. Rethinking Agricultural Extension.* Blackwell, UK.

Lira district Local Government (2006). Three year District development Plan 2006/07-2008/09

Lopez, M.R., (2004). The mapping of the agricultural innovation system in Nicaragua. Proceedings of the summer conference on industrial dynamics, innovation and development, Elsinore Denmark

MAAIF (2000). Ministry of Agriculture Animal Industry and Fishery, Uganda. National Agricultural Advisory services Programme (NAADS): Master document of the NAADS task force and joint Donor groups

MAAIF and MFPED (2000). Ministry of Agriculture, Animal Industry and Fisheries and Ministry of Finance Planning and Economic Development. Plan for Modernization of Agriculture. Eradicating poverty in Uganda. "Government Strategy and Operational framework". Kampala.

MFPED (2003). Ministry of Finance Planning and Economic Development, Uganda. Background to the budget 2002/3

Mubiru, J.B. and Ojacor, F.A. (2001). Agricultural extension and education. Pp 294-306. In J.K. Mukiibi (ed). *Agriculture in Uganda. Vol. I. General Information*. Fountain Publishers Kampala.

MWLE (2002). Ministry of Water Lands and Environment. National Biomass study Technical Report. Forestry Department, Kampala

Mytelka, L.K. 2000. Local systems of innovation in a globalized world economy. *Industry and Innovation* 77(1): 15–32.

Oyelaran-Oyelaran-Oyeyinka, B. and Sampath, P. G. (2007). Innovations in African Development. Case study on Uganda, Tanzania and Kenya. A World bank study.

Peppelenbos, L. and Verkuijl, H. (2007). Chain empowerment: Supporting African small holders to develop markets. pp 117-131. In Ton, G. (ed). *Producer Organizations and Market Chains.* Facilitating Trajectories of Change in Developing Countries. Wageningen Academic publishers.

Ponniah, A., Puskur, R., Workneh, S. and Hoekstra D. (2008). *Concepts and practices in agricultural extension in developing countries*: A source book. Improving Productivity and Market Success (IPMS) of Ethiopian farmers' project International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia

Semana, A.R., 2000. Agricultural extension services at cross roads: present dilemma and possible solutions for future in Uganda. Available at http://www.codesira.org/links/conferences/ifs/semana.pdf accessed 1/06/2008

SNV, (2007). Netherlands Development Organization (SNV). Oil crops sector entry point for poverty reduction plans. Online, accessed on 15th April 2008 at http://www.snvworld.org/en/regions/esa/ourwork/Pages/Oilseeds.aspx

Ton, G. and Jansen, D. (2007). Farmers' organizations and contracted R&D services: service provision and innovation in the coffee chain. *Markets, chains and sustainable development strategy and policy paper, no.3.* Stichting DLO: Wageningen. Available at: http://www.boci.wur.nl/uk/publications/

UBOS (2006). Uganda Bureau of Statistics. Uganda National Household Survey 2005-2006. Kampala also available at www.ubos.org accessed 28/7/2008.

UBOS (2008). Uganda Bureau of Statistics. Statistical abstract 2008, available at www.ubos.org accessed 28th July 2008

Vellema, S. and Danse, M. (2007). Innovation and development. Institutional Perspectives on technological change in agri-food chains. *Markets, chains and sustainable development strategy and Policy Paper,* no. 2. Stichting DLO: Wageningen. Available at: http://www.boci.wur.nl/uk/publications/

VODP (2002). Vegetable oil development Project. Appraisal report Vol. 1. Ministry of Agriculture Animal Industry and Fisheries, Republic of Uganda.

VODP (2007). Vegetable Oil Development project. Impact assessment report

Waters-Bayer, A., Van Veldhuizen, L., (2005). Promoting Local Innovation: Enhancing IK Dynamics and Links with Scientific Knowledge. *IK Notes* (World Bank Knowledge and Learning Centre, Washington DC, 2005)

Waters-Bayer, A., Van Veldhuizen, L., Wongtscchochowski, M. and Wettasinha, C. (2006). Recognizing and enhancing local innovation processes. Enhancing local innovation, innovation Africa Symposium Entebbe November 21 -23, 2006.

World Bank (2006). Enhancing Agricultural innovations. How to go beyond strengthening agricultural research systems. Agriculture and Rural Development, World Bank, Washington, USA. Accessed on May 5th 2008 at http://siteresources.worldbank.org/INTARD/Resources/Enhancing_Ag_Innovation.pdf