

**TRANSFER AND UTILISATION OF SELECTED AGRO-PASTORALISTS’  
LIVESTOCK INDIGENOUS PRODUCTION INNOVATIONS IN TANZANIA:  
A CASE OF HANANG DISTRICT**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
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## **ABSTRACT**

A sound understanding of amalgamation of indigenous and modern innovations could result into improved quality of live and can increase the opportunities of individuals to partake in agro-pastoral communities. The purpose of this study was therefore to assess availability, transfer and utilisation of selected agro-pastoralists' livestock indigenous production innovations in Hanang District of Manyara Region, Tanzania. The specific objectives were to, identify agro-pastoralists livestock indigenous production innovations available to the extension service in Hanang District; determine the extent to which agro-pastoralists' livestock indigenous production innovations are transferred; determine the extent to which agro-pastoralists' livestock indigenous production innovations are utilised; and identify factors contributing to success or failure in transfer and utilisation of agro-pastoralists' livestock indigenous production innovations. Data were collected from 144 respondents, including 120 agro-pastoralists household heads, 4 extension workers, 20 key informants and various documentary sources using questionnaires, researcher's diary and checklist. Quantitative data were analysed using SPSS computer software and "content analysis technique" was used to analyse qualitative data. The study found that agro-pastoralists production innovations are generally available although in forms that vary in terms of degree to which they can be useful to agro-pastoralists and livestock field extension workers. It is concluded that agro-pastoralists livestock indigenous production practices were generally in use at different levels with more agro-pastoralists depending on traditional practices. The study recommends that more work need to be done by livestock field extension workers in order to gain the confidence of agro-pastoralists with regard to use of recommended practices in livestock production. The study also suggested to undertake case studies on interaction between livestock field extension workers and agro-pastoralists in order to elicit more reliable clues about communication behaviours of livestock field extension workers and agro-pastoralists.

**DECLARATION**

I, GODSON LUCAS MLAVI, do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

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**Date**

The above declaration is confirmed

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**Prof. R.M. Wambura**  
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**Date**

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## LIST OF ABBREVIATIONS

APHHs	Agro-pastoralists House Hold heads
ASDS	Agricultural Sector Development Strategy
DAICO	District Agriculture, Irrigation and Cooperative Officer
DAS	District Administrative Secretary
DED	District Executive Officer
DLFO	District Livestock and Fisheries Officer
DSI	Development Studies Institute
FAPHHs	Female Agro-pastoralists Households Heads
FGDs	Focus Group Discussions
FHHs	Female Household Heads
IK	Indigenous knowledge
LGRP	Local Government Reform Programme
LR&D	Livestock research and development
MAPHHs	Male Agro-pastoralists Household Heads
MDG	Millennium Development Goal
MKUKUTA	<i>Mpango wa Kuondoa Umaskinina Kukuza Uchumi Tanzania</i>
NSGRP	National Strategy for Growth and Reduction of Poverty
NBS	National Bureau Statistics
R&D	Research & Development
RDS	Rural Development Strategy
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture

UNDP United Nations Development Programme

URT United Republic of Tanzania

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background Information

An innovation is an idea, practice or object perceived as new by an individual or other unit of adoption. On the other hand, technology is a design for instrumental action that reduces the uncertainty in the cause effect relationship involved in achieving a desired outcome (Rogers, 1995). Innovation as a process of outcome is crucial for development (Roling *et al.*, 1976; Kroma, 2003). Mortimore and Tiffen (1995) research in Kenya confirmed the capacity of traditional rural farming strategies to adapt their environment to cope with increasing population. In a similar study Vein Scoones (1995) confirmed the prevalence of local innovation and adaptability among African pastoral groups, such as housing, breeding and disease control.

Pastoralists are generally classified according to their mobility: nomadic, semi-nomadic, semi-settled and settled (Neely *et al.*, 2009). According to Oram (1973) in terms of crop/livestock integration, however, it is more meaningful to classify them according to their enterprise system and their degree of contact with cultivators, recognising that individual pastoralist units are variable and modify their production strategies according to perceived risks and advantages. It is sufficient to distinguish between full time livestock keeper: ranging from those with no consistent association with a particular farming/land-use system (nomads), to those who have more or less regular contact with cropping system at their grazing sites. The group can be referred to as pure pastoralists. Livestock keepers who practice some cropping: have consistent association with a particular farming land-use system, and could exploit improved opportunities for integrated crop/livestock production. These 'agro-pastoralists' can be subdivided into

those who grow crop at one site but move all or most of their livestock to other grazing areas during the non-cropping season (transhumant agro-pastoralists) and those who keep livestock throughout the year near their cropping activities (sedentary agro-pastoralists) (Kitanyi *et al.*, 2006).

Livestock development planners in tropical Africa often regard sedentarisation of pastoralists as a prerequisite for any form of improvement in animal production and of the welfare of the pastoralists (Swift, 1982), and tend to consider livestock husbandry in isolation from cropping. However, one of the greatest strengths of agro pastoralist's production in sub-humid areas is that they permit spatial integration of cropping and livestock keeping which at a certain level of external inputs, allows more food to be produced per unit area than either enterprise alone. In the emerging global knowledge economy a country's ability to build and mobilize knowledge capital, is equally essential for sustainable development as the availability of physical and financial capital (World Bank, 1997; UNDP, 2003). The basic component of any country's knowledge system is its indigenous knowledge (IK). IK encompasses the skills, experiences and insights of people, applied to maintain or improve their livelihood; and it has value not only for the culture in which it evolves, but also for scientists and planners striving to improve conditions in rural localities. The knowledge set has been influenced by the previous generations' observations and experiment and provides an inherent connection to one's surroundings and environment (Mundy and Compton, 1991).

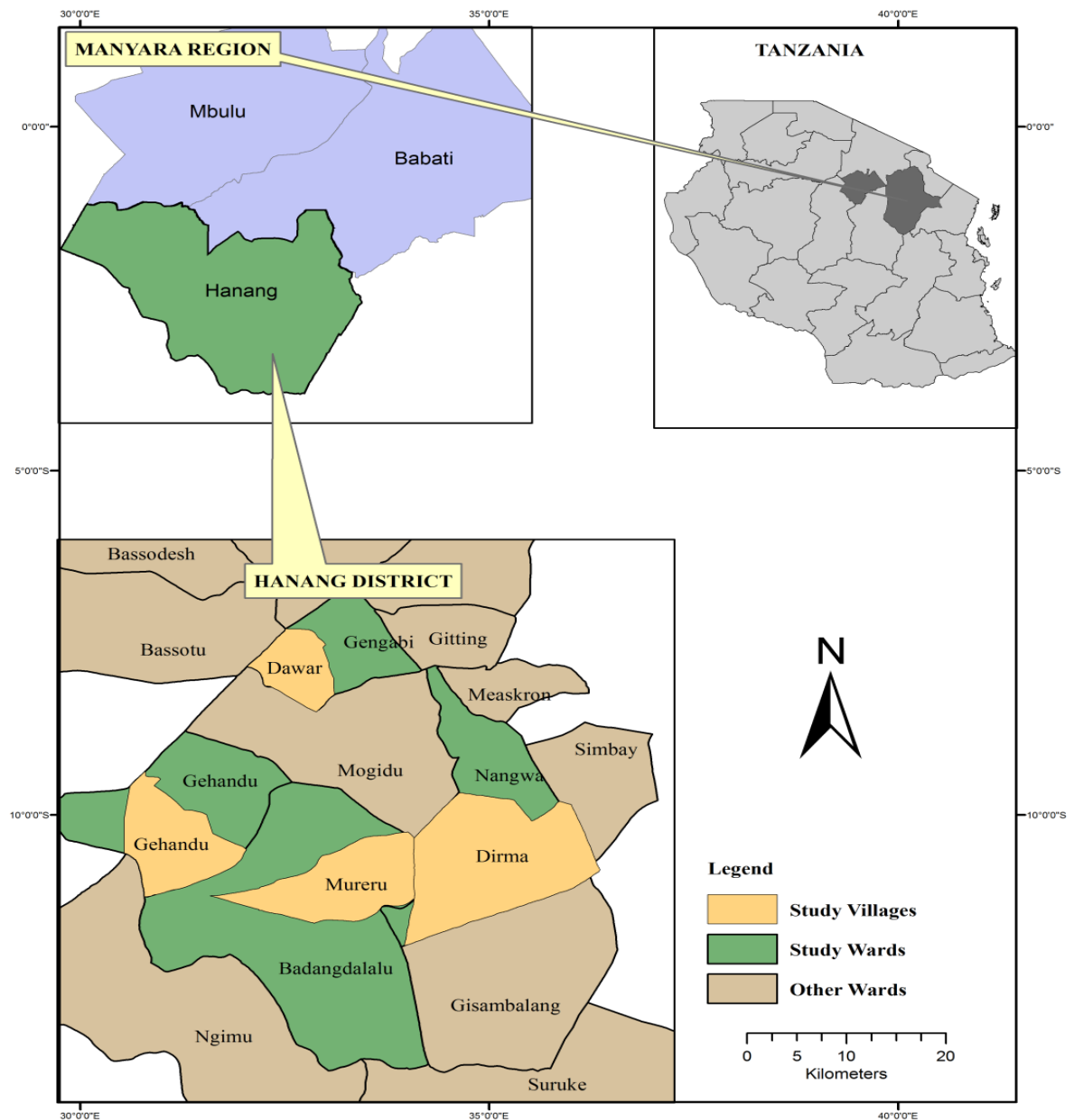
Tanzania is undergoing a rapid pace of policy change. Vision 2025, the National Strategy for Growth and the Reduction of Poverty (NSGRP), Rural Development Strategy, the Agricultural Sector Development Strategy (ASDS), Livestock Policy, Wildlife Policy, and the Local Government Reform Programme (LGRP) are just some of the institutional

changes that have recently taken place in the country (URT, 2012). The NSGRP, for example, clearly recognises pastoralism as a livelihood that should be preserved. Since this provides the overall strategic direction for all the government initiatives, dialogue should centre on how the proposals in the NSGRP can be translated into action by the different ministries and given legal force (URT, 2005a; URT, 2005b; URT, 2010). Although driven by noble objectives, these reforms will in practice affect different communities in different ways. This, in part, reflects the difficulty central level policy making has in accommodating the huge diversity of Tanzania's environment and natural resources, and the very varied manner in which its citizens derive their livelihoods. But it is also due to the fact that certain policies are designed explicitly to favour one sector over another, or to encourage radical changes in the manner in which a particular sector is organised and supported. The latter is particularly true for pastoralism and agro-pastoralists; two sectors which the government seek to modernise and change in its drive towards modernisation.

It has been observed (URT, 2010) that some of Tanzania's institutional reforms are going to have serious repercussions on pastoral and agro-pastoral livelihoods, the good management of the environment and peaceful coexistence among communities. The rapid pace of change has also prevented many citizens from participating in and shaping the policy options and direction being proposed by the government. As a result, many communities have been left behind. This is particularly true for rural people; the pastoral and agro-pastoral communities are included.

Manyara region (where data from this study were collected) is one of the 31 administrative regions in Tanzania (Fig.1). The region has an area of 44 522 km<sup>2</sup>. Administratively it is divided into five districts of Hanang, Babati, Mbulu, Kiteto and

Simanjiro. It is composed of 393 villages which are grouped into 123 wards with population of 1 425 131 at average annual growth rate of 3.2% (NBS, 2012).



**Figure 1: Map of Manyara Region showing Hanang District and study the villages.**

Due to its favourable rainfall and wide range of altitudes, a considerable number of crops are growing in the region. Wheat is the major cash crop and export crop grown in large scale plantations, while sunflower and coffee are grown in limited scale by agro-

pastoralists. Major food crops produced are maize, beans, sorghum, finger millet, Irish and sweet potatoes. Furthermore, the region is one of the major livestock producing regions in the country. A good number of agro-pastoralists keep cattle, goats, sheep, donkeys, chicken and pigs. In Hanang District, agro-pastoralists' are among the community members who grow crops and keep livestock in the region and need utilisation of appropriate agro-pastoralists' livestock indigenous production innovations. The District (Fig.1) covers about 35 232 ha comprising a population of 275 990 people and annual growth rate of 5.6% (NBS, 2012). The extent of availability, transfer and utilisation of agro-pastoralists' indigenous production innovations and their policy implications need to be classified by this study. With this in mind, the problem outline for the study is set in perspective.

## **1.2 Problem Statement and Justification for the Study**

Conventional approaches imply that development processes always require technology transfers from locations that are perceived as more advanced. This has often led to overlooking the potential in local experiences and practices (Jalloh, 2012). Today, many indigenous knowledge systems are at risk of becoming extinct because of a rapidly changing natural environment and fast pacing economic, political and cultural changes on a global scale. Practices vanish, as they become inappropriate for new challenges or because they adapt too slowly. However, many practices disappear only because of the intrusion of foreign technologies or development concepts that promise short-term gains or solutions to problems without being capable of sustaining them (Lwonga and Ngulube, 2008). The tragedy of the impending disappearance of indigenous knowledge is most obvious to those who have developed it and make a living through it. But the implication for others can be detrimental as well, when skills, indigenous knowledge (IK) technologies, artifacts, problem solving strategies and expertise are lost.

The purpose of this study was therefore to assess availability, transfer and utilisation of selected agro-pastoralists' livestock indigenous production innovations in Hanang District of the Manyara Region, Tanzania. A sound understanding of amalgamation of indigenous and modern innovations result to improved quality of life and can increase the opportunities of the individuals to partake in agro-pastoral communities. This requires a means for the capture and validation, as well as for the eventual exchange, transfer and dissemination of improved indigenous innovations.

### **1.3 Objectives**

#### **1.3.1 General objective**

To assess availability, transfer and utilisation of selected agro-pastoralists livestock indigenous production innovations in Hanang District.

#### **1.3.2 Specific objectives**

- (i) To identify agro-pastoralists livestock indigenous production innovations available to the extension service in Hanang District
- (ii) To determine the extent to which agro-pastoralists' livestock indigenous production innovations are transferred.
- (iii) To determine the extent to which agro-pastoralists' livestock indigenous production innovations are utilised.
- (iv) To identify factors contributing to success or failure in transfer and utilisation of agro-pastoralists' livestock indigenous production innovations.

### **1.4 Research Questions**

- (i) What agro-pastoralists' livestock indigenous production innovations are available to the extension service in Hanang District?

- (ii) Do agro-pastoralists receive any advice on selected agro pastoralists' livestock indigenous production innovations from field extension agents or other sources? If so in what ways(s) does advice reach them?
- (iii) What is the state of agro-pastoralists with regard to knowledge, trial and adoption of selected agro-pastoralists' livestock indigenous production innovations?
- (iv) What are the characteristics of agro-pastoralists' livestock indigenous production innovations and how do those characteristics affect the transfer and adoption or rejection of selected agro-pastoralists' livestock indigenous production innovations?

## **1.5 Operational Definitions of Key Terms**

The terms that will be used frequently in the text are defined here to provide a common basis for conveying meaning. These terms include: Livestock development, poverty alleviation, agro-pastoralists, agro-pastoralists production innovations, agro-pastoralists extension, agro-pastoralists extension worker and key variables used.

### **1.5.1 Livestock development**

A systemic use of scientific and technical knowledge to meet specific livestock requirements (URT, 2012). In this study the term “livestock development” refers to utilisation of agro-pastoralists livestock indigenous production innovations in the study area.

### **1.5.2 Poverty alleviation**

Poverty alleviation or poverty reduction is any process which seeks to reduce the level of poverty in a community or amongst a group of people or countries. Its products may be

aimed at economic or non-economic poverty through education, economic development and income re-distribution (Bagachwa, 1994). In this study, “poverty alleviation” means improved livelihoods of agro-pastoralists resulting from increased income and food security through adoption of agro-pastoralists livestock indigenous production innovations.

### **1.5.3 Agro-pastoralists**

Agro-pastoralists are livestock owners who depend on both livestock and crop farming for their subsistence and income generation (Kitanyi *et al.*, 2006). In this study the term “agro-pastoralist” applies to agro-pastoralists household heads involved in the study.

### **1.5.4 Agro-pastoralist production innovations**

An innovation has been defined as the successful exploitation of a new idea. This implies that it is not just the invention of new idea, but that this idea has actually been brought to the market, used, put into practice, exploited in some way and may be leading to new products, processes, systems, attitudes and services that improve something or add value (Rogers, 1983). In this study, the terms “agro-pastoralists production innovations” means selected agro-pastoralists production innovations in the study area.

### **1.5.5 Agro-pastoralist extension**

Extension has been defined as an on-going process of getting useful information to people and then assisting those people to acquire necessary knowledge, skills and those attitudes to utilise this knowledge fully (Boz, 2002). In this study, the terms “agro-pastoralists extension” will be shortened as “extension” for sake of brevity. Both terms will be used to denote a service or system which assist agro-pastoralists through educational means, in improving livestock and crop farming methods and techniques, increasing production

efficiency and income, bettering their levels of living and lifting their social and educational standards of agro-pastoralists community life.

#### **1.5.6 Agro-pastoralist extension worker**

An extension worker is individual who is fully employed and engaged in extension work in rural communities (Swanson and Claar, 1984). The term as used here implies the staff employed by Hanang District council responsible for agro-pastoralism extension work in villages where the study was done.

#### **1.5.7 Key variables used**

The definition of key variables (background, independent and dependent variables) as used in this study are given in Appendix 1. Literature review is presented in the next Chapter.

## **CHAPTER TWO**

### **2.0 LITURETURE REVIEW**

This Chapter reviewed literature of other studies in order to provide a theoretical framework which guided the development of the study model on which analysis of data for the present study was based. It focuses on empirical literature which includes: livestock development, livestock innovations, availability of innovations, transfer of innovations and adoption/rejection of innovations and technology, theoretical framework and conceptual framework.

### **2.1 Empirical Literature**

#### **2.1.1 Livestock development**

Development is a systematic use of scientific and technical knowledge to meet specific requirements. The livestock industry can be categorised into two major production systems, namely: extensive and intensive. The intensive system, though limited in size, has been receiving more emphasis in investment and improvement because of its contribution to the market oriented economy. On the other hand, the extensive system, which is mostly agro-pastoralism and pastoralism, is a production system based on seasonal availability of forage and water thus resulting into uncontrolled mobility. This system is mostly constrained by poor animal husbandry practices, lack of modernization, accumulation of stock beyond the carrying capacity and lack of market orientation. Despite, the constraints this system has sustained the livelihood of the pastoral communities for many decades (de Lasson *et al.*, 1985).

At the global level, the livestock sector is undergoing rapid transformation. Indeed, never before in history, has the demand for livestock products been at such a high level. Nor has

the sector been exposed to as many negative and positive driving forces. As de Haan *et al*, (2001) noted, the global livestock sector is changing fast. With a strong and growing demand, rapid institutional and macro-economic policy changes, and a fundamental shift in the functions of livestock, there is a significant danger of the poor being crowded out, the environment eroded, and global food security and safety compromised. Thus, livestock development is under increasing pressure to address the rapidly changing needs and demands of both the poor and the expanding global population. Consequently, it is apparent that livestock development is now at a crossroads. Although more and more evidence is available to illustrate the importance of livestock in poverty alleviation, projects and programmes are mired in less than positive outcomes. Given the problems of the poor, there is an urgent need for a new paradigm of livestock development, which incorporates both people-centered and technological solutions to the specific needs of poor livestock keepers.

### **2.1.2 Livestock innovations and technology**

An innovation is an idea, practice or object perceived as new by an individual or other unit of adoption. Technology is a design for instrumental action that reduces the uncertainty in the cause effect relationship involved in achieving a desired outcome (Rogers, 1995). The components of technology are: Hardware (physical) and Software (knowledge base). A good innovation should have following five attributes: (i) relative advantage; (ii) compatibility; (iii) complexity; (iv) triability and (v) observability. Re-invention is the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation. Livestock development requires and depends on innovation, which refers to the successful application of knowledge with social and economic significance. Innovation as a process and outcome is crucial for development (Roling *et al.*, 1976; Gupter, 2000; Kroma, 2003).

### **2.1.3 Availability of innovations**

According to Warkup (2011), we have been innovating in livestock production since we first domesticated the species we now farm. The main changes we have made are to the animals themselves. Breed improvement and effective dissemination (e.g. via reproductive technologies) has been, and remains, one of the most effective ways to feed more people from the same or fewer resources. Modern biology has accelerated the process of breeding better animals and rapid further acceleration can be expected. Muir (2005) noted that innovations in the way we manage the performance and health of livestock will be delivered by advances in our ability to understand and control reproduction, productivity and health. Technologies can have both positive and negative effects simultaneously (for example improving disease resistance may improve productivity and welfare, but at some cost to efficiency in the absence of disease) so we need systems approaches that enable us to measure (or ideally forecast) the balance of the impacts – examining benefits, harms, risks and the trade-offs between them. At the same time we must have a rational approach to risk in our regulatory processes – there are, after all, many risks to inaction and stagnation.

Scoones (1995) confirmed the prevalence of innovation and adaptability among African pastoral groups. New livestock technologies are considered to have been determinant for some major successes in Sub-Saharan African livestock development. Livestock research and development (LR&D) therefore features prominently in livestock development policies. Over the last two decades the context for livestock development and innovation has changed which has also affected LR&D institutions and rural producer organisations (Feder *et al.*, 1985). Increased livestock and crop production is a result of varied number of factors including use of improved breeds and utilisation of improved production technologies. Research recommendation on livestock and crop production technologies to

ascertain appropriate animal and crop breeding and production; traditional fodder and forage species and their specific uses; animal-disease classification; fertiliser utilisation and traditional ethnoveterinary medicine, for example, has been given to agro-pastoralists in different pastoral communities (Gupter, 2000).

Combining indigenous knowledge with scientific knowledge can help create solutions that are culturally acceptable, economically feasible and environmentally sustainable for the society being aided (Puffer, 1995). The old notion of research & development (R&D), as an isolated process carried out in a laboratory, concerned with generating new technologies and/or applications that are then transferred to the passive users, has now changed. Research and development is now widely seen as a learning process that follows inclusive, participatory, exploratory and experiential approach. Also termed as user-led approach, where in the user becomes an integral constituent of the R&D team. It is therefore critical to create an enabling environment, for seamless fusion of indigenous and scientific knowledge by utilising complimentary expertise and experience of people, and the one that is based on mutual respect. This will help stimulate and foster the culture of indigenous innovations in a particular country (Reji and Ann, 2005).

#### **2.1.3.1 Indigenous/traditional innovations**

Most recent African indigenous knowledge (IK) literature, especially in livestock, emphasises that Africans are innovators. This literature is filled with success stories. Excellent examples of local innovations and discoveries include (Chaicken, 1998): crop breeding; grafting against pests; water harvesting; soil management; conservation; and processing. Indigenous livestock innovations have continued to be important as most of the locally-domesticated animals is for local consumption. The indigenous knowledge in the livestock sector can be characterised as: (i) rooted in particular places, experiences

and unique climatic conditions, (ii) orally transmitted or transmitted through imitation and demonstration, (iii) widely relevant for poor women, (iv) constantly reinforced by experiences and trial and error and adapting, (v) pragmatic, (vi) shared occasionally, (vii) usually asymmetrically distributed and preserved within a group, (ix) may involve specialists by virtue of experience or authority, and (x) situated within a culture/society including technical information.

At a general level, new approaches may still be needed to address some of Africa's problems. There is some unique knowledge among the local producers that can contribute to help make hunger and malnutrition history, and reduce grass-root poverty, especially among poor women without changing cultural food patterns in Africa. But, too often African indigenous innovators are overlooked in the search process for new solutions (Gupter, 2000). Two main reasons can be attributed for this: (i) the innovations and discoveries they produce are mostly incremental, that they do not carry high income gains; and (ii) culturally, there is little knowledge sharing due to lack of records and the application of innovations in isolation. Indigenous innovators face uncertainty because of a lack of organising frameworks. They lack information as to who needs innovations, how to find the users, when to approach them, why they should be approaching them, and most importantly, whether the receivers will appreciate the effort. The consequence of the lack of an organising framework is that innovators mostly become indifferent to diffusing their knowledge, and not utilising potential scale effects, efficiency and productivity gains from their innovations.

Gupter (2000) further notes that the system can now be said to be caught in an 'indifference-trap' which occurs in a system when innovators no longer share potentially efficiency and productivity-enhancing innovations and discoveries. People thus hold

back on productive innovations and discoveries that they would have otherwise passed to others. However, Gupter argues that, in spite of an indifference trap, African agricultural/livestock producers continually need new environmentally-specific innovations and hence, processes and products to deal with changing supply conditions and to use core competencies in a profitable way. To continually increase efficiency and productivity, producers need the support and advice of others. Lack of a cohesive learning and sharing network for innovations detracts from the ability of isolated individuals to take advantage of generally available skills. Therefore, an important obstacle to sharing indigenous knowledge in Africa, particularly in the low-income sector of agriculture/livestock, is the absence of a sharing mechanism. Organisational conditions must, therefore, be changed to gradually enable people to share and connect to those who may add to their knowledge.

Allen (2001) noted that in endogenous technological advances, imitations and innovations determine the long-run economic growth-path of a country. Growth of technological knowledge produces useful outputs, and technological advances define the values of resources and the rates of utilisation, hence impacting sustainability in a sector such as African agriculture/livestock production. To complement the innovative achievements of African local agro-pastoralists, a mechanism is needed to promote, with participatory public support, a sharing and additive system of innovation among the lowest-income producers of Africa. Incubating local agro-pastoralists innovations can help to unlock the secrets of the economic and cultural transformation of these societies. The innovations technological and secular approach to innovation systems is based on putting these innovations into the public domain to achieve a scale effect, and increasing the productivity of the poorest.

### **2.1.3.2 Generation of modern/scientific innovations**

There are several stages in the generation of innovations (Backer, 1994; Kangashiemi, 2002). The first stage is discovery, characterised by the emergence of a concept or results that establish the innovation. A second essential stage is development, where the discovery moves from the laboratory to the field, and is scaled up, commercialised, and integrated with other elements of the production process. In cases of patentable innovations, between the time of discovery and development there may also be a stage where there is registration for a patent. If the innovation is embodied, once it is developed it has to be produced and, finally, marketed. For embodied innovations, the marketing stage consists of education, demonstration and sales. Only then does adoption occur.

Haug (1999) formalised and empirically verified the theory of induced innovations that closely linked the emergence of innovations with economic conditions. He argued that the search for new innovations is an economic activity that is significantly affected by economic conditions. New innovations are more likely to emerge in response to scarcity and economic opportunities. For example, labour shortages will induce labour-saving technologies and food shortages or high prices of livestock commodities will likely lead to the introduction of a new high-yield breed, and perceived changes in consumer preferences may provide the background for new innovations that modify product quality.

### **2.1.4 Transfer of innovations**

According to the literature (Chambers and Ghildyal, 1985) is difficult to transfer livestock development technologies compared to crop technologies for a variety of reasons which emanate basically from the differences in crop and animals itself. The livestock owners depend upon the technical persons for adopting technologies/practices

which include Artificial Insemination (AI), pregnancy diagnosis, vaccination, deworming, diagnosis and treatment of animals. This means the livestock owner needs to take the animals to the technical person (veterinarian or stock assistant) or the latter have to be brought to the animal for services/adoption of practices. As a sequel not only the distance between livestock owner and the technical person but also the attitude and skill of the technical persons also come into the picture. If Rogers' (1983) attributes of innovations are taken into consideration it will be very clear that crop technologies outweigh the livestock technologies in terms of observability of results, simplicity and cultural compatibility.

The livestock and agricultural extension system in developing countries has always been challenging with the task of transmitting livestock and agricultural innovations from the researcher to the farmers. The major role of extension system is therefore to facilitate such a link. This is viewed as a three-step- process passing scientific information in livestock and agriculture from the research scientist to the extension worker then to the participating farmer (Feder *et al.*, 1985). For effective performance of extension worker it is imperative that he be conversant with the communities at both ends, which are the research and agro-pastoralists communities, he himself be a liaison between research and agro-pastoralist. A successful extension worker therefore needs to acquire the knowledge of better communication methods. A close working relationship with the research system is not sufficient condition for increased livestock and agricultural productivity. The agro-pastoralist community must also be included in the technology development and utilisation equation. Agro-pastoralists education on the use of innovations is an essential ingredient in livestock and agricultural development. Agro-pastoralists cannot successfully adopt a new technology unless they are aware of it and learn how to incorporate it into their farming systems (Swanson and Claar, 1984).

### **2.1.5 Adoption/rejection of innovations**

There is often a significant interval between the time an innovation is developed and available in the market, and the time it is widely used by producers. According to van den Ban (1998), an adoption process is the mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject and to later confirmation of this decision. Rogers (1995) has given the following five stages of adoption process: awareness; interest; evaluation; trial and adoption. Duration and length of time between any two stages varies with each practice and individual.

The rate at which different individuals go through the different stages varies with the personal characteristics of the individual and the nature of the group influences on him. Rogers (1995) observed that the level of adoption of innovations depends on the following factors: (i) source of information, (ii) intrinsic characteristics of the information itself and its appeal to clients (complexity, probability, riskness, and compatibility with other activities), (iii) characteristics of units concern (resources, size, type of activities, and degree of specialisation), and (iv) preparation of innovation client. Among the members of a social system some innovations diffuse from first introduction to wide spread use in a few years where as others take more number of years. This is due to characteristics of innovation, that affect the rate at which they diffuse and are adopted. There are five perceived attributes of innovations in universal terms (Rogers, 1995): relative advantage; compatibility; complexity; trialability and observability. In addition, Rogers (1983) suggested the following standard set of adopter categories that is widely followed today: innovators; early adopters; early majority; late majority and laggards.

## **2.2 Theoretical Framework**

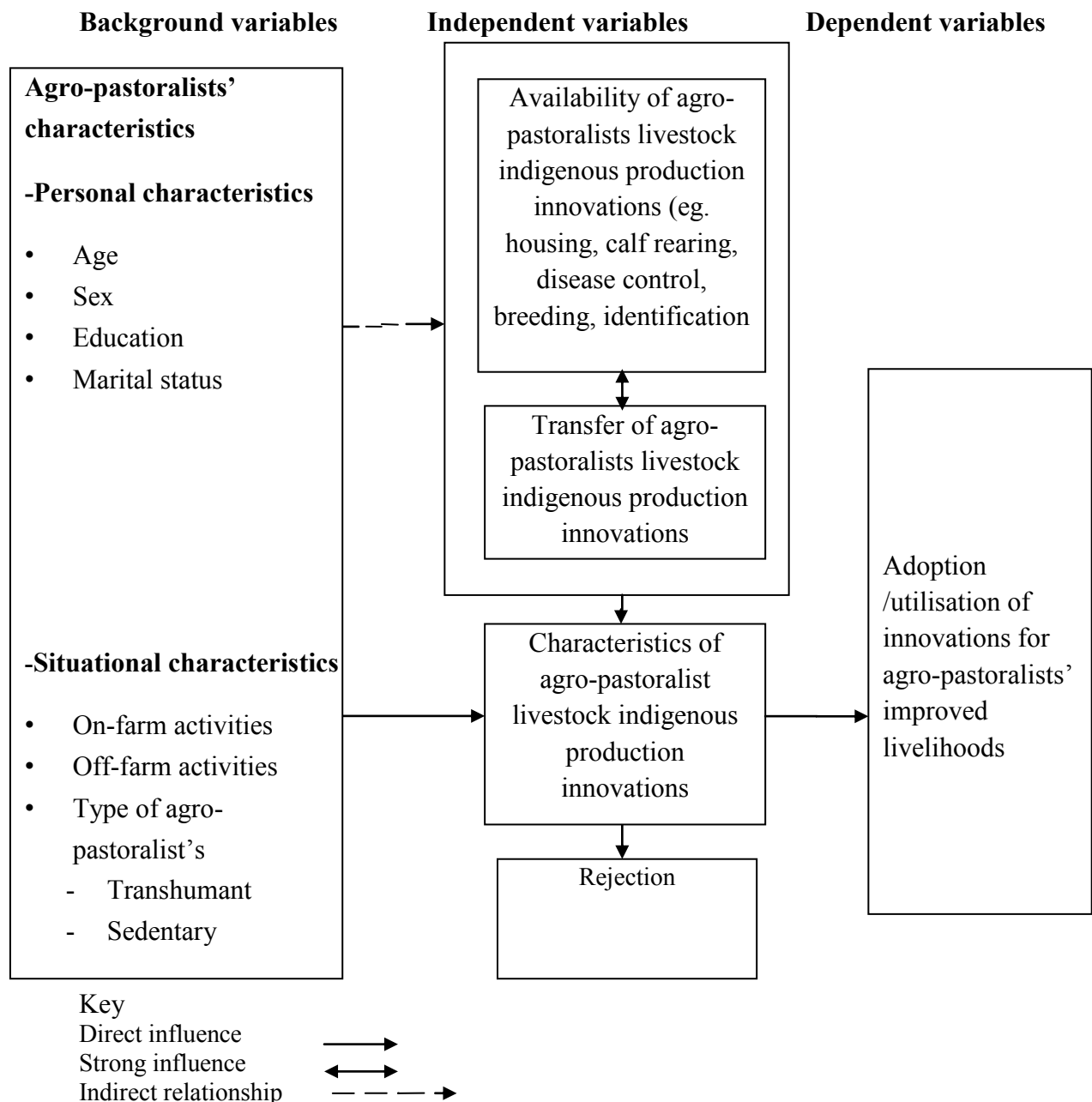
This study was informed by the Endogenous Growth Theory which holds that economic growth is primarily the result of endogenous and not external forces (Romer, 1994). The theory states that investment in human capital, innovation and knowledge are significant contributors to economic growth. The theory also focuses on positive externalities and spillover effects of a knowledge-based economy which will lead to economic development. The endogenous growth theory primarily holds that the long run growth rate of an economy depends on policy measures. For example, subsidies for research and development or education increase the growth rate in some endogenous growth models by increasing the incentive for innovation. Innovation is the key to success in all social developments (Goh, 2005).

According to Benerji (2004), indigenous innovations can aid developing nations embark on a cumulative path of positive growth; thereby helping them join the ranks of the more advanced nations. Local challenges and opportunities that are as varied as the individual communities themselves, such as agro-pastoralists, provide great opportunities to stimulate economic growth by capitalising on the local knowledge and resources residing in the communities. The need to promote indigenous innovations as evolving alternatives to development has now been well recognised.

## **2.3 Conceptual Framework**

The literature from the present Chapter has been reviewed from a wide perspective of agro-pastoralists livestock indigenous production innovations. The reflection drawn from this review provides a basis for assessing the availability, transfer and utilisation of selected agro-pastoralists livestock indigenous production innovations in Hanang District, the conceptual framework shown in Fig. 2 has been developed. This conceptual framework

was for analysing a large volume of data and was oriented towards establishing findings which fulfill the objectives of the study. It allows drawing implications on the extent to which agro-pastoralists livestock indigenous production innovations could be integrated with the farming system of agro-pastoralists and made an engine of economic growth and poverty alleviation in Tanzania. The operational definitions of key variables used are given in Appendix 1. The research methodology is presented in the following Chapter.



## **CHAPTER THREE**

### **3.0 METHODOLOGY**

This Chapter describes the methodology adopted in the study under eight parts, namely: study area, study design, sampling procedures, sample size, data collection instruments, data collection procedures, data processing and analysis and limitations of the study.

#### **3.1 Study Area**

The study was conducted in Hanang District, Manyara Region, Tanzania. The District was purposively selected based on the evidence of dominance of ethnic group of agro-pastoralists keeping livestock and growing crops for a long time as their main economic activities (Warren, 1995). The study took place in four villages namely: Dirma, Dawar, Mreru and Gehandu, as shown in Fig. 1.

#### **3.2 Study Design**

The study employed a case study cross-sectional research design. The design was useful, appropriate and feasible. It involves collection of data at one point in time and data collected can be used to determine relationships between variables focused in the field of study (Bailey, 1994). Also the design allows the combination of various survey methods of both qualitative and quantitative data gathering and offer quick results with low cost (Agresti and Finlay, 1997).

#### **3.3 Study Population and Sampling Procedures**

The study population involved all agro-pastoralists household heads (APHHs) in Hanang District. A multi-stage sampling technique was adopted. The technique involved purposive selection of study area and respondents based on evidence of dominance of

ethnic group of agro-pastoralists keeping livestock and growing crops as their main economic activities. The technique was adopted under two main stages, as follows.

Stage 1: The first stage involved purposive selection of divisions, wards and villages based on evidence of availability of agro-pastoralists livestock production innovations to extension services in Hanang District. There were five divisions and each division had more than three wards, each ward had more than two villages. Thus, two divisions were purposively identified, namely: Katesh and Balang'dalalu. In turn, four wards were selected from the selected division, namely: Nangwa and Gendabi from Katesh division and Balang'dalalu and Gehandu from Balang'dalalu division. Finally, four villages were identified from the selected wards (one from each ward) namely: Dawar from Gendabi ward, Mreru from Balang'dalalu ward, Dirma from Nangwa ward and Gehandu from Gehendu ward.

Stage 2: The second sampling stage involved purposive selection of sample of 120 agro-pastoralists' household heads (APHHs) respondents (30 from each village). Purposive and stratified sampling techniques were used to get male and female APHHs members from a corrected register of 2636 APHHs members (1718 male and 918 female) involved in agro-pastoralism in the study villages. Each of the selected villages had more than 584 APHHs members in the register. Each of the selected villages had one livestock extension worker who was involved in the study. In addition, a total of 20 key informants were selected using snowball technique. Thus, a sample of 120 APHHs and 24 key informants (including four extension workers) were identified involved in the study.

### 3.4 Sample Size

A total of 144 respondents comprising of a sample of 120 APHHs, 4 extension workers and 20 key informants, as shown in Table 1, was involved in the study. According to Mass and Joop (2005), a sample size of at least 30 respondents is reasonably large in social science research studies to ensure normal distribution of sample size.

**Table 1: Distribution of all respondents (n=144) involved in the study**

Type of respondent	Number		Total
	Male	Female	
Agro –pastoralists	71	49	120
Key informants	12	8	20
Extension workers	4	0	4
Total	87	57	144

### 3.5 Data Collection Instruments

Data collection instruments used for the study were questionnaires, researchers diary and checklist, as follows:

- (a) Questionnaires/interview schedule: One type of interview schedule used to collect qualitative and quantitative primary data from agro-pastoralists household heads (APHHs) respondents, namely: Agro-pastoralists household heads questionnaire (Appendix 2).
- (b) Researchers' diary: This was used to collect secondary data from relevant documentary sources, including official reports, websites, Sokoine National Agriculture Library (SNAL) as well as researcher's observations of agro-pastoralists activities related to their livestock indigenous productions innovations.
- (c) Checklist: This type of tool was used to collect primary data from livestock extension workers and key informants (Appendix 3 and appendix 4) to supplement information gathered through interview schedules and the researcher's diary.

### **3.6 Data Collection Procedures**

Field work was conducted by the researcher and one research assistant from October to December 2014. The permit for data collection was obtained from District Administrative officer (DAS) for Hanang District after getting an introductory letter from Sokoine University of Agriculture (SUA). Much care and foresight were given in legitimising the research on the eyes of the relevant village leaders, agro-pastoralists as well as Government officials at village and district levels. Structured and unstructured interview schedules were used to collect both qualitative and quantitative primary data from selected 120 APHHs. Prior to actual data collection, the schedules were translated from English to Kiswahili and pre-tested among few agro-pastoralists in the study villages, who were not involved as study respondents for validity and reliability and any other improvements. In addition, primary data were collected from four extension agents and 20 key informants through directed discussions using checklist.

Of the 120 interview schedules meant for APHHs respondents, all were properly completed constituting a return rate of 100%. As far as possible interviews were conducted in private agro-pastoralists farm environment and each lasted for about 30 minutes. When interviews were completed in one village the author moved to the next, usually spending about 4 to 5 days in each village. Furthermore, the author collected secondary data through review of documentary information from Hanang Districts official reports, wards and village offices, websites, and Sokoine University of Agriculture National Library (SNAL) using researcher's dairy. Four focus group discussions which involved 32 APHHs (16 male 16 female) from the study villages and researcher's observations on agro-pastoralists indigenous livestock production practices were also important source of information for the study.

### **3.7 Data Processing and Analysis**

#### **3.7.1 Data processing**

Data from the completed 120 agro-pastoralists household heads interview schedules were coded for computer analysis. Each schedules had 206 variables. In addition, data from researcher's dairy and checklist were summarised manually to single sheets of paper. In summarising the data, great care was taken to ensure that it accurately reflected the original meaning of the statements made.

#### **3.7.2 Data analysis**

Data processed from the surveyed agro-pastoralists household heads interview schedules coded for computer analysis were analysed by using statistical package for social science (SPSS) programme, version 16.0 for windows. The method of analysis was univariate and bivariate analysis. It employed techniques of frequency counts, means, percentages and cross-tabulations. Furthermore, data processed from extension workers and key informants, checklist and researcher's diary were also examined. Qualitative data were analysed using "content analysis" technique which mainly involved transcription of recorded note books and then clustering information into themes and sub-themes. Quantitative data were analysed to produce frequencies to facilitate assessment of availability, transfer and utilisation of selected agro-pastoralists livestock indigenous production innovations in the study villages.

### **3.8 Limitations of the Study**

- (i) Agro-pastoralists respondents were involved in social events, like election of hamlet leaders and funerals which made them not to participate as planned. The researcher had to reschedule the timetable based on availability of respondents, which prolonged data collection period.

(ii) Poor record keeping by most of the respondents created difficulties in obtaining correct information. The researcher had to take more time to probe in order to get correct information which also prolonged data collection period. The following Chapter presents results and discussions.

## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSION**

This Chapter presents the major findings and discussions arising from data analysis related to availability, transfer and utilisation of agro-pastoralists livestock indigenous production innovations in Hanang District. These are discussed under five main sections: Agro-pastoralists household heads (APHHs) respondents characteristics, APHHs respondents opinions on availability of agro-pastoralists livestock indigenous production innovations, APHHs respondents opinions on transfer of agro-pastoralists livestock indigenous production innovations, APHHs respondents opinions on the extent to which agro-pastoralists livestock indigenous production innovations are utilised and APHHs respondents opinions on factors contributing to success or failure in transfer and utilisation of agro-pastoralists livestock indigenous production innovations.

#### **4.1 Agro-pastoralists House hold head Respondents Characteristics**

The APHHs characteristics were personal and situational characteristics in agro-pastoralism which were expected to influence their utilisation of livestock indigenous production innovations. These characteristics were examined under two main parts. The first part under personal characteristics involved sex, age, marital status, level of education and household size. The second part dealt with situational characteristics. Those examined were on-farm activities, off-farm activities, income from on-farm and off-farm activities and types of agro-pastoralists.

#### 4.1.1 Agro -pastoralists respondents personal characteristics

Among the more important personal characteristics dealt with in this part were: sex; age; marital status; level of education and household size. Examination of APHHs respondents' sex revealed that of 120 respondents, 71 were males and 49 were females (Table 2).

**Table 2: Percentage distribution of APHHs respondent's (n=120) by personal characteristics**

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Sex</b>		
Male	71	59.2
Female	49	40.8
<b>Age</b>		
20-35	14	11.7
36-51	51	42.5
52-70	55	45.8
<b>Marital status</b>		
Single	6	5
Married	68	56.7
Widowed	36	30
Divorced	10	8.3
<b>Level of education</b>		
None	41	34.2
Adult education	13	10.8
Primary	62	51.7
Post primary	4	3.3
<b>Household size</b>		
<3	8	6.7
3-7	44	36.7
>7	68	56.7

##### **a) Age**

Age distribution of APHHs respondents was between 20 and 70 years. The majority (54.2%) were below 52 years of age, this is the active and working group as shown in

Table 2. However, these findings suggest that, in general, the study respondents were drawn from different age groups of agro-pastoralists in the study villages.

#### **b) Marital status**

It was expected that marital status of APHHs respondents would influence adoption of livestock indigenous production innovations. Results in Table 2 show that the majority (56.7%) of the respondents were married. This is more likely to positively affect their participation in agro-pastoralists livestock indigenous production practices, where innovation can easily be carried out by couple and readily implemented by one in the absence of other.

#### **c) Level of education**

It was assumed that the extent to which APHHs respondents were educated would tend to influence their ability to gain knowledge. According to URT (2005), education equips people to face the existing challenges of the world which is most likely to affect agro-pastoralism as a basis for improved livelihoods. The APHHs member respondents were therefore asked to indicate their level of education as shown in Table 2. Results in Table 2 show that 51.7% of the APHHs respondents had primary level of schooling. Hence it is impressive that the majority of APHHs respondents had some formal education that can enable them read and write, hence can easily engage and learn in any training programme in the long run, as education is one of the tools to aid in implementation.

#### **d) Household size**

Results in Table 2 show that most (56.7%) of the APHHs respondents had household size above 7. This observation implies that larger household sizes were common in the APHHs respondents. This is due to fact that the many people in the study area practice polygamous (more than one wife) marriage as reported by one of the key informants. The

study further revealed that the average household size was 5.9. This figure is higher than the one found during the population census of 2012 which was 3.2 for Manyara Region and 4.8 for Hanang District. This implies that there is an increase in population growth in the study area. Increase in the population growth had a positive impact on transfer and utilisation of indigenous livestock production innovations, since population growth increase labour to crop and livestock production.

#### **4.1.2 APHHs respondents situational characteristics**

The situational characteristics dealt are in four categories. The first category involves factors related to on-farm activities. These include: land ownership, crop production and livestock production. The second category involves off-farm activities engaged in by APHHs respondents. The third category is based on income generated from on-farm and off-farm activities. Finally, the last category deals with APHHs respondents types as either being transhumant or sedentary.

##### **(a) On-farm activities**

###### **(i) Land ownership**

Land is one of the most important factors and means of agro-pastoralism production. The APHHs respondents were asked to indicate the size (acres) of farm they owned in their villages as shown in Table 3. Results in Table 3 indicate that farm size of APHHs respondents ranged from less than two to more than five acres with average of 1.5 acres per APHHs respondent. The APHHs respondents average farm size lies below Hanang District agro-pastoralists average farm size which ranges from 2 to 2.5 acres (URT, 2008). This implies that average farm size of the study respondents was less than that of agro-pastoralists in the District.

**Table 3: Percentage distribution of APHHs respondents (n=120) by farm size and gender**

Farm size (Acres)	MAPHHs (n=71)		FAPHHs (n=49)	
	Frequency	Percentage	Frequency	Percentage
<2	19	26.8	10	20.4
2-5	41	57.8	20	40.8
>5	11	15.4	19	38.8

## ii) Crop production

APHHs respondents opinions on types of crops they had grown examined in this part were in terms of cash and food crops. The APHHs respondents were asked to give major types of crops and average crop yields in kg/acre (2013/2014 season) as summarised in Table 4. The major crops grown in the study area and their average yields for MAPHHs and FAPHHs a given in Table 4. In general, results in Table 4 revealed that MAPHHs and FAPHHs respondents produced an average yield of 524.8 kg/acre and 475 kg/acre, respectively. This implies that both MAPHHs and FAPHHs respondents were concerned with crop production which could be used as food and generate income for fulfilling family basic needs, medical services and sending children to school, all of which require use of money.

**Table 4: Distribution of APHHs respondents (n=120) on types of crops grown and average yield in kg/acre by 2013/2014 by gender**

Type of crop grown	Respondents	
	MAPHHs (n=71)	FAPHHs (n=49)
	Average yield (Kg/acre)	Average yield (Kg/acre)
<b>Cash crops</b>		
Sunflower	538	402
Wheat	578	343
Pigeon peas	377	349
<b>Food crops</b>		
Maize	889	1051
Beans	451	336
Sorghum	316	357
<b>Average</b>	<b>524.8</b>	<b>475</b>

### iii) Livestock ownership

The members of livestock owned by APHHs respondents were expected to indicate their economic status. The APHHs respondents were therefore asked if they owned livestock and the findings are summarised in Table 5. The results in Table 5 indicate that the major types of livestock owned by respondents in the study villages were cattle and chicken, where 22.5% of the MAPHHs respondents and 7.5% of FAPHHs respondents owned more than 40 cattle and chicken, respectively. However, the findings indicate that livestock was an important economic activity in the study villages.

**Table 5: Distribution of APHHs respondent (n=120) by type of livestock kept**

Type of livestock	MAPHHs ( n=71)	FAPHHs (n=49)
	Percent	Percent
<b>Cattle</b>		
0	0.0	0.0
1-20	10.8	12.5
21-40	25.8	21.6
>40	22.5	6.6
<b>Goats</b>	0.0	0.0
0		
1-20	18.3	10.8
21-40	27.5	25.0
>40	13.3	5.0
<b>Sheep</b>		
0	10.8	5.6
1-20	34.1	20.8
21-40	18.3	13.3
>40	6.6	6.6
<b>Pig</b>		
0	21.2	13.6
1-20	47.5	33.3
21-40	1.6	5.6
>40	0.0	0.0
<b>Chicken</b>		
0	0.0	0.0
1-20	32.5	27.5
21-40	15.0	5.0
>40	11.6	7.5
<b>Donkeys</b>		
0	10.8	12.5
1-20	21.6	15.0
21-40	28.3	2.5
>40	0.0	0.0

**b) Off-farm activities**

Off- farm activities are carried out in order to supplement income generation. The APHHs respondents opinions were therefore sought on the extent to which they were engaged in off-farm activities, as shown in Table 6. The results in Table 6 indicate that involvement in off-farm activities was not popular to both FAPHHs and MAPHHs respondent's. The major off-farm activities carried out mainly by MAPHHs respondents was livestock broker. The findings suggest that engagement in off-farm activities was not an important

economic undertaking for APHHs respondents in the study villages. However, there was a potential for off-farm employment for the agro-pastoralists in the study area.

**Table 6: Distribution of off-farm activities for APHHs respondent (n=120) by type of off-farm activities engaged**

Types of off-farm activities	MAPHHs (n=71)		FAPHHs (n=49)	
	Frequency	Percent	Frequency	Percent
Shop	4	5.6	2	4.1
Livestock broker	14	19.7	1	2.0
Food vendors'	1	1.4	4	16.3

**c) Monthly income generated from on-farm and off-farm activities**

The APHHs respondents were asked to estimate their average monthly income in TShs from their on-farm activities (crop and livestock) and off-farm activities in one year as given in Table 7. Results in Table 7 show that both MAPHHs and FAPHHs obtained more monthly income from livestock activities compared to what they obtained from crop and on-farm activities. Thus, suggesting that there is need for increased engagement on crop and off-farm activities.

**Table 7: Distribution of APHHs respondents (n=120) opinions on their average monthly income estimated in TShs by on-farm and off-farm activities**

Income sources	MAPHHs (n=71) (Tshs)	FAPHHs (n=49) (Tshs)
<b>On-farm income</b>		
Crop	580.70	420.75
Livestock	719.80	521.40
<b>Off-farm</b>	191.40	138.60

#### d) Agro-pastoralists categories

Considering that livestock keepers who practice some cropping can be divided into those who grow crops at one site and move all or most of their livestock to other grazing areas during cropping season (transhumant agro-pastoralists) and those who keep livestock throughout the year near their cropping activities (sedentary agro-pastoralists) the APHHs respondents opinions were sought on whether they belong to transhumant or sedentary category, as given in Table 8. Results in Table 8 indicate both transhumant and sedentary agro-pastoralists were involved in the study in almost equal proportions by gender. Thus, suggesting that their varied experiences provided a rich source of information for the study.

**Table 8: Distribution of respondent's (n=120) by types of agro-pastoralist and gender**

Type of agro-pastoralist	MAPHHs (n=71)		FAPHHs (n=49)	
	Frequency	Percent	Frequency	Percent
Transhumant	32	45.1	22	44.9
Sedentary	39	54.9	27	55.1

#### 4.2 APHHs Respondents Opinions on Availability of Agro-pastoralists Livestock Indigenous Production Innovations

The study sought to find out whether there were recommended agro-pastoralists livestock indigenous production innovations to extension services for cattle in Hanang District. The information provided by key informants revealed that there were pastoralists indigenous production innovations that existed for a long time. The major sources of such innovations were family members, neighbours and livestock extension agents. Table 9 gives an indication of existing innovations in the study area available to the extension service. It was also found available pastoralists livestock indigenous production

innovations had been organised in five specific recommendations for family members, neighbours and extension agents to transfer and agro-pastoralists to use. The recommendations have been organised in operations as follows: housing, breeding, pasture management, livestock identification, calf rearing and disease control.

**Table 9: Existing agro-pastoralists livestock indigenous production innovations in Hanang District**

Type of innovation	Availability of innovations
Livestock housing	x <sup>1</sup>
Livestock breeding	X
Livestock feeding	- <sup>2</sup>
Pasture management	X
Soil conservation	-
Livestock identification	X
Calf rearing	X
Livestock diseases control	X

Key:

x<sup>1</sup> available innovation

-<sup>2</sup> unavailable innovation

#### 4.2.1 Livestock housing

It is recommended to construct kraals arranged in circular fashion. Fence the kraal using *acacia* thorns, which prevents lions from attacking livestock as well as preventing livestock from feeding on crops at night. Do maintenance of the fence throughout the year including removing of animal dung. Within the kraal make partitions to separate goats and sheep during the day from cattle to avoid injuries.

#### 4.2.2 Livestock breeding

The recommended key breeding methods include identification, recording and separation (castration) of animals. Give cattle collective individual names at birth based on genealogy. Use females for breeding. Recruit bulls into breeding or non-breeding groups

on basis of performance of ancestors and individual outlook. The method of recruitment of animals facilitates continuous use of animals of the same lineage over long time.

#### **4.2.3 Pasture management**

It is recommended to divide grazing land into two feeding seasonal categories, dry and rainy seasons as to make feed available for livestock throughout the year. It is also recommended to practice rotational grazing and control burning practices in order to improve quality of pasture in grazing land, regeneration of new green pasture and reduce ticks infestation. A special area of grass is also recommended to be reserved close to homestead for weak animals and calves.

#### **4.2.4 Livestock identification**

It is recommended to mark cattle in order to prove ownership and for recording purposes. Mark calves by clipping the ear or by tattoo with metal ear tag. Burning the mark on skin or hoof (branding) is also recommended. Branding is a great practical importance on animal's identifications because lost animals can easily be traced by the markings they bear and stealing is made more difficult, as the ownership of the animal can be easily identified wherever it is.

#### **4.2.5 Calf rearing**

It is recommended that young calves should receive the first milk (colostrum) few days after giving birth. Give special care and do everything possible to see that they are kept warm, well fed and disease is prevented. Maintain a high standard of cleanliness and hygiene on calf buildings by keeping them dry and insect free. It is also recommended that cow after parturition has to stay with young calf few hours before being kept to a special house pen that is prepared for new born calves.

#### **4.2.6 Livestock disease control**

Veterinary care in terms of prevention can improve livestock production. However, it is recommended that in indigenous livestock systems, use indigenous local medicines and learn to cope with diseases by spreading risks, using animals tolerant to local diseases and running low cost operation.

These findings may be evidence that village livestock extension workers have access to information about recommended agro-pastoralists livestock indigenous production innovations based on family members. However, the study does not provide clues about effective linkages between research and extension service with regard to agro-pastoralists livestock indigenous production practices. Evidence suggests that available agro-pastoralists livestock indigenous recommended practices for livestock production practices appear to be complex and therefore not easily usable by the pastoralists and extension workers. On the other hand, the lack of refinement of agro-pastoralists livestock indigenous production practices may be a reflection of the extent of research that has been done in relation to agro-pastoralists livestock indigenous production practices.

### **4.3 APHHs Respondents Perceptions on Transfer of Agro-pastoralists**

#### **Indigenous Livestock Production Innovations**

Based on the list of agro-pastoralists livestock indigenous production innovations identified in Table 9, the following parts are addressed in this section: (a) sources of extension advice on agro-pastoralists livestock indigenous production innovations and (b) extension methods used on agro-pastoralists livestock indigenous production innovations.

### 4.3.1 Sources of extension advice on agro-pastoralists livestock indigenous production innovations

It was expected that understanding sources of extension advice used on recommended agro-pastoralists livestock indigenous production practices would indicate the extent to which agro-pastoralists were advised. The APHHs respondents were therefore asked to give opinions on sources of extension advice on recommended agro-pastoralists livestock production practices in their villages. The findings are summarised in Table 10.

**Table 10: Percentage distribution of APHHs respondents' household heads (n=120) by source of information on livestock indigenous innovations**

Type of practice	Sources of Advice		
	Family Percent	Neighbour Percent	Extension worker Percent
Livestock housing	59.2	35.0	7.8
Livestock breeding	60.2	25.8	14.0
Pasture management	49.4	29.2	21.4
Livestock identification	60.5	24.3	15.5
Calf rearing	59.5	23.0	17.5
Livestock disease control	50.5	20.8	28.7
<b>Average</b>	<b>56.6</b>	<b>26.4</b>	<b>17.1</b>

Results in Table 10 revealed that, on the average, 56.6% of APHHs respondents identified family members as a source of extension advice on agro-pastoralists livestock indigenous production innovations, while 26.4% and 17.1% respectively, identified neighbours and extension workers, respectively. The results further show that the situation was about the same in all selected practices. The low level of agro-pastoralists dependence on livestock extension workers who are expected to transfer modern knowledge implies centralised decision-makers need to be aware of challenges agro-pastoralists communities face in achieving and/or maintaining sustainable livelihoods as there are few mechanisms for

local communities to transmit their knowledge to outside decision-makers, and the communities are often economically and politically marginalised. This implies that when managing agro-pastoralism for poverty reduction, it is important to ensure that appropriate policy framework is in place to support and preserve indigenous and local knowledge, innovations and practices.

#### **4.3.2 Extension methods used on agro-pastoralists livestock indigenous production innovations**

An attempt was made to identify extension methods frequently used in advising agro-pastoralists with regard to recommended practices for selected agro-pastoralists livestock indigenous production innovations. Three categories of methods (individual, group and mass) were used to solicit agro-pastoralists responses. The views expressed in percentages of respondents are as given in Table 11. Results in Table 11 show that, on average, 58.5% of APHHs respondents identified individual extension method as more frequently used. Mass method was identified by 22.4%, while group method was identified by only 19.2%. Generally, the results show that individual extension method was more frequently used followed by mass and group methods as least frequently used. This implies that individual extension method offers opportunity for dialogue between agro-pastoralists and extension agent to respond to individual agro-pastoralists problems since their individual circumstances differ significantly. Furthermore, with regard to group extension method, the results imply that agro-pastoralists consist of groups of people with common interest, who get together to study the “how and why” of particular innovations. Finally, mass method seemed to be important in relation to pasture management compared to other selected production practices. This could be due the efforts currently made by the government to create agro-pastoralists awareness on the management of pasture as an important source of animal feed.

**Table 11: Percentage distribution of agro-pastoralists household heads respondents' (n=120) perceptions by extension methods frequently used**

Type of practice	Extension Methods used		
	Individual Percent	Group Percent	Mass Percent
Livestock housing	68.3	22.5	9.5
Livestock breeding	60.0	17.5	22.5
Pasture management	43.3	7.5	49.2
Livestock identification	59.4	20.3	20.8
Calf rearing	65.8	20.0	14.2
Livestock disease control	54.1	25.8	20.1
<b>Average</b>	<b>58.5</b>	<b>19.2</b>	<b>22.4</b>

#### **4.4 APHHs Respondents Opinions on the Extent to Which Agro-pastoralists Indigenous Livestock Production Innovations are Utilised**

The study sought to determine APHHs respondents opinion on adoption/rejection of agro-pastoralists livestock indigenous production innovations. Results in this case constituted respondents' extent to which traditional and recommended agro-pastoralists indigenous innovations as well as their degree of innovativeness are utilized and APHHs respondents perceptions on recommended indigenous livestock production innovations.

##### **4.4.1 APHHs respondents opinions on the extent of utilization of traditional and recommended agro-pastoralists livestock indigenous production innovations**

In order to determine the extent of use of traditional and recommended agro-pastoralists livestock indigenous production innovations, APHHs respondents' views expressed in percentages were sought as given in Table 12. The study revealed that, on average, 66% and 34% of APHHs respondents' use traditional and recommended indigenous livestock production practices, respectively. Results in Table 12 suggest that APHHs respondents felt that agro-pastoralists indigenous livestock production practices were generally in use

at different levels with more agro-pastoralists relying on traditional practices. This observation is not surprising in light of the fact that traditional livestock production practices have been advocated for years in this study area. However, these findings imply that more work needs to be done by livestock field extension workers in order to gain confidence of agro-pastoralists with regard to recommended practices in livestock production.

**Table 12: Percentage distribution of APHHs respondents (n=120) opinions on the use of traditional and recommended agro-pastoralists indigenous production innovations**

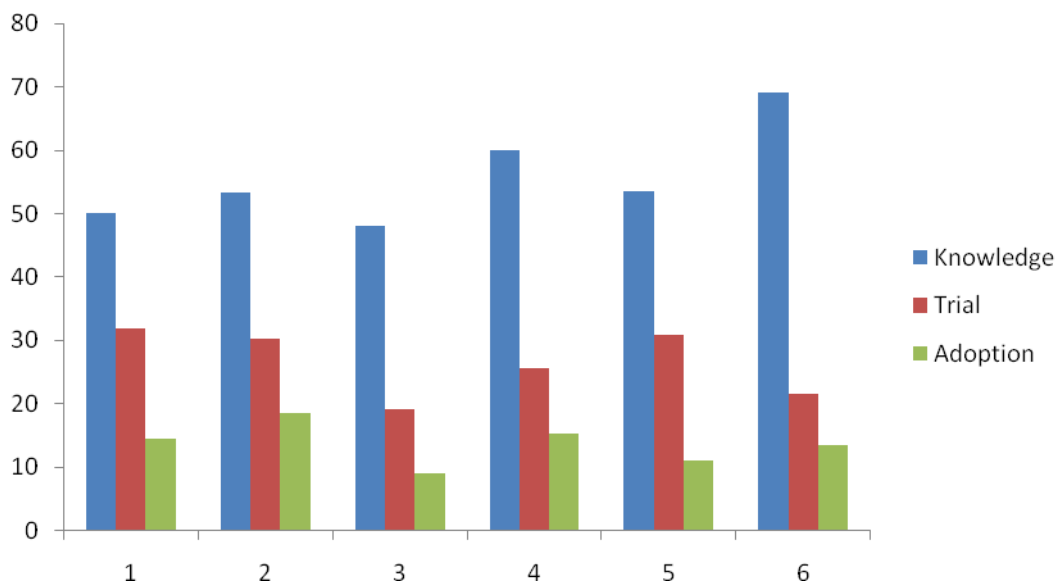
<b>Type of practice</b>	<b>Traditional Percent</b>	<b>Recommended Percent</b>
Livestock housing	73.6	26.4
Livestock breeding	68.3	31.7
Pasture management	59.7	40.3
Livestock identification	78.4	21.6
Calf rearing	67.5	32.5
Livestock disease control	48.3	51.7
<b>Average</b>	<b>66.0</b>	<b>34.0</b>

More specifically, results in Table 12 reveal that there was a high rate (51.7%) of use of recommended practices with regard to disease control, suggesting that veterinary care is increasingly used by agro-pastoralists in order to improve their livestock production. Furthermore, high rate (59.7% to 78.4%) of traditional practices with regard to all other selected agro-pastoralists indigenous livestock production practices may imply that agro-pastoralists are still conservative in the use of such practices. It could also be an indication that extension services have not made major breakthroughs. As noted by Gupter (2000), the agro-pastoralists are not necessarily conservative but are certainly more cautious. They know what they will get if they follow traditional practices. The

moment they change to new practice, they are moving from a state of security to insecurity.

#### 4.4.2 APHHs respondents perceptions on recommended indigenous livestock production innovations

It was assumed that APHHs respondent's indigenous livestock production innovations would provide some indications of extent to which the agro-pastoralists utilised recommended indigenous livestock production practices for improved livestock production in the study area. Three elements of adoption process namely: knowledge, trial and adoption were chosen in this case by use of questions in relation the six selected agro-pastoralists indigenous livestock production innovations posed to APHHs respondents it was possible to determine their degree of innovativeness. In terms of the extent they had performed in respect to the three elements, as summarised in Fig.3.



**Figure 3: Recommended agro-pastoralists indigenous livestock production innovations**

Key: Recommended agro-pastoralists indigenous livestock production innovations

1. Livestock housing
2. Livestock breeding
3. Pasture management
4. Livestock identification
5. Calf rearing
6. Livestock disease control

According to Fig. 3, a number of observations can be made. First, the level of knowledge acquired by agro-pastoralists was generally higher than the extent to which trial and adoption were reached. This observation is in line with the principles of adoption process which portray human beings as progressing from an initial stage of awareness through interest and trial before adopting an innovation (Rogers, 1995). Therefore, one is likely to expect progressively more agro-pastoralists in the “knowledge” category than in trial and adoption categories. Second it appears that more agro-pastoralists had scored higher in terms of knowledge with regard to disease control than any other practice. It can be inferred here that with regard to this practice, extension livestock field workers have done relatively good job in raising the consciousness of agro-pastoralists as well as demonstrating its operations and merits to the extent of convincing them to start controlling diseases properly. Third, agro-pastoralists lagged behind when it came to knowledge, trial and acceptance of pasture management. This might be a reflection of agro-pastoralists utilisation of communal grazing areas.

These results bear a relationship with what is already known about adoption process. The implication that may be drawn from these findings is that the successful motivation of agro-pastoralists is culmination of series of distinct phases. These involve awareness of a new opportunity, generation of interest in it, consideration of its suitability, its trial examination and finally its adoption in crop and livestock production practices. Each group of agro-pastoralists and each phase of adoption tends to require a particular behavior and rejection can occur at any time. Good field extension workers will therefore adjust their approach to agro-pastoralists in light of this sequence. That is, field extension

workers need to learn what stage of adoption process agro-pastoralists are in. Based on this, they can operate in according to stage reached. In this way field extension workers can communicate to agro-pastoralists at different levels.

#### **4.5 APHHs Respondents Opinions on Factors Contributing to Success or Failure in Transfer and Utilisation of Agro-pastoralists Livestock Indigenous Production Innovations**

It was felt that understanding APHHs respondents reasons for rejecting recommended indigenous livestock production innovations would provide some clue on the extent of acceptance or rejection of indigenous livestock production innovations. Five intrinsic characteristics of innovations and appeal of innovations to agro-pastoralists were used. APHHs responses to structured questions involving these characteristics were analysed. The results were summarised in percentages of respondents for each of the recommended practices, as shown in Table 13. The results in Table 13 show that, on average, less than 50% of all respondents reject the recommended indigenous practices with regard to intrinsic characteristics of innovations.

**Table 13: Percentage distribution of APHHs respondents' (n=120) opinions on reasons for rejecting recommended agro-pastoralists livestock indigenous production innovations**

<b>Type of practice</b>	<b>Practices previously used are better Percent</b>	<b>Inconsistence with past experience Percent</b>	<b>Difficult in technology Percent</b>	<b>Not easily triable Percent</b>	<b>Not easily observable Percent</b>
Housing	19.2	24.0	27.8	19.2	9.8
Breeding	20.8	14.3	40.7	14.5	8.7
Pasture management	12.5	38.1	47.5	2.5	15.0
Livestock identification	10.8	20.8	40.2	5.9	8.3
Calf rearing	12.3	25.4	49.0	7.5	11.8
Disease control	14.2	27.5	39.6	8.5	8.2
<b>Average</b>	<b>13.3</b>	<b>24.6</b>	<b>42.1</b>	<b>8.9</b>	<b>11.1</b>

More specifically, factors that caused rejection of practices in declining order were the recommended practice being difficult in technology (42.1%), inconsistency with past experience (24.6%), practices previously used are better (13.3%), not easily observable (11.1%) and not easily triable (8.9%). This could be due to APHHs respondents perception that recommended indigenous livestock production practices are much better than traditional practices. This could be attributed to adequate advice to APHHs respondents on the importance of using recommended livestock production practices. These results may generally imply that various characteristics of innovations, such as: relative advantage, compatibility, triability and observability appear in this study to contribute to different rates of acceptance or rejection of livestock production innovations. Thus, suggesting that considering number of youth currently benefiting from secondary education in Tanzania will be future agro-pastoralists in the country side, there is a need for the government to improve secondary education quality, access and equity.

#### **4.6 Summary of the Discussions**

The overall objective of this study was to assess availability, transfer and utilisation of selected agro-pastoralists' livestock indigenous production innovations in Hanang District. It was found that available agro-pastoralists recommended practices for livestock production appear to be complex and therefore not easily usable by agro-pastoralists and their field extension workers. The transfer of agro-pastoralists livestock indigenous production innovations was mainly done by family members through individual extension methods. The agro-pastoralists livestock production innovations were utilised at different levels with more agro-pastoralists depending on traditional practices. In addition, it was revealed that less than 50% of respondents reject indigenous recommended agro-pastoralists livestock indigenous production practices with regard to intrinsic characteristics of innovations. The following Chapter gives major conclusions and recommendations of the study.

## **CHAPTER FIVE**

### **5.0 CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Conclusions**

- (i) Available agro-pastoralists livestock production innovations that have existed for a long time appear to be complex and not easily usable by agro-pastoralists. It would seem that such innovations need to be further refined.
- (ii) The lower level of agro-pastoralists dependence on livestock extension workers who are expected to transmit modern knowledge implies centralised decision-makers need to be aware of challenges agro-pastoralists communities face in achieving and/or maintaining sustainable livelihoods, as there are few mechanisms for local communities to transmit their knowledge to the outside decision-makers, and the communities are often economically and politically marginalised.
- (iii) Agro-pastoralists livestock indigenous production practices were generally in use at different levels with more agro-pastoralists depending on traditional practices.
- (iv) Agro-pastoralists prefer to utilise innovations which are perceived to be better than those which were previously used, consistent with past experience, simple to apply, triable and observable.

#### **5.2 Recommendations**

- (i) Since, generally, agro-pastoralists livestock indigenous production innovations are available but in forms that are not easily understandable and complex to agro-pastoralists use, much effort should be made to refine the innovations into simplified packages of practices that can easily be disseminated to agro-pastoralists. This calls for closer linkages among research, training and extension organisations for such further refinement.

- (ii) When managing agro-pastoralism for poverty reduction, it is important for the government to ensure that appropriate policy framework is in place to support indigenous and local knowledge, innovations and practices.
- (iii) More work need to be done by livestock field extension workers in order to gain confidence of agro-pastoralists with regard to use of recommended practices in livestock production.
- (iv) Considering the number of youths currently benefiting from secondary education in Tanzania will be future agro-pastoralists in the country side, there is a need for the Government to improve secondary education quality, access and equity.
- (v) Suggestions for further research
  - (i) To undertake a case study on interaction between livestock field extension workers and agro-pastoralists in the study area. The major purpose of the case study would be to elicit more reliable clues about communication behaviors of extension and agro-pastoralists during process of innovations transfer. The participant-As-Observer technique could be useful in seeking data for such study.
  - (ii) To undertake case studies on the process of acquisition of information by agro-pastoralists from livestock extension workers. The major purpose of such studies would be to find out if extension workers are offered opportunities to retrieve information on agro-pastoralists livestock indigenous production innovations from research stations to process it adequately for use by agro-pastoralists.

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## APPENDICES

### Appendix 1: Definition of the key variables used

<b>Variables</b>	<b>Operational definition</b>
Age	Number of years living by individual since birth
Sex	Biological differences between male and female
Education level	Highest level of formal- education acquired
Marital status	Current state of marriage of an individual
On-farm activities	A wide range of activities, which are related to the production of food or of cash crops and livestock keeping
Off-farm activities	Participation of individuals in remunerative work different from crop/livestock activities, have been seen to play an increasingly important role in sustainable development and poverty reduction, especially in rural areas
Farm size	Area of land owned for agricultural production activities
Crop yield	Food and cash crop average yield obtained per acre
Availability of innovations	A situation whereby practices, ideas or objects are readily used or obtained by an individual or group of individuals
Transfer of innovations	A process by which a new practice or ideas generated in one place is passed to another place
Characteristic of innovations	Features which influence the reception and utilisation of indigenous knowledge practices
Adoption of innovations	A choice to accept and utilise new practices or ideas.
Utilisation of innovations	Used interchangeably with term “adoption of innovations”
Rejection of innovations	A choice to refuse to adopt innovations
Improved livelihood	A situation of having enough of food and cash income to meet basic needs
Livestock	The term livestock in this study refer to both indigenous cattle, sheep, goats, pigs, donkeys and chicken kept by agro-pastoralists’

## Appendix 2: Agro-pastoralist household heads questionnaire

### *Confidential*

**Questionnaire:** Personal Interviews

**Respondents:** Agro-pastoralist's

**Study Topic:** The transfer and utilisation of selected agro-pastoralist's production innovations in Tanzania: A case study of selected villages in Hanang District

District: \_\_\_\_\_ Division \_\_\_\_\_ Ward \_\_\_\_\_ Village \_\_\_\_\_

Respondent's Number \_\_\_\_\_ Date \_\_\_\_\_

### **1.0: Agro-pastoralists' Characteristics**

#### **1.1 Personal characteristics**

1.1 Age \_\_\_\_\_ (years)

1.1.2. Sex \_\_\_\_\_

1.1.3. Marital status \_\_\_\_\_ [1] Single [2] Married, [3] Widowed, [4] Divorced { }

1.1.4. Final level of education?

[i] None

[ii] Adult literacy

[iii] Standard IV { }

[iv] Standard VII/VIII

[v] Post primary

[vi] Others (specify).....

1.1.5 What is your family size.....(-----male.....female)

1.1.6 A you born in this village 1=YES 2=NO. { } If NO, how long have you lived in the village ----- (years)

#### **1.2 Situational Characteristics**

1.2.1. Do you have a private farm for crop production? [1] YES [2] NO { }

1.2.2. If YES in 1.2.1 above, indicate crops grown in 2013/2014, as follows:

Type of crop	Area (acres)	Average yield (kg)	Purpose (Cash/Food)	Income (TShs)

1.2.2 Do you own livestock? YES/NO.....If YES, indicate type of livestock you own and average monthly income in 2013/2014, as follows: { }

Type of livestock	Number	Income (TShs)

1.2.3 What is the major source of income earner in the family? 1=from livestock and crop farming, 2=from wages employment, 3=from entrepreneurship, 4=Other (Specify)..... { }

1.2.4 (a) How many livestock's owned by family, 1=(1-5),2=(6-11),3=(12-17),4= 18 and above { }, types of livestock do you own.....

1.2.5 How many hectare owned by family, 1=(1-3), 2=(4-7),3=(8-11),4= 12 and above...{

1.2.6 Do livestock move from residential area for graze during cropping seasons?

1=yes,2=no { }

1.2.7 If yes, how many months away from residential area before turning back? 1=1-3 months, 2=4-7months,8-11months ,4=12months and above .....{ }

1.2.8 What is the distance from home to extension's (vert-office) office?..... km

1.2.9 What is the distance from home to grazing area? .....km

1.2.10 Do you graze livestock and return home every day on each seasons?1=yes 2=no { }

1.2.11 And if no how many months do stay away on residential area? .....  
Months

1.2.12 Which months do you stay away to residential area for grazing livestock? .....

1.2.13 Do you engage in any off-farm activities? ....1=YES 2=NO. If YES, indicate the type of off-farm activities you are engaged and average monthly income in 2013/2014, as follows: { }

Type of off-farm activity	Income (TShs)

## 2: 0 Availability of agro-pastoralists' livestock indigenous production innovations

2. I would like to have your views on the recommended agro-pastoralists' indigenous production practices indicate (v) for appropriate opinion.

Type of practice	Opinion			
	Aware	Ever used	Using	Rejected
Housing				
Breeding				
Feeding				
Pasture management				
Soil conservation				
Identification				
Calf rearing				
Disease control				
Others (Specify)				

2.2. What do the following practices imply as currently used in agro-pastoralists' livestock indigenous production innovations?

Type of practice	Recommendation
Housing	
Breeding	
Feeding	
Pasture management	
Soil conservation	
Livestock Identification	
Calf rearing	
Disease control	

### 3.0 Transfer of agro-pastoralists' livestock indigenous production innovations

3.1. Have you ever received advice from your family or any other source on the following practices involving agro-pastoralists' livestock indigenous production practices? Indicate (v) in appropriate opinion

Type of practice	Opinion				
Type of practice	Family	Neighbour	Extension agent	Others (Specify)	No
Housing					
Breeding					
Feeding					
Pasture management					
Soil conservation					
Identification					
Calf rearing					
Disease control					
Others (Specify)					

3.2. If yes in Qn. 3.1 above, through which extension methods were you advised in agro-pastoralists' livestock indigenous production practices?, indicate (v) for appropriate

Type of Practices	Extension Methods		
	Individual	Group	Mass
Housing			
Breeding			
Feeding			
Pasture management			
Soil conservation			
Identification			
Calf rearing			
Disease control			
Others (Specify)			

#### 4.0 Adoption/ Rejection of Agricultural Innovations

4.1. What is your opinion on the use of traditional and recommended practices with regard to agro-pastoralists' livestock indigenous production practices? Indicate (v) in appropriate opinion.

Type of practice	Traditional		Recommended	
	Mostly used	Not mostly used	Mostly used	Not mostly used
Housing				
Breeding				
Feeding				
Pasture management				
Soil conservation				
Livestock Identification				
Calf rearing				
Disease control				
Others (Specify)				

4.2. Which of the following statements accurately describe the major reason for your continued rejection or failure to use the recommended agro-pastoralists' livestock production practices? Indicate (v) for appropriate opinion.

Type of practice	Practices used are not better	Inconsistence with past experience	Difficult in technology	Not easily triable	Not easily observable
Housing					
Breeding					
Feeding					
Pasture management					
Soil conservation					
Identification					
Calf rearing					
Disease control					
Others (Specify)					

4.3. List problems that make it difficult for agro-pastoralists' to adopt livestock indigenous production innovations put forward to them

- i. ....
- ii. ....
- iii. ....
- iv. ....
- v. ....

4.4. What recommendations can you give for successful transfer and utilisation of agro-pastoralists' livestock indigenous production innovations?

- i. ....
- ii. ....
- iii. ....
- iv. ....

**Thank you for your cooperation**

### Appendix 3: Livestock extension worker and key informants Checklist

#### *Confidential*

**Checklist:** Directed discussions

**Respondents:** Agro-pastoralist's/extension urgent

**Study Topic:** The transfer and utilisation of selected agro-pastoralist's livestock production innovations in Tanzania: A case study of selected villages in Hanang District

District: \_\_\_\_\_ Division \_\_\_\_\_ Ward \_\_\_\_\_ Village \_\_\_\_\_

Respondent's Number \_\_\_\_\_ Date \_\_\_\_\_

- 1 .Are you aware of agro-pastoralists' livestock indigenous production practices? .1=YES  
2=NO. { } If YES, what are the specific recommendations?

Type of practice	Specific recommendation
Housing	
Breeding	
Feeding	
Pasture management	
Soil conservation	
Livestock Identification	
Calf rearing	
Disease control	
Others (Specify)	

2. List problems that make it difficult for extension workers to adequately transfer recommended agro-pastoralists' livestock indigenous production innovations

- i. ....
- ii. ....
- iii. ....
- iv. ....
- v. ....

3. List problems that make it difficult for agro-pastoralists' to adopt livestock production innovations put forward to them

- vi. ....
- vii. ....
- viii. ....
- ix. ....
- x. ....

4. What recommendations can you give for successful transfer and utilisation of agro-pastoralists' livestock indigenous production innovations?

- v. ....
- vi. ....
- vii. ....
- viii. ....

**Thank you for your cooperation**

**Appendix 4: Checklist questions for Focus Group Discussion**

**Study Topic:** The transfer and utilisation of selected agro-pastoralist's livestock production innovations in Tanzania: A case study of selected villages in Hanang District  
 District .....Division.....Ward.....Village..... Total of  
 respondent of FGDs.....

1. What types of livestock indigenous livestock production innovation exists and still been used in livestock practices in daily life (to be listed).
2. How do those selected indigenous knowledge are transferred from one person to another
3. What are the disadvantages and advantages of the use of indigenous knowledge in livestock keeping systems?
4. Why livestock indigenous knowledge is rejected or adopted to be used on livestock practices
5. Why are formal knowledge rejected or adopted in livestock keeping systems.
6. How is livestock indigenous production innovation be practiced?
7. Major problem facing adoption of livestock indigenous

**Thank you for your good cooperation**