

**Enhancing food security in Northern Ghana
through smallholder small ruminant
production and marketing**

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This research was conducted under the auspices of the Graduate Schools of
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Sciences (WIAS).

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Thesis

submitted in fulfillment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus
Prof. Dr M.J. Kropff,
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on Thursday 12 December 2013
at 1.30 p.m. in the Great Hall of the University of Ghana.

Kwadwo Amankwah

Enhancing food security in Northern Ghana through smallholder small
ruminant production and marketing

160 pages.

PhD thesis, Wageningen University, Wageningen, NL (2013)

With references, with summaries in English and Dutch

ISBN: 978-94-6173-820-2

DEDICATION

To my mother, Maame Ama, sisters Mary and Fakaa (deceased),
wife Angela and sons Kwame and Kofi with love.

ACKNOWLEDGEMENTS

Possibly, the most important lesson over the past five years for me is that completion of PhD studies is more about humility than academic brilliance. That is, I needed to ask for help and listen to numerous individual and organizational actors over the course of my studies. I acknowledge the diverse sources of assistance below.

My sincere and unqualified gratitude to the team of Supervisors at Wageningen: Prof. Akke van der Zijpp, Dr. Laurens Klerkx, Dr. Simon Oosting, and Prof. Cees Leeuwis. Prof. van der Zijpp shared her vast experience on animal production systems and that helped me to grasp the complex issues and tasks involved in interventions that seek to commercialize smallholder livestock production. She also hosted my colleagues and I at her home more than once which were welcome breaks from academic preoccupations. Prof. van der Zijpp, your academic and social inputs are very much appreciated. I am thankful to Dr. Klerkx for his visit to the study location and superb guidance in writing. I am confident that his constant reminders will be internalised and bear fruit in my future work. Dr. Oosting discerned that diagramming the concepts in writing the papers enhanced my understanding and was always ready to come to my aid. Dr. Oosting's forethought helped me to integrate natural and social science concepts. Prof. Leeuwis chipped in with his trademark broad picture of issues whenever his schedule allowed.

My supervisors in Ghana, Dr. Owuraku Sakyi-Dawson and Dr. Naaminong Karbo including the Advisory Group members Prof. David Millar and Prof. Ben Ahunu, please, accept my heartfelt thanks. Dr. Sakyi-Dawson, who also served as the CoS-SIS National Coordinator, visited the study location a couple of times and provided the needed guidance. His coordination responsibilities were excellently executed. I am thankful to Dr. Karbo, a paramount chief in-waiting, for his attention to technical details of the case studies. Prof. Millar, you are approachable and you display of humility was incredible to me and worthy of emulation. Prof. Ahunu's encouraging words of advice helped me to weather the storm in the early part of this thesis.

I acknowledge the efficient management of the CoS-SIS Project by Prof. Niels Röling, Prof. Arnold van Huis and Dr. Hounkonnou. Prof. Janice Jiggins and Prof. Röling are worthy of thanks for their academic inputs as well as hosting my colleagues and I (CoS-SIS PhD candidates) on several occasions. I admire so much the management efficiency of Prof. van Huis. He hosted us several times in his home. Dr. Hounkonnou

has the knack for sharing practical experiences that made CoS-SIS meetings more relaxing. Prof. Leontine Visser also hosted us more than once in her home.

I express my gratitude to the principals of Animal Health and Production College whom I worked under: Dr. Gaari-Kweku (deceased), Dr. Mark Hanson, Dr. S.H.M. Opoku and Dr. Eric Obeng Bempong. I will always cherish Dr. Bempong for his kind-heartedness and the active interest he took in my carrier development.

My thanks and appreciations go to the farmer groups at Orbili, Nandom Tankyara, Tangasie and Tabiasi. Individuals who gave freely of their time include Beltug Ubaldo, Paul Deng, Gervase, and Luke Busukuo at Nandom Tankyara; Manour, Gban and William Kpenong at Orbili; Abdulai (Seth) and Kanyor at Tabiasi; and Richard Gaari, Adam Yenli (late Regent), John Dindori and Joshua at Tangasie. I thank the staff of Ministry of Food and Agriculture (MoFA) in Lawra, Nadowli and Jirapa districts and Regional Office, Wa. Special thanks to Isaac Dari, Mikari, Chirey, Roland, Nicholas and Mr. Konigini, the District Director at Nadowli; Woro, Rashid, Damien, James, Zackari, Charles Yenli, Eric (Retired), Sasah (retired), Nicholas (retired), Ojingo, the then District Director, Dy-yakah Salifu (Chief of Lumbusie), current District Director and rest of staff at Lawra; Dr. Degbe and Baba at Jirapa; Baton at Hamile; James at Tumu. At Babile, I thank the Manager of Livestock Breeding Station, Mr Sarpong, Mr. Asenso-Mensah, William, Pot-One; Quest house mates Mr. and Mrs Sixtus Viiru and Kelvin Tengan, staff of Animal Research Institute at Babile. Thanks to Mr. Charles Adams, the then Regional Director and Naa Saaka, the Regional Livestock Officer, Mr. Akorful, the Livestock Component Head during UWADEP for their time. I cherish the regular interactions I had with my Christian brothers and sisters during the field work including Mr. and Mrs. Aseti, Sampson, Solomon, Stephen, and Mr and Mrs. Ambey.

Thanks to individuals who facilitated my interaction with organizations including Dr. Nipa, Dr. Yebuah, Dr. Opoku, Dr. Salia, Dr. Peterson, Mr Dasebu and Dr. MacHansen at Veterinary Services Directorate; Madam Lena, Madam Zelia and Mr. Oheming at Policy Planning, Monitoring and Evaluation Directorate (PPMED); Mr. Dodoo and Nonuu at Ejura Livestock Breeding Station; Mr. Fynn at Animal Production Directorate, Mr. Shahadu at Pong Tamale Livestock Breeding Station, Dr. Cudjo at Central Veterinary Station Pong Tamale; Officers Oppong, Tetteh, Arko and Nana of the Ghana Police Service at Lawra and Nadowli; and Mr. Stans of NANDIRDEP.

My special thanks to the CoS-SIS secretariat in Ghana especially Ezekiel Odonkor for his efficient management and Nana for words of encouragement. My experience indicates that Wageningen University runs smoothly largely due to the efficient and reliable services provided by the secretaries and accounts officers. My deep appreciation to Inge Ruisch for making a number of timely arrangements and deliveries on my behalf. Bea Prijn was quick to respond to my request – it was like magic to me coming from a civil service environment with different work ethic. Vera Mentzel facilitated several transactions for me. What can I say to Annette Dijkstrat, Sylvia Holvast and Mirjam Cevat! Perhaps, service providers in Ghana and elsewhere in Africa can benefit from exposure to your professionalism and work ethic.

My sincere thanks to my colleagues Charity Osei-Amponsah and Willaim Quarmin for interaction and especially for last minute help with the technical aspect of the thesis document. I say thanks to Amadou Sidibe, Edmon Totin, Akpo, Togbe, Nathalie, and Rolland for a number of fruitful interactions. My thanks to colleague PhD Candidates: Betty Adjei for several kind gestures during our stay at Wageningen; Catherine Kilelu for several rounds of discussion from beginning to the end of our studies; Duguma for sharing his deep understanding of technography and practice-based research; and Joseph Tanui for insight on economists' perspective on institutions. I am grateful to Kwame Ahoritor, University of Ghana, my childhood friend. Kwame and I often discussed the logic of social research. Sincere thanks to Prof. E. L. Okorley, University of Cape Coast, who alerted me to the advert on recruitment of candidates for the CoS-SIS Project. I appreciate the many kind gestures and support of Mr. Kofi Debrah who served for a period as the research associate for the Food Security domain. Thanks to Dr. Adjei-Nsiah for assistance and words of advice.

Last, but by no means the least, are my family members. My deepest appreciation to my wife, Angie for taking care of our two sons whiles I pursued this study. My heartfelt thanks to my elder sister, Mary, for caring for our ailing mother. Thanks to Kofi Gyasi, my nephew who bought an external hard drive for storage of my documents. My nephews, Amadou Asuma, Kwabena Aboagye and Kofi Gyasi contributed 'pocket money' when I was travelling to Wageningen to begin the coursework. Individuals and organizations I could not recollect when writing this acknowledgement, my apologies and thanks. Your contribution helped in the making of this thesis.

Kwadwo Amankwah

Tamale, 23rd October, 2013

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ACRONYMS

ADRA	Adventist Relief Agency
AEA	Agricultural Extension Agent
AKIS	Agricultural Knowledge and Information Systems
APD	Animal Production Directorate
ARI	Animal Research Institute
CAHW	Community Animal Health Workers
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CIG	Concertation and Innovation Group
CoS-SIS	Convergence of Sciences - Strengthening Innovation Systems
DADU	District Agriculture Development Unit
DVO	District Veterinary Officer
ERP	Economic Recovery Programmes
FAO	Food and Agricultural Organization
FSD	Farming System for Development
FSR	Farming System Research
GPRS I	Ghana Poverty Reduction Strategy
GPRS II	Growth and Poverty Reduction Strategy
GTZ	German partnership for technical collaboration (in German: <i>Deutsche Gesellschaft für Technische Zusammenarbeit</i>)
GVMA	Ghana Veterinary Medical Association
ha	Hectare
hh	Household
IBAR	International Bureau of Animal Resources
ICRA	International Centre for Development Oriented Research in Agriculture
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILRI	International Livestock Research Institute
IMF	International Monetary Fund
IS	Innovation System
ISSER	The Institute of Statistical, Social and Economic Research
LPIU	Livestock Planning and Information Unit
MoAP	Market Oriented Agricultural Programme
MoFA	Ministry of Food and Agriculture
n	Number
NAES	Nyankpala Agricultural Experiment Station
NANDIRDEP	Nandom Diocese Development Project
NGO	Non-Governmental Organisation
NCCE	National Council for Civic Education
NPD	Non-Positive Deviant
NPP	New Patriotic Party
OIE	Organisation of Animal Health

PAMSCAD	Programme of Actions to mitigate the Social Costs of Adjustments and Development
PD	Positive Deviant
PNDC	Provisional National Defence Council
PPR	Peste Des Petits Ruminants
PRA	Participatory Rural Appraisal
PTD	Participatory Technology Development
R & D	Research and Development
RADU	Regional Agriculture Development Unit
RVO	Regional Veterinary Officer
SAP	Structural Adjustment Policies
SRID	Statistical Research and Information Directorate
SRPIP	Small Ruminant and Poultry Improvement Project
SSA	sub-Saharan African
TA	Technical Assistant
TLU	Tropical Livestock Unit
TO	Technical Officer
ToT	Transfer-of-Technology
UWADEP	Upper West Agricultural Development Project
UWR	Upper West Region
VSD	Veterinary Services Department/Directorate
WDR	World Development Report
WFP	World Food Programme

CHAPTER 1

GENERAL INTRODUCTION

1.1 Introduction

Livestock is the source of livelihood and food security for about one billion people worldwide. It is kept by two-thirds of rural poor in developing countries (Budisatria, 2006). In most case studies from West Africa to East Africa, livestock is a source of liquid assets and insurance for resource-poor smallholders. Besides, livestock is important in crop-livestock farming systems in many semi-arid sub-Saharan African countries. Their manure contributes to soil fertility which improves crop yields. Also they feed on crops residues and enhance total farm income. Thus, livestock can make important contribution to household food security and sustainable rural development (De Vries, 2008, Kyeyamwa et al, , 2008, Bosman et al, , 2010, Kusek and Rist, 2004, Legesse et al, , 2008, FAO, 2012).

Worldwide livestock production systems are undergoing rapid changes in response to population growth, urbanisation and increasing incomes. Developing countries are projected to account for 85% of the growth in demand for meat products between 1995 and 2020 (FAO, 2005). The increasing demand for animal products is expected to improve the incomes and livelihood of smallholders who account for the bulk of production in developing countries. However, most of the increases in livestock production are taking place outside the smallholder sector i.e. the high demand for livestock products co-exist with low direct market participation by smallholder farmers (FAO, 2005, Udo et al., 2011).

Significant numbers of smallholders are engaged in rain-fed agriculture in high risk and resource poor environments where technology-driven projects have failed (Chambers and Jiggins, 1986). This prompted a shift to alternative development paradigm that emphasized enabling institutions and policy environments as essential for addressing the needs of the poor in the late 1990s. In response, international organizations and the donor community sought to promote policies and institutional changes that would enhance livelihood of large number of livestock-dependent poor people. Hence, diversification into livestock and increasing livestock productivity became an important component of the strategy for poverty reduction and agricultural productivity growth (FAO, 2012).

The World Bank's World Development Report (2007) argued that enhancing smallholder agricultural productivity requires improving access to markets and developing market chains. Therefore, it purposed to enhance development of commercial agriculture as a means to achieve sustainable development and poverty reduction. Similarly, World Bank (2009b) argued that poverty reduction in Africa is dependent largely on stimulating agricultural growth. Feldman and Biggs (2012) have noted a growing consensus in development practice that African smallholders in favourable environments can be competitive.

However, Poole et al (2013) have cautioned that a rural sector that prioritizes food security should not be assumed to undertake commercial production. Similarly, Douthwaite et al (2001, p. 824) posits that in less favourable production environments "farmers' priorities tend to be subsistence in nature, that is, their objective is to guarantee sufficient food each year for their families rather than grow large surpluses for sale." Thus, these authors advocate for multidisciplinary understanding of the diverse local contexts that influences knowledge generation and development design as well as smallholder farmers decision making. Apparently, contribution of livestock to the livelihoods of many of the world's rural poor is not disputed, but then, the rapid increase in demand for livestock products in developing countries and their integration into global markets provide both new opportunities and threats to the livelihoods of poor and small-scale livestock producers, traders and processors (FAO, 2012).

The foregoing shows three main reasons for livestock interventions: 1) large share of rural poor keep livestock; 2) livestock can contribute to improved soil fertility and sustainable crop production; and 3) rapid growth in demand for livestock products is taking place in developing countries (FAO, 2012). The case of Northern Ghana reflects on the global situation. Livestock, especially, small ruminants (i.e. sheep and goats) is kept by over 80% of smallholder farmers in Northern Ghana for multiple purposes including insurance for emergency and planned expenditure, source of manure for boosting crop production, and for cultural performances. Besides, there is significant local demand for livestock products. Ghana produces only 30% of the national demand for meat. Northern Ghana accounts for 70% of the local production. The remainder is met by imports from neighbouring countries to the north i.e. Burkina Faso, Mali and Niger. The Guinea Savannah grassland vegetation of Northern Ghana is conducive for livestock grazing. Marketing is assured by traders who link Northern Ghana smallholder livestock producers to vibrant consumer markets in central and southern parts of Ghana (ICRA and NAES, 1993, APD et al., 2009). However, the

potential of livestock for revenue generation, maintenance of soil fertility, and contribution to household food security in Northern Ghana is often not realised due to persistent of constraints.

1.2 Problem statement

Recent studies show that technical constraints in rain-fed crop-livestock farming systems persist in Northern Ghana because of their institutional implications (Kudadjie, 2006, APD et al., 2009, North, 2005). Notable technical constraints in Northern Ghana are diseases and high mortality and inadequate livestock feed. These constraints have institutional dimensions including inadequate animal health services delivery and weak structure of veterinary services organization, principle of optimum investment in staple food crop production but comparatively minimal investment in animal husbandry, annual ritual of bush burning, and unequal distribution of incomes along the livestock supply chain (Addah et al., 2009, Animal Research Institute, 1999). However, the main previous interventions namely the National Livestock Services Project (1993 - 1999) and the Livestock Development Project (2003 - 2009) were skewed towards technical changes. This bias towards technical solutions might have contributed to the failure of the interventions to bring about changes in the production and marketing systems, and hence benefits accrued to the smallholders (APD et al., 2009).

Besides, many models of intervention including farming systems research and participatory technology development (PTD) approaches have concentrated on technical innovations (Leeuwis, 2004). For example, the ILCA (1990, currently International Livestock Research Institute or ILRI) observed that the need for appropriate policies and institutional conditions are recognized as essential in livestock systems research. However, in practice more attention and resources are directed at development of new technologies and improving productivity. Similarly, an FAO manual noted that “The FSD [farming system for development] approach can help also in facilitating linkages not only between farmers and station-based researchers but also with other actors, including those responsible for designing and implementing the policy/support system. But to date most work on FSR concentrate on the technology thrust” (Norman et al., 1995, p. 11).

In the late 1990s, models of intervention switched from focus on technology to markets and commodity value chains as the principal driver of agricultural growth (Röling, 2009). However, recently, several authors have commented on mismatch

between interventions aimed at improving smallholder livestock productivity and market participation on one hand, and the farming system and the wider-socio-institutional contexts, on the other hand (Mekoya et al., 2008, Sumberg, 2002, Tarawali et al., 2011, Wambugu et al., 2011). Thus, there is increasing recognition that technical changes often require complementary institutional changes, for example, in the organization of labour, land tenure, markets and distribution of benefits (Klerkx et al., 2010, Spielman et al., 2009). However, there is inadequate knowledge on the processes by which institutions shape the production and market participation by smallholder ruminant producers in Northern Ghana in particular. As a point of departure from previous interventions, this study was conducted as the Food Security component of the Convergence of Sciences - Strengthening Innovation Systems (CoS-SIS) Programme in Northern Ghana to explore the inter-linkage of technical and institutional constraints in smallholder small ruminant production and marketing in Upper West Region of Ghana.

1.3 General research objectives and main research questions

This study aimed to 1) examine the salient technical and institutional constraints that hinder smallholder ruminant production and marketing, and 2) analyse how previous interventions as well as smallholder farmers themselves sought to address the combined technical and institutional constraints in the environment of ruminant production in Northern Ghana. Four research questions were derived from the general objectives. Question 1 takes a diagnostic stance by examining the broader context of small ruminant production and marketing system. Salient issues from Question 1 are the basis of further analysis in Questions 2 to 4.

Research Question 1: What are the salient technical and institutional constraints to innovation and market participation by smallholder small ruminant farmers in Northern Ghana?

There is significant local demand for livestock products in Ghana, but then, smallholder farmers in Northern Ghana do not fully exploit the available market opportunities. To provide a descriptive understanding of the reasons for smallholders' low production and participation in livestock markets, this study investigates 1) the prevailing practices of small ruminant production and marketing in crop-livestock smallholder households in Upper West Region of Ghana, and 2) the farm level and higher level constraints related to technical, infrastructural, institutional, and

competencies that hinder improved small ruminant production and market participation by smallholder farmers.

Research question 2: What are the effects of institutional change, namely, decentralization and privatization reforms on delivery and smallholders' use of veterinary services in Northern Ghana?

One of the important institutional constraints that hinder smallholder farmers is high livestock mortality that results from inadequate provision and weak structure of veterinary services organization. This institutional constraint was linked to decentralization and privatization reforms of veterinary services since the mid-1990s as part of structural adjustment policies implemented by most sub-Saharan African country governments including Ghana. I examine the effect of these policy changes on delivery and smallholders' use of veterinary services in Lawra and Nadowli districts in Northern Ghana by assessing 1) the changes in delivery of animal health services, and 2) responses of stakeholders to the reforms.

Research question 3: To what extent did interventionists and farmers co-learn and adapt in livestock supplementary feeding interventions in Northern Ghana?

Animal production systems literature indicates that, next to health, nutrition is the most important constraint in smallholder ruminant production. Most researchers have established that supplementary feeding with leguminous fodder and crop residue such as groundnut haulms are important source of high quality protein that can offset scanty and low-quality natural pastures and crop residue during dry season. This study examines the extent to which interventionists and farmers co-learned and adapted during the main phases of supplementary feeding interventions (using *Cajanus cajan*, *Stylosanthes hamata* and groundnut crop residue) that were part of projects (1996 to 2009) to improve smallholder small ruminant production in Upper West Region of Ghana.

Research question 4: How did smallholder farmers, characterised as positive deviants, overcome institutional constraints and become more effective at flock growth and market participation than their peers with access to similar resources in Northern Ghana?

Consistent with agricultural innovation system literature, the first study in this thesis showed that smallholder farmers characterised as positive deviants produced novelties

by accumulating livestock assets and participating in high value domestic markets. This study, therefore, examines how positive deviants succeeded to introduce change and the strategies they employed to overcome technical and institutional constraints in their environment. I compared farming system characteristics of positive deviants and non-positive deviants on whether there were substantial differences between them.

1.4 Analytical concepts

An innovation system (IS) inspired conceptual framework is employed to guide this study. This framework draws sensitizing concepts from IS studies (Geels and Schot, 2007, Hall and Clark, 2010, Klein Woolthuis et al., 2005) within the context of farming systems research, livestock systems research, and Agricultural Knowledge and Information Systems approaches (Engel and Salomon, 1997, FAO, 2001, ILCA, 1990, Norman et al., 1995). That is, given that crop-livestock systems are prevalent in the complex, diverse and risk-prone environment of Northern Ghana (Animal Research Institute, 1999), drawing concepts from the IS approach and other system approaches is deemed more instructive than reliance on a single theoretical perspective.

An IS model categorise actors into five domains: (1) Enterprise Domain e.g. farmers, commodity traders; (2) Intermediary Domain e.g. extension services, NGOs, farmer organizations; (3) Research Domain e.g. research institutes, universities; (4) Support Structures e.g. financial services providers, transporters, market infrastructure; and (5) Consumer Domain e.g. consumers, policy makers (Hall et al., 2006). A fundamental assumption of the IS model is that innovation results from interactions and complementary activities among the different domain of actors that are regulated by institutions. The IS model indicates that bringing about changes in the institutional settings requires formation of platforms to comprise representatives of all the supply chain actors to collectively discuss the limitations and opportunities to improve small ruminant production and marketing. Within this platform, a nodal organization or broker has to be assigned responsibility of strengthening network linkages among the diverse actors engaged in the supply chain (Klerkx et al., 2010, Hall et al., 2007).

The IS framework is a heuristic and analytical tool for identifying aspects of a system that are conducive for or hindering innovation. It has proven to be a useful tool in participatory analysis of impediments in system innovation of an infrastructural, institutional, market or capabilities nature (Klein Woolthuis et al., 2005, Van Mierlo et al., 2010b). The adapted IS inspired framework is participatory in the procedures it

suggests for both identification and resolution of constraints in the small ruminant production and marketing system. First, the framework supports the examination of how the smallholder farmers have been responding to changes in the environment. Secondly, it supports multi-stakeholder platform of all the relevant actors in the supply chain for resolving the salient technical and institutional constraints.

This study purposes to examine the relationship between the micro-level small ruminant production and marketing on one hand, and the meso-level institutional settings on the other hand, in Lawra and Nadowli districts in Northern Ghana. In order to resolve this purpose/problem statement, an IS inspired framework suggests tracking processes and events at both local/micro-level and institutional settings/meso-level (Geels and Schot, 2007, Hall and Clark, 2010). The main conceptual issues at the micro-level are as follows: adaptive responses of crop-livestock smallholders to changes in the environment; and the technical limitations in these responses. At the meso-level, the focal conceptual issues are the following: the institutional reasons which are outside the control of individuals and which account for the persistence of the technical constraints; and the need for multi-stakeholder platform composed of organizational actors with stake in small ruminant production and marketing to collectively discuss and resolve the salient technical and institutional constraints. (Clarificatory note: multi-stakeholder platform was initiated but later discontinued due to facilitation bottlenecks).

1.5 Methodology

1.5.1 Study design, population, sampling procedure and data gathering methods

Multiple methods of qualitative and quantitative design (Neuman, 2000) are employed to answer the Research Questions 1 to 4 in Upper West Region in Northern Ghana. Qualitative methods are used uncover the meaning that people assign to their experiences (Yin, 2003). In order to have an over view of the study area, a quantitative survey is employed to characterise the farming systems. The region is located in the north-western corner of Ghana stretching from Longitude $9^{\circ} 35' \text{ N}$ to 11° N and Latitude $1^{\circ} 25'$ to $2^{\circ} 50' \text{ E}$. The population of this study is smallholder crop-livestock farmers in Upper West Region of Ghana who experience household food insecurity between one to five months in the year (Quaye, 2008). Purposive sampling (Yin, 2003) is used first to select the Upper West Region (UWR) out of the three northern regions and to select Lawra and Nadowli districts out of eight districts in UWR, based on the

fact that household food insecurity was shown in the exploratory and scoping studies (Amankwah, 2009, Dormon et al., 2010) to be high in these areas.

Interviews with staff of Ministry of Food and Agriculture (MoFA) in Lawra and Nadowli and with other technical experts at two workshops organised in Wa, the regional capital, showed that there are three principal categories of communities in the two selected districts (Amankwah, 2009). In order to capture this diversity, purposive sampling (Silverman, 2000) then was used to select from the three categories of communities:

- (i). Communities where smallholders are oriented to trading in livestock: of these, Kumasal (1 km from Babile market) in Lawra District and Tangasie in Nadowli District were selected;
- (ii). Communities inclined to livestock production: of these, Tabiasi and Dakyiae in Nadowli District were selected (Tabiase was omitted due to time constraints).
- (iii) Communities oriented towards livestock production and that also have been beneficiaries of recent interventions in the sector. The two selected communities are Oribili and Tankyara near Nandom (in Lawra District). Both communities participated in interventions (i.e. UWADEP and ARI-MoFA) from 1996 to 2009.

1.5.2 Data collection and analysis

Methods employed include in-depth interviews, direct field observations, focus group discussion, stakeholder workshops, document review and a quantitative survey (of 355 household heads in four villages). Table 1 provides an overview of qualitative research methods and sample categories for each research chapter.

Qualitative data (from field notes and transcripts) were analysed using Atlas.ti version 5. The data was coded using the questions ‘what is the actor doing or saying in this data segment’, ‘what salient factors affect the actor’s actions and what are the consequences.’ Guided by these analytical questions, concepts were identified and short notes or memos written for each concept. Patterns in terms of recurrent and concurrent concepts were identified and narrative summaries using the memos were composed (Charmaz, 2012). The quantitative survey data were summarised using descriptive statistics.

Table 1.1 Overview of qualitative research methods and sample categories in research Chapters

Research Method	Study sample unit	Total respondents
Chapter 2		
In-depth interviews	HH heads in 5 villages	53
	Supply chain actors	45
Stakeholder workshops	Supply chain actors	39
Chapter 3		
Focus group discussion	Groups of 12 members in 3 villages	36
In-depth interviews	Farmers in 4 villages	20
	MoFA staff	25
	Traders	10
	Fulani herdsmen	2
	Community Animal health Workers	2
	Veterinary store operators	6
Chapter 4		
Focus group discussion	Groups with 35 and 17 members each in two communities	52
In-depth interviews	Adopters, non-adopters and dis-adopters; MoFA staff	16
		10
Chapter 5		
In-depth interviews	Positive deviants	9
	Key informants	15

1.5.3 Description of study area

Upper West Region is one of the three regions in Northern Ghana. The ecological zone is mostly Guinea Savannah grassland. Rainfall of UWR is unimodal with the months of precipitation confined between April and October. Mean temperature is 32⁰. Vegetation is Guinea Savannah characterised by short grasses and few woody plants. Common trees are baobab, dawadawa, shea, and acacia which are drought and fire resistant. The soils are laterite with low organic matter content (2%). Agriculture engages about 80% of the population. Most farmers engage in both crops and livestock. Common crops are maize, millet, cowpea and groundnut. Persistent low

agricultural production has resulted in annual imports of maize and other crops from Southern Ghana and Burkina Faso (Animal Research Institute, 1999, APD et al., 2009, ICRA and NAES, 1993).

1.6 Structure of thesis chapters

This thesis comprises six chapters: an introduction in chapter 1, four empirical chapters from 2 to 5, and a conclusion in chapter 6. A diagnostic study in chapter 2 informs chapters 3 to 5.

Chapter 2 employs innovation system framework to diagnose salient technical and institutional constraints that hinder improved production and marketing of small ruminants by smallholder farmers in Lawra and Nadowli districts. It identifies joint technical and institutional constraints that farmers experience. Chapters 3 to 5 then details attempts by state organizations as well as farmers to resolve the constraints.

Chapter 3 examines the effect of policy reforms on farmers use and delivery of veterinary services. It employs a framework comprising allocative, normative and cognitive institutions to examine changes in various types of veterinary services following the reforms and how diverse stakeholders responded in Northern Ghana.

Chapter 4 analyse interventionists' effort to facilitate co-learning and adaptation by farmers in supplementary feeding interventions to improve small ruminant production in Northern Ghana. It uses a learning selection model that shows the trajectory of intervention from awareness creation through execution of decisions to outcomes of implemented activities.

Chapter 5 examines how smallholder farmers characterised as positive deviants are more successful at herd growth than non-positive deviants with similar resources in Northern Ghana.

Chapter 6 synthesize the findings from chapter 2 to 5 and draws implications for policy and further research.

CHAPTER 2

DIAGNOSING CONSTRAINTS TO MARKET PARTICIPATION OF SMALL RUMINANT PRODUCERS IN NORTHERN GHANA: AN INNOVATION SYSTEMS ANALYSIS

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Published in NJAS – Wageningen Journal of live Sciences

Abstract

This paper assesses why participation in markets for small ruminants is relatively low in Northern Ghana by analysing the technical and institutional constraints to innovation in smallholder small ruminant production and marketing in Lawra and Nadowli districts. The results show that the limitations experienced by smallholders i.e. water shortages during the dry season, high mortality and theft of livestock persist because of institutional constraints. These include structural limitations related to availability of arable lands, weak support systems for animal production and health services delivery, communities' values that are skewed towards crop production more than animal husbandry, ineffective traditional and formal structures for justice delivery, and gaps in the interaction between communities and district and national level organisations such as the Ministry of Food and Agriculture, district assemblies, rural banks, and non-governmental organisations as well as traders and butchers. Confronted with such constraints, the strategies that most smallholders have adopted to be resilient entail diversified sources of livelihood, low input use in small ruminant production, and maintaining the flock as a capital stock and insurance. Only a few smallholders (i.e. 'positive deviants') engage in market or demand-driven production and/or exhibit successful strategies in small ruminant husbandry. It is argued in this paper that for the majority of smallholders, market production, which requires high levels of external inputs or intensification of resource use, is not a viable option. The main implications of the study are that a) other institutional constraints than market access constraints should be addressed, b) that commercial livestock farming should not be idealised as the best or only option (as is being done in many contemporary interventions that aim at incorporating smallholders into commodity value chains), and c) that different types of small ruminant system innovation pathways should be explored by making use of local positive deviants.

Keywords: livestock markets, techno-institutional constraints, innovation systems
Ghana

2.1 Introduction

Worldwide livestock production systems are undergoing rapid changes in response to population growth, urbanisation and increasing incomes. Developing countries are projected to account for 85 per cent of the growth in demand for meat products between 1995 and 2020 (FAO, 2005). The increasing demand for animal products is expected to improve the incomes and livelihood of smallholders who account for the bulk of production in developing countries. However, most of the increases in livestock production are taking place outside the smallholder sector (FAO, 2005, Udo et al., 2011). This is also the case for the production of small ruminants such as goats, because most smallholders have a low market participation that will not easily increase since they invest very little in their management and suffer from high transaction costs (Animal Research Institute, 1999, van Rooyen and Homann-Kee Tui, 2009). High demand for livestock products and low direct market participation by smallholders also describes well the situation in Northern Ghana. As elsewhere (Udo et al., 2011, van Rooyen and Homann-Kee Tui, 2009, Kocho et al., 2011) several interventions with a focus on smallholder small ruminant commercialisation have been made to improve Ghanaian small ruminant production systems and markets, such as the National Livestock Services Project (1993 – 1999) and the Livestock Development Project (2003 – 2009). However, these have not changed the small ruminant production and marketing systems in any significant way (APD et al., 2009).

Recent studies of agricultural innovation indicate that innovation is not just about adopting new technologies. New technical practices also call for alternative ways of organizing, for example, markets, labour, land tenure and the distribution of benefits (Adjei-Nsiah et al., 2004, Dormon et al., 2004). Different parts of production systems and of the institutional environment in which they are embedded (e.g. the value chain, the market, the policy environment) thus need to evolve simultaneously in order to enable innovation, and this requires interactions among multiple actors (Ochieng, 2007, Geels and Schot, 2007, Hall et al., 2007). The realization that many actors and their activities matter for innovation is the essence of innovation systems thinking. An innovation system can be defined as the set of all individual and organisational actors that are relevant to innovation in a particular sector or issue, their interactions and governing institutions (Anandajayasekeram et al., 2009). Institutions in this perspective are defined as the rules, standards or principles that coordinate interactions (North, 2005).

The concept of innovation systems presupposes that they stimulate innovative developments but often they work imperfectly. For example, there may be deficient collaboration among actors for innovation to occur, due to differences in focus and incentives (Klerkx et al., 2009). Furthermore, innovation systems might only support innovations that merely sustain dominant practices, instead of enabling radically different pathways of development (Klerkx et al., 2010, Hung and Whittington, 2011). Hence, innovation systems often do not work as a coherent system in support of innovation, and present ‘innovation system failures’. Klein Woolthuis et al. (2005) have reviewed the commonly occurring types of innovation system failure and on basis of the typology have designed a framework for structured analysis of constraints in innovation processes. This framework can be applied to reveal why a certain desired innovation goal is not achieved (Van Mierlo et al., 2010a). The various constraints in the innovation system failure framework (Van Mierlo et al., 2010a) are structured according to their nature: physical (e.g. roads, farming infrastructure, technical devices), knowledge (e.g. extension) and service (e.g. banking) infrastructure; hard institutions (by which is meant the formal rules and regulations which perpetuate an existing regime, or the lack of them, hampering innovation because the actors are unsure how legislation will affect their innovation); soft institutions (by which is meant the implicit, unwritten rules, or ‘the way business is done’, which influences for instance the mind-set for innovation or the propensity to collaborate for innovation). The former also relates to failures concerning interactions among actors, expressed by too strong networks (sets of powerful actors that maintain the system *status quo* in a way that is not conducive to innovation) and weak networks (lack of linkages with actors who can provide new insights, insufficient trust for social learning). The framework also encompasses indicators of the actors’ capabilities for innovating (e.g. education level, time available) (Klein Woolthuis et al., 2005).

The direct linkage between the technical and institutional dimensions of livestock production systems and the need to address such issues simultaneously has become increasingly recognized in the livestock innovation literature that applies an innovation systems perspective (FAO, 2005, van Rooyen and Homann-Kee Tui, 2009, Hall et al., 2007). Beyond yielding information about constraints to innovation in small ruminant production in Northern Ghana, the present paper aims to contribute to the livestock innovation systems literature. It deepens innovation system analysis by applying a comprehensive and systematic framework based on a categorization of so-called innovation system failures (Klein Woolthuis et al., 2005) to analyse and categorise the coupled technical and institutional constraints.

The overall purpose is to assess why participation in the market for small ruminants is relatively low in Northern Ghana, by means of a broad diagnostic study of the institutional and technical constraints to innovation of small ruminant livestock production systems in Lawra and Nadowli districts.

2.2 Methodology

2.2.1 Selection of the domain

A preliminary exploratory study in the Upper West Region in Northern Ghana identified a number of strategies that smallholders employ in response to food insecurity (Dormon et al., 2010). At a workshop held in Elmina, Ghana in June 2009, an expert discussion (involving three university lecturers, one PhD student, one representative of a farmer organisation, and two representatives of NGOs) about livestock interventions identified small ruminant keeping as an essential strategy for coping with food insecurity in the three northern regions in Ghana (Animal Research Institute, 1999, APD et al., 2009, Quaye, 2008). A follow-up scoping study showed that a number of development organisations have on-going livestock production interventions in all the districts in Upper West Region - a further indication of the perceived importance of and opportunities in livestock keeping (Amankwah, 2009). The results of the exploratory and scoping studies and the expert discussion were used to select small ruminant production and marketing as an entry point for intervention under the Convergence of Sciences – Strengthening Innovation Systems (CoS-SIS) Programme in Northern Ghana.

2.2.2 Characteristics of the domain, problem description, and research questions

Small ruminants (i.e. sheep and goats) are a significant source of livelihood and food security in Northern Ghana where almost all smallholders combine crop production with small ruminant husbandry. Ghana produces only 30% of the national small ruminant meat demand. Northern Ghana accounts for 70% of the local production. The remainder is met by imports from neighbouring countries to the north i.e. Burkina Faso, Mali and Niger (APD et al., 2009). The vegetation of Northern Ghana is mostly Guinea Savannah grassland that is conducive for livestock grazing. However, the potential of livestock for revenue generation, maintenance of soil fertility, and contribution to household food security in Northern Ghana is often not realized

because of a number of persistent constraints. This study's initially sought simply to furnish a descriptive understanding of the constraints so that the potential could be realised. The study was guided by two principal questions:

1. What are the prevailing practices of small ruminant production and marketing in crop-livestock smallholder households in Upper West Region of Ghana?
2. What are the farm level and higher level (e.g. value chain, policy environment, market) constraints of a technical, infrastructural, institutional, interactional, and capability related nature that hinder small ruminant innovation, with particular reference to improved production and market participation by smallholders?

2.2.3 Study design, population, sampling procedure and data gathering methods

An explorative and interpretivist qualitative case study design (Erickson, 1986) was employed. This design is suited to uncovering the meaning that people assign to their experiences. The population of this study is smallholder crop-livestock farmers in Upper West Region of Ghana who experience household food insecurity between one to five months in the year (Quaye, 2008). Purposive sampling (Silverman, 2000, Yin, 2003) was used first to select the Upper West Region (UWR) out of the three northern regions and to select Lawra and Nadowli districts out of eight districts in UWR, based on the fact that household food insecurity was shown in the exploratory and scoping studies (Amankwah, 2009, Dormon et al., 2010) to be high in these areas.

Interviews with staff of Ministry of Food and Agriculture (MoFA) in Lawra and Nadowli and with other technical experts at two workshops organised in Wa, the regional capital, showed that there are three principal categories of communities in the two selected districts (Amankwah, 2009). In order to capture this diversity, purposive sampling (Silverman, 2000) then was used to select from the three categories of communities:

- (i). Communities where smallholders are oriented to trading in livestock: of these, Kumasal (1 km from Babile market) in Lawra District and Tangasie in Nadowli District were selected;
- (ii). Communities inclined to livestock production: of these, Tabiasi and Dakyiae in Nadowli District were selected (Tabiase was omitted due to time constraints).
- (iii) Communities oriented towards livestock production and that also have been beneficiaries of recent interventions in the sector. The two selected communities are Oribili and Tankyara near Nandom (in Lawra District). Both participated in the Small

Ruminant Improvement Project implemented by Animal Research Institute (ARI) from 2003 to 2009.

Systematic sampling (Silverman, 2000) was employed to select 53 compound houses in the five communities (see Table 2.4 for number of households interviewed per community). In most of the cases the respondent was the male head or landlord of the compound house. Two female landlords and four other females were interviewed in the absence of the male heads. Snowball sampling (Silverman, 2000) also was employed to identify and interview other individual and organisational actors in the supply chain. These actors included traders, butchers, and food sellers (i.e. ‘chop bar operators’) at the two main local markets i.e. Babile and Tangasie and in the two largest cities in Ghana i.e. Accra and Kumasi. Other actors were the staff of MoFA in the two districts and at national headquarters, rural banks, district assemblies, non-governmental organisations (NGOs), and police officers in the two districts.

The interview schedule included the practices of the diverse actors in the small ruminant supply chain, constraints experienced by the actors, and who or what influenced their activities. In addition to the interviews, a review of archival documents (see (Animal Research Institute, 1999, APD et al., 2009, Atengdem and Dery, 1997, Ojingo, 2008, UWADEP, 2000)) and participant observation also were employed. Finally, a farmer group in each of the five communities was invited to rank the identified constraints.

After obtaining a broad view of the limitations in small ruminant production system in the five communities, the researchers subsequently focused on two of the communities for further institutional analysis. The criteria used in selecting the two communities were participation (Oribili in Lawra District) and non-participation (Tangasie in Nadowli District) in ARI project and practical considerations such as the distance from Babile (i.e. the resident of the researchers) to the communities. The respondents to the initial interviews indicated that the members of the two communities hardly interacted and therefore that the ARI intervention was not likely to have a spill over effect.

In order to examine the reasons behind the farmers’ prioritised constraints at Oribili and Tangasie, one-day multi-stakeholder workshops (Gildemacher et al., 2009) were organized in Lawra and Nadowli districts respectively. The participants included farmers, traders and butchers, staff of MoFA, district assembly, NGOs, rural banks, and police service. The participants were divided into groups during the workshop,

based on the first three priority constraints identified by farmers in the respective community (see Table 2.5). The Research Associate, whose role in the CoS-SIS Programme is in part the facilitation of multi-stakeholder processes, guided the groups to examine the reasons for the persistence of the limitations, using the socio-technical root system analysis tool (Leeuwis, 2009). In using the root system analysis, each group was assigned a prioritised constraint identified during the community-based interviews. The groups discussed prevailing practices that contributed to the problem and the reasons why these practices persist. The output of each group's discussion was drawn on a flip chart (see Figure 2.1). The groups presented in turn their analysis at a plenary session. The limitations identified were converted to a table conceived as an innovation systems failure matrix (Table 2.6).

The data in this study were analysed by the researchers manually, using thematic analysis (Ryan and Bernard, 2003). All the field notes were read and the pages numbered. Each page was coded manually using the question 'what concept is this data an instance of' so that any assertions to be made could be grounded in the data (Erickson, 1986). Concepts were identified and short notes or memos were written for each concept on a piece of paper using the data from the corresponding page. All the pieces of papers that had similar conceptual headings were pulled together under a higher order term or theme, which was discovered by means of the similarity between the concepts. Memos or narrative summaries were then written on the higher order concepts, using the notes under the concepts to illustrate the themes. To provide readers with a vicarious experience of this process and in line with the interpretivist philosophy adopted in this paper, the narrative summary provided in this paper is populated with direct quotations that illustrate the documented meaning and perspectives of the actors in this study (Erickson, 1986). Under the analysis and discussion section, the various themes are related to each other as well as to the findings and the conceptual framework.

2.3 Findings

The results are organized under seven themes: the crop-livestock farming systems; reasons for keeping small ruminants; tethering practices; free-range management practices; the market off-take of small ruminants; the constraints experienced by smallholders in small ruminant production; and, the institutional underpinnings of the constraints.

2.3.1 Overview of crop-livestock farming systems

The population, households and their sizes in the five communities studied are described in Table 2.1.

Table 2.1: Population, households and average household size in five selected communities

District	Community	Population (n/village)	Households (n/village)	Household size (n/hh)
Lawra	Kumasal	381	66	5.8
	Orbili	256	30	8.5
	Tankyara	272	44	6.2
Nadowli	Dakyiae	219	37	8.1
	Tangasie	1009	154	6.4

Source: Ghana Statistical Service, (2005)

All the inhabitants in our sample have diverse sources of livelihood; for instance, all eleven households interviewed at Tangasie in March 2011 engage both in crop farming (during the main season from May to November) and livestock keeping. Six out of the eleven engage in dry season gardening (from December to April); and six out of the eleven also conduct small-scale trading activities (such as buying and selling livestock, selling provisions laid out on tables at weekly markets). Similarly, at Orbili, all nine households interviewed undertake both crop and livestock production; six out of the nine engage in dry season gardening; and five out of the nine engage in trading activities. (In this paper most of the concrete examples are drawn from these two communities, where detailed follow up interviews were conducted).

Various kinds of crops and animals are raised, as shown for Tangasie and Orbili in Tables 2.2a and 2.2b. The farming systems characteristically combine mixed cropping and mixed farming. The most common farming systems are the millet/sorghum based farming system, groundnut based farming system, cowpea based farming system, and maize based farming system. In terms of farm structure there are two kinds of farms: compound farms (farms built around the main residence), and bush farms (farms distant from the main residence). The distance from the place of residence to the bush farms typically is about 5 kilometres. Farm sizes range from 0.4 ha to 1.6 ha. Un-

cropped or marginal lands near the residences are where animals are tethered for grazing during the rainy season.

The smallholders in the five communities studied keep several kinds of livestock and poultry, namely, sheep and goats (i.e. small ruminants), pigs, cattle, donkeys, guinea fowls, chickens and turkeys. The average herd or flock sizes for the five major kinds of animals and birds were found to be: small ruminants 20.2; chicken 14.9; pigs 5.3; guinea fowls 4.8; and cattle 1.9. The percentage of households keeping various livestock and poultry at Tangasie and Orbili is shown in Table 2.2b.

Table 2.2a: Percentage (%) of households cultivating various crops at Tangasie and Orbili during the 2010 farming season

Community	Maize	Sorghum	Millet	Groundnut	Cowpea	Bambara beans	Rice	Yam
Tangasie (n=11)	81.8	72.7	9.1	81.8	58.0 (18.25 intercropped cowpea and sorghum)	45.5 (22.2 intercropped cowpea and bambara beans with groundnuts)	18.2	45.5
Orbili (n=9)	100	77.8	100	100	11.1	11.1	11.1	11.1

Table 2.2b: Percentage (%) of households keeping various livestock at Tangasie and Orbili in March 2011

Community	Goats	Sheep	Chicken	Guinea fowls	Cattle	Pigs
Tangasie ¹	100	30.4	63.6	27.3	9.1	45.5
Orbili ²	55.6	88.9	77.8	11.1	33.3	66.7

¹ n = 11 (selected by stratified sampling with wealth as criteria)

² n = 9 (selected by stratified sampling with wealth as criteria)

Six out of seven smallholders interviewed in one of the communities, Dakyiae, preferred to raise small ruminants to other livestock because small ruminants do not

require much investment but are prolific and can be relied on in times of need. One farmer captured the sentiment of his fellows when he said: *“the goat is easy to keep. It does not require much labour. For instance, you don’t buy grass or leaves, the animals can fend for themselves.”* An animal production officer in MoFA, in Tamale explained this preference in these terms: *“farmers don’t want to put in any money. At best they give only water. At the end of it, they can get something and still feel comfortable. They don’t invest in it because they pay more attention to crops.”* It appears that one of the main attractions of small ruminants is their low input requirement.

Most of the farmers keep local West African Dwarf sheep and goats, which are hardy, disease resistant and prolific. The average herd size of small ruminants (standard deviation in brackets) per household for each of the five communities in 2009 is shown in Table 2.3.

Table 2.3: Average herd size of small ruminants per household in 2009 in five communities in Lawra and Nadowli districts

Community	Orbili	Tankyara	Kumasal	Tangasie	Dakylae
herd size (n/household)	43.7	21.8	9.1	17.5	12.5
Standard deviation	(31.0)	(7.7)	(3.9)	(15.3)	(5.8)

Source: field interviews, 2010

The average herd size per compound house, for Northern Ghana as a whole, ranges from eight to twelve small ruminants (Atengdem and Dery, 1997). Herd sizes of approximately 44 and 22 were observed at Oribili and Tankyara respectively. These are the two communities that were beneficiaries of ARI project interventions from 2003 to 2009. The District Directorate of MoFA has reported that small ruminant numbers doubled under the ARI intervention: from 453 at Oribili and 476 at Tankyara in 2005 to 1076 and 972 respectively in 2008 (Ojingo, 2008).

2.3.2 Reasons for keeping small ruminants

Small ruminants are kept for multiple purposes, including stock of capital, insurance, and for meat to celebrate religious festivals. However, the principal purpose is that smallholders rely on their herd during ‘critical times’. Our respondents recognise three

kinds. First is the occurrence of household food shortages. A farmer at Kumasal said: *“when I run short of food, I sell [a goat] and use it [the money].”* A lecturer in animal production explained that farmers keep small ruminants *“to fill the food security gap when the household runs short of food. They fill a gap rather than [being kept] as a business. An orientation such that we are going to go beyond this purpose, that is not there.”* The second critical period is related to the cost of farm labour and other inputs. A farmer at Kumasal conceded: *“I can’t farm without having goats. I can sell one to prepare pito [locally brewed alcohol] for the labour gang.”* A trader at Babile Market observed: *“farmers do sell at this time [June – August] for money for ploughing, seeds and fertiliser. When they harvest and they have food, they don’t have any problem again. So, they are compelled to keep the animals for the next season.”* Unforeseen circumstances, such as a drought or a funeral, constitute the third type of crisis that prompts farmers to rely on small ruminants. As a farmer at Orbili said: *“during farming when there is drought, we sell [small ruminants] to get income.”* A farmer at Dakyiae summed the reasons succinctly, as follows: the *“main purpose of keeping small ruminants is that they are a source of income in hardship.”*

2.3.3 Tethering during the rainy season

Two distinct husbandry practices are used: tethering, and leaving the sheep and goats to range freely. These are associated with the seasons: tethering in the rainy season, from May to October, and free-range management in the dry season, from November to April. During the cultivation season, which begins in May, small ruminants are tethered i.e. tied with ropes to a stake planted on uncultivated fields or communal lands, where they graze the sparse vegetation during the day, in order to prevent the animals from grazing on the growing crops. Around noon, most smallholders provide water to the tethered animals. In the evenings the animals are brought back into the house compound or penned for the night. This routine is repeated throughout the farming season. The main labour input in small ruminant keeping relates to the tethering and watering tasks; these tasks are carried out mainly by women and children.

One of the consequences of tethering is that animals lose weight and become emaciated due to the restricted movement and feeding. Little or no breeding occurs for the duration of the tethering period. The animals that do fall pregnant record high rates of abortion and post-partum kid mortality. The wet conditions suit the growth of pathogens and this is the time when the incidence of small ruminant diseases is high.

Only a few farmers have adopted alternative strategies to mitigate the negative effects of tethering. Two strategies were observed. One is the provision of supplementary feeding of cultivated leguminous fodder crops. For example, one farmer at Orbili nine years ago had planted a half-acre of *Stylosanthes hamata*, a permanent leguminous fodder plant, and he and his neighbours tether their animals in this field. Another farmer, at Tangasie, had planted *Leucaena leucocephala* as live fence around his backyard garden and he cuts this for his flock. The second strategy we observed is shepherding if the flock size is large (i.e. over 80 sheep), a task carried out by the elderly household members. Two men, each over 60 years, were observed shepherding their sheep at Orbili. The men explained that the children have to go to school and that the young men - who are endowed with more strength - have to work at the farm and thus the responsibility for herd management is shifted to the relatively weaker elderly men.

2.3.4 *Free-range management during the dry season*

The tethering period ends after the harvesting of field crops in October. During the dry season the animals are released to roam on their own. Most smallholders also do not ensure that their animals are housed in the evenings. Uncontrolled breeding occurs during the free-range period. However, crossbreeds of the local West African Dwarf Sheep (or Djallonke) and the long-legged Sahelian type were maintained in one out of the five communities (i.e. Tankyara). These crossbreeds are the visible outcome of a small ruminant improvement initiative in the Upper West Region that formed part of a project supported by the International Fund for Agricultural Development (IFAD) from 1996 to 2004 (UWADEP, 2000). The six breeding stations in Ghana formerly focussed on the introduction of exotics but during 1992-1993 their breeding policy changed to the improvement of native breeds in order to meet concerns about the loss of valuable genetic traits in the local breeds.

In four out of the five communities bush burning is a common practice even though it leads to loss of biomass for feeding small ruminants during the dry season (Animal Research Institute, 1999). Tankyara, where there is a still-functioning co-operative (that was started in 1976) is the only community where the farmers have succeeded in implementing measures to prevent bush burning, for which they have won a national award. Tankyara is also the only community where the farmers practise storage of farm by-products such as groundnut vines for supplementary feeding of small ruminants during the dry season. They store the vines on wooden planks under the

shade of trees. They also gather, dry and store the fruits of *Faidherbia albida* tree (known in the local language as Goozie) which is adapted to dry conditions, and use these also as fodder. When queried about these practices, which are unique to Tankyara, the farmers responded that the training by and encouragement from the cooperative society account for the difference between their practices and that of others.

In the other four communities most of the smallholders do not make any serious provision for supplementary feeding. The only form of supplementary feeding observed at Tangasie for instance was the leaves that some farmers occasionally cut from *Ficus gnaphalocarpa*, a tree sometimes planted to provide shade or a wind break near houses. The general perception among our respondents in these four communities was that the food supply for the small ruminants in the dry season was not a problem. A farmer from Dakyiae typified this viewpoint when he observed: “*even in the dry season, at that time goats improve, better than during this time [the farming season] when they become lean because of tethering.*” It is common knowledge among the smallholders and traders alike that small ruminants gain weight during the dry season in Northern Ghana.

A few of the smallholders provide water during the dry season for their animals. The animals return to the house in the evenings where they drink and then lie around the compound house during the night-time. These farmers employ the provision of water as a strategy that enables them to monitor herd numbers during the dry season. As one smallholder explained: “*we provide water so that when one [animal] is not there we will know.*” Many of those who do not provide water complained about the loss of animals, which go to the river or a dam site to drink and then get stolen or preyed upon by stray dogs.

2.3.5 Market-related off-take

Most smallholders in the study communities sell their animals directly at the main markets without going through middlemen. The market centres are close-by and can be reached by most of the farmers by bicycle or motor vehicles. The smallholders claimed that they receive competitive prices at the market because of their direct access to the traders. The average market-related off-take across the five communities was low, at 10.5 per cent. Table 2.4 compares the households in the five communities in terms of the pattern of off-take of small ruminants in 2009.

Two motivations for selling small ruminants were recorded. The first is distress sales that occur mostly in the lean season i.e. June, July and August after the planting of new fields but before harvest. Distress sales flood the market and consequently the prices are low. As a farmer observed despondently: *“everybody is selling so the price is low. Some even have to return with their animals to the house because they are not sold at Babile market.”* A butcher concurred, saying *“when supply is high in the market, demand is low and the bargaining price starts low. Hence traders pay a low price.”* The remuneration is used primarily to buy food.

Table 2.4: Comparison of households in five communities by type of sale of small ruminants in 2009

Name of community	Number of households in community	Number of households interviewed	Number of households selling animals	Number of households making distress sales	Number of households making demand-driven sales	Number of households making demand-driven sales as a % of households selling animals (%)
Orbili	30	10	10	8	2	20.0
Tankyara	44	11	7	4	3	42.9
Kumasal	66	10	5	4	1	20.0
Tangasie	154	10	3	3	0	0.0
Dakyiae	37	12	8	4	4	50.0
Total	331	53	33	23	10	30.3

Source: Statistical Service (2005) and field interviews, 2010

The second motivation is demand-driven sales i.e. the household sells animals in order to take advantage of high market demand on occasions such as Christmas, Easter or the Ramadan festival. The proceeds from demand-driven sales are used for purchasing zinc roofing sheets or cement for house construction, or to cover the expenses incurred during the festivities. The type of sale thus has two dimensions: the period of sale and the utilization of the income from the sale. From Table 4 it can be seen that households that engaged in distress sales in all the five communities in 2009 were twice the number of those making demand-driven sales.

However, Table 2.4 also reveals that there were two communities where demand-driven sales were relatively high, Dakyiae and Tankyara. In Dakyiae more households

were able to produce enough food as a result of an input credit scheme for one acre of maize, provided by ADRA, an NGO. In Tankyara, the cooperative society buys food during the harvesting period from its members and resells this to anyone in the community when needed, with only a modest price mark-up and so the community members are not compelled to sell animals under distress. In the other three communities, on the other hand, about half of the households interviewed had been compelled to sell animals to buy food. For instance, at Oribili in 2009, five out of ten households interviewed bought food and in 2010, four out of nine households interviewed bought food (compare with the one out of the eleven household heads interviewed at Tankyara who reported that he had bought food in 2010).

2.3.6 Technical and labour organisational limitations

The limitations experienced in small ruminant production that subsequently were ranked by farmer groups in each of the five communities are shown in Table 2.5.

The first ranked in three out of the five communities was water shortages during the dry season. The two communities that chose livestock mortality as the first limitation were located near to dams that had been constructed in the 1990s through an IFAD-funded project. The limitation ranked second by respondents in three out of the five communities was high mortality. A subsequent interview in two of these communities (Oribili and Tangasie, an ARI community and non-ARI community, respectively) confirmed that there was high mortality in 2010, with mortality rates as high as 63% among kids (less than 1 year); 59% among lambs (less than 1 year); 47% among goats (over 1 year); and 12% among sheep (over 1 year). In these communities only a few farmers (i.e. 3 at Oribili and 6 at Tangasie) recorded less than 10% mortality, probably as a result of their special feeding and health care interventions. These rates can be contrasted to the 0.88% and 1.98% for lamb and adult mortality respectively that were recorded at the MoFA's Ejura Sheep Breeding Station for the same year. The limitation ranked third is livestock theft. Livestock theft is prevalent especially at Tangasie. Only one farmer, whose house is located on the outskirts of Tangasie town, had succeeded in employing a number of trained dogs to prevent the stealing of his animals.

Table 2.5: Ranking of constraints in the small ruminant system in five communities in Lawra and Nadowli districts

Community	Ranked 1	Ranked 2	Ranked 3
Oribili	Lack of water during dry season.	Diseases, mortality and high cost of treatment.	Lack of tractor services ¹
Nandom Tankyara	Water shortage during dry season.	Diseases, mortality and unavailable veterinary extension.	Lack of shepherding
Dakylae	Diseases, mortality and lack of veterinary extension.	Theft	Lack of water in dry season.
Kumasal	Diseases, mortality and lack of veterinary extension.	Water shortage during dry season	Kid mortality caused by free-range pigs
Tangasie	Water shortage during dry season.	Diseases, mortality and lack of veterinary extension.	Theft

Source: Focus group meetings, 2010, and institutional analysis workshop at Lawra in 2011.

An analysis of the institutional reasons behind the farmers' prioritised constraints is given in Table 2.6 and Figure 2.1. The institutional underpinnings mainly relate to contextual factors at the local level, or conditions in the higher level institutional regime, that have hindered a transition towards niche developments of a more profitable small ruminant livestock system. Table 2.6 provides a summary of the causal analysis of the three top-ranked limitations that was undertaken by sub-groups of stakeholders at the workshops in Lawra and Nadowli Districts.

Figure 2.1 is a synthesis of the causal analysis output of the two sub-groups that worked on the high mortality of small ruminants at the Lawra and Nadowli workshops. It was selected for presentation in this paper because it reveals all the three types of structural and institutional underpinnings that were identified in the causal analysis exercise: (1) a structural limitation in the availability of arable lands; (2) weak support systems for animal production and health services delivery; and (3) communities' values, that are skewed towards crop production more than animal husbandry.

Table 2.6: Techno-institutional system analysis of the small ruminant production and marketing system in two communities in Lawra and Nadowli districts, 2009

Constraint	Underlying reason	Type of institutional constraint	Agreed action	Responsibilities
i. Inadequate water during dry season	Community is not putting pressure on District Assembly (DA) to fulfil its responsibility for community water (i.e. pay 5% of total project cost for water infrastructure)	Capability failure, infrastructural failure	Community to send delegation to DA and Member of Parliament	BonikuuSaaleh (opinion leader, Zambo) Stephen (District cooperative officer)
	Ritual of annual bush burning (destroys environment)	Soft institutional failure	Promote non-burning	Gban (farmer, Oribili) Kuubezuur (Tovuori) Oppong (Police Services)
ii. High livestock mortality	Routine of mass selling of animals in lean season for farm expenditure	Soft institutional failure	Promote demand-driven selling and saving proceeds with a bank	Project officer (Lawra Area Rural Bank)
	Practice of land allocation skewed towards crop cultivation than livestock grazing	Soft institutional failure	Cultivation of fodder crops along borders of crop fields	Rashid (supervisor, MoFA)
iii. Inadequate tractor services	Land inheritance leading to scattered crop fields	Soft institutional failure	Block or group ploughing: farmers to organize as group for tractor ploughing	Manuor (farmer, Oribili), Faar (AEA, MoFA)
iv. Inadequate water during dry season	Lack of community initiative	Capability failure, soft network failure	Strengthen community organizing ability	Regent, Assemblyman, Unit Committee
	Party politicians interference that ignores due procedures for provision of community water	Soft institutional failure	Create awareness on procedures for getting funding from DA for community water	DA sub-committee on environment, NCCE
	Non-enforcement of laws on bush fires	Hard institutional failure	Enforce laws on bush fires	Police, Fire Service, Unit Committee Traditional authorities

v. Livestock mortality	Attitude of minimum investment in animal husbandry especially housing and feeding	Soft institutional failure	Form community livestock committee to foster attitudinal change	Isaac Dari (AEA, MoFA)
	Weak structure for animal production and health care delivery	Hard institutional failure, infrastructural failure, weak network failure	Foster structural changes	National CIG
vi. Theft	Routine of free-ranging and stray animals	Soft institutional failure	Education on housing; field trips with farmers	Regent
			Enforce bye-laws on bush fires	Police, Fire Service, Traditional authorities. Coordination by: Regent & Florence Dari
vii. Low body weight of local breeds that fetch low price	Weak structure of breeding stations (except one) engaged in small ruminant breed improvement programmes and outreach to smallholders	Capability failure, infrastructural failure, weak network failure	Fostering structural changes in breeding stations to enhance breed improvement programmes and outreach to smallholders	National CIG
viii. Inadequate slaughter slaps in Accra and Kumasi	Lack of coordination of slaughtering activities by authorities in the cities	Interaction failure	Create platform for regular interaction among relevant city authorities	National CIG
ix. Payment of unofficial fees by livestock traders at police barriers on highways	Institutionalization of bribery in Police Service	Soft institutional failure	Foster interaction between police and other supply chain actors	National CIG

Source: Stakeholder workshops, Lawra and Nadowli, 2011

Notes: Limitations 'i.' to 'iii.' were discussed at the Lawra workshop. Participants were 18 including 8 farmers; Limitations 'iv.' to 'vi.' were discussed at the Nadowli workshop. Participants were 21 including 4 farmers; Limitations 'vii.' to 'ix.' were mentioned by other actors in the supply chain.

The first two institutional constraints were made visible when the farmers who often cross the border to Burkina Faso to engage in family and business transactions contrasted in our interviews their own animal production system with that in Burkina Faso (which shares a border with Ghana). One farmer summarised the differences as follows: *“land is available in Burkina Faso. They always locate a large place for livestock grazing. We can’t do that – we need a place to farm. Theft is here in Ghana. There people don’t steal. In Burkina Faso, the government has constructed dams which make the place wet and suitable for the growth of grasses at all times.”*

Another farmer observed that there is *“more land in Burkina Faso than here. There somebody will rent a place out for rearing animals; here it is not like that. There is much stealing of animals in the dry season here. In the dry season our only source of water is a bore hole.”*

The issue of limited arable land is a structural constraint that arises partly from the high population density, which for Ghana as a whole is 101.6 persons per square kilometre, compared to 59.4 in Burkina Faso (Worldatlas, 2010). Control of livestock theft is related to the effectiveness of the state police. In Ghana the general perception is that there is an undue delay in administering justice when theft cases are reported to the police. For instance, in early 2010, 12 cattle were stolen from a farmer at Tangasie and loaded onto a truck but, in the process of transportation, the lorry broke down and the driver was arrested. At the time of writing this paper (August 2011), the theft case was still pending at the police station. The traditional authorities also appear incapable of addressing livestock theft, due to kinship relations. The Regent (or substitute chief) at Tangasie narrated his personal experience as follows:

“Recently, some of the [five] goats that were stolen were mine. When some inhabitants apprehended the thieves, I took back my [two] animals and left the boys the two thieves] on their own. Now that I am a Regent if I take any action [against the boys] they [the community] will blame me. I have said that anybody who catches a thief should not bring the case to me. In every community there is a taboo. Where the taboo system does not work, that is when you have a theft problem. . . . It was Balu’s cattle that were stolen, and every month he goes to the police to complain” (Tangasie, 12-04-2011).

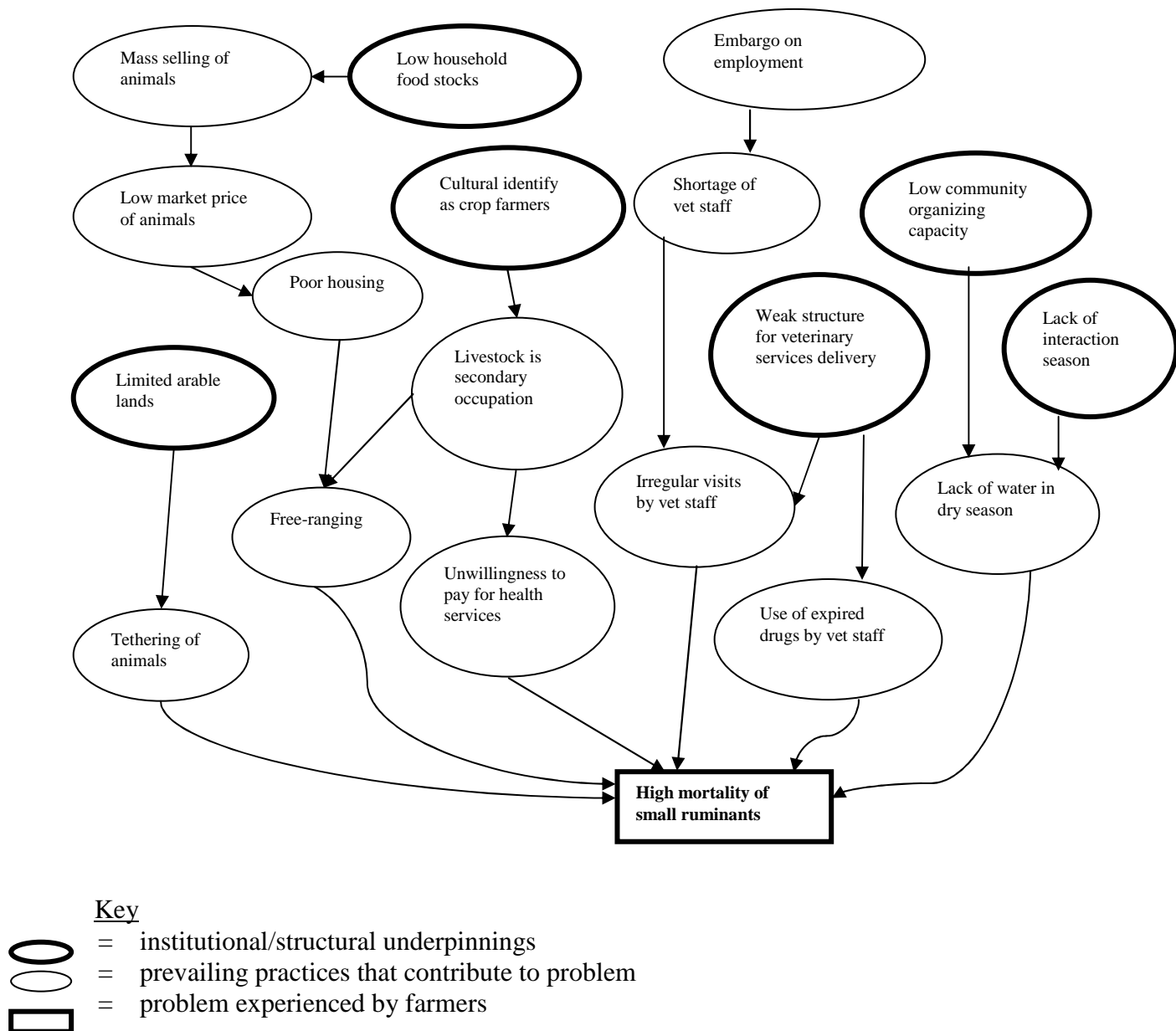


Figure 2.1: Causal diagram for high mortality of small ruminants

The Burkina Faso police appear to be more responsive in addressing the social problem of theft. For instance, in early May 2011, livestock traders from the Lawra District were attacked by armed robbers when the traders were attending a weekly market in Burkina Faso. Since then the Burkina Faso authorities have deployed the police to patrol the roads on their side of the boarder during market days but no similar action has been taken in Ghana.

There also is weak support for animal production and health services delivery in Ghana. As an informant at Tankyara said: *“we don’t get veterinary people to come and vaccinate. At present there are about three veterinary personnel in the whole district. They are not monitored to ensure that they deliver animal health services.”* A farmer at Kumasal observed: *“no regular vaccination is done since the retirement of the last veterinary officer, Mr. Sampa. Now no one comes here. When there were many veterinary officers here, our animals don’t die.”* Comments such as these were repeated during the institutional analysis workshop. The participants’ analysis indicated that since the decentralisation of MoFA services in 1998, the control of resources for the delivery of animal production and health services had been shifted from the district animal production and veterinary officers to the district director. The consequences include a reduction in the supervision of veterinary field staff and a lowering in the coverage and quality of their services to smallholder farming communities.

Routine vaccination against Peste Des Petits Ruminants (PPR), which could contribute to the control of small ruminant mortality, is hampered by the ineffective organisation of the veterinary services. For example, during the 2011 farming season (June to August) when the animals were tethered and therefore most farmers could assemble their small ruminants for vaccination, there was no vaccine available for PPR in Ghana. The stock of PPR vaccines expired in June 2011 and apparently no provision was made by the Veterinary Services Directorate of MoFA for restocking. Recently, a national newspaper, the Daily Graphic of August 19, 2011 (Adu-Gyamrah and Donkor, 2011), reported that imported PPR vaccines, worth thousands of euros, had expired in August 2008 and 2009 and the MoFA was summoned to explain the circumstances to a Parliamentary Commission. Meanwhile, the farmers interviewed in this study indicated that the over 50 per cent mortality rate among their small ruminants in 2009 and 2010 resulted from pneumonia and diarrhoea (i.e. symptoms indicative of the fact that PPR vaccination had not been carried out). Recently, three out of the six experimental goats purchased at Tangasie market in August 2011 for an on-farm experiment in this study died within three weeks of acquisition, from pneumonia according to the post-mortem report of the principal veterinary officer for the area.

The third institutional underpinning of the constraints experienced by farmers in the small ruminant production system relates to community values and norms. The interviews indicated that all the farmers in all five communities valued crop production more than animal husbandry. For example, a farmer at Dakyiae kept two bullocks for

ploughing and 28 small ruminants (eight sheep and twenty goats). He said that every year he spends money in treatment of *“only the cattle to prevent illness and ensure that they work hard.”* However, he does not spend money on the health of the small ruminants. Another farmer at Kumasal concurred with this view, saying that *“many people don’t pay to treat animals. They think that government subsidy should cater for animal treatment. They also reason that humans get sick and go to hospital, so why should animals go to hospital.”* Another informant related the low value his community placed on small ruminants (compared to crop production) to the difference in livestock production systems between Ghana and Burkina Faso. He observed that *“the difference between Ghana and Burkina Faso is cultural – this is our way of life – crop farming is our main occupation whereas livestock is an auxiliary activity.”* Many of the farmers interviewed repeated the phrase that *“in Burkina Faso, livestock is their main activity.”*

The high value placed on crop production as compared to animal husbandry is reflected also in the low adoption of fodder technologies. From 2003 to 2009 ARI promoted cultivation of *Cajanus cajan* as fodder banks in two of the communities (i.e. Orbili and Tankyara) as part of a small ruminant improvement project. In the first year of the cajanus experiment the project ploughed the fields and provided cajanus seeds to selected farmers. The majority of the beneficiary farmers did not plant the seeds; and out of those who planted the seeds, many failed to harvest the fodder (Ojingo, 2008). On the other hand, a number of farmers belonging to the Wala ethnic group (who trace their origin to the Fulanis in Mali who are noted for cattle herding) have adopted cajanus fodder bank cultivation under a project coordinated by MoFA during the same period.

2.4 Analysis and discussion

2.4.1 The interrelationship between technical and institutional constraints: going beyond optimizing markets

Our analysis indicates that constraints related to technical, infrastructural, institutional, interactional, and capability factors are strongly co-related and serve to lock-in the current small ruminant production system in Ghana to existing practices. Our analysis suggests in addition that there is a clear relationship between the constraints experienced by small ruminant producers at the local level and higher-level organisational and institutional conditions. Such a relationship has been reported also

in other areas (van Rooyen and Homann-Kee Tui, 2009, Hall et al., 2007). However, Van Rooyen and Homann-Kee Tui (2009), Udo et al. (2011) , and Kocho et al. (2011) highlight the need to change the higher level constraints in the sphere of market access before local level innovation can occur. By applying the innovation systems failure framework our study is able to highlight that simultaneous investments are needed in related sectors, such as in improving the organisation of water management, re-organising veterinary service delivery, and improving law enforcement.

In our study the prioritised local level constraints were water shortages, high livestock mortality and theft. The corresponding institutional limitations include the weak interaction between community and district and national level organisations for water provision, the weak organisational structure for animal health delivery, and weak traditional and formal delivery of justice. A number of social mechanisms or processes link the local constraints to the higher-level institutional settings. For example, with regard to water shortages during the dry season, community members have failed to organize contributions to provide their own water supply, or made demands as a collective interest on the district assembly and other politicians. In the case of animal health services delivery, the few farmers who could afford to pay for the services still were not getting any service because of inadequacies in the veterinary technical service and because they did not have the clout to advocate or lobby the central government to lift the ban on employment of new veterinary field staff. On the other hand the available veterinary technical officers lamented that most farmers appear unwilling to pay for services rendered. With regard to livestock theft, the smallholder farmers who become victims have to make repeated visits to the police station yet justice is not delivered.

We argue on the basis of our findings and analysis that what needs to change is the existing pattern of interaction, in the broadest sense. Numerous small-ruminant system optimization studies similarly suggest changes in relationships (van Rooyen and Homann-Kee Tui, 2009, Hall et al., 2007, Kocho et al., 2011) at regime level in order to release lower level constraints but in recent years they have tended to focus one-sidedly on market relationships. Our study indicates a need for a more systemic change.

2.4.2 Understanding the rationale that holds small ruminant production systems below the optimum

In the prevailing high-risk environment and the numerous constraints identified in this study, most smallholders seek to achieve a livelihood from multiple sources and by means of low input-sufficient volume small ruminant production in order to meet their needs whenever the occasion demands. Only a few individuals in four out of the five communities (i.e. Orbili, Kumalsa, Tangasie, Dakyiae), and the cooperative members in Tankyara community, had developed successful strategies for improved small ruminant husbandry that enabled them to take advantage of the periods of high market demand. For the majority of the smallholders higher input, market-oriented is not seen as a viable option.

Consequently, the investment of smallholders' resources in terms of capital and labour is skewed towards crop farming rather than livestock rearing. Yet crop production is apparently co-dependent on the income from small ruminants. This finding is consistent with an earlier observation made by the Animal Research Institute of Ghana that smallholders in the Lawra area are guided by the principle of minimum investment in livestock but optimum investment in crop production (Animal Research Institute, 1999). The minimum investment principle is also consistent with the numerous studies that indicate that the production decisions of farmers in semi-arid sub-Saharan Africa are strongly based on risk avoidance rather than maximization of returns (Kristjanson et al., 2009, van Rooyen and Homann-Kee Tui, 2009, Hella et al., 2001). The keeping of large numbers of livestock is an insurance against climatic risks and uncertainties. In the study area the average numbers of small ruminants kept by one person is small but this totals to a higher number at community levels. The skewed investment in crop farming as against animal husbandry also is related to the communities' own perceptions of their identity as crop farmers. The relationship between self-image and livelihood strategies has been found also elsewhere (Crane et al., 2011).

A strategy of risk-avoidance rather than return maximisation, when coupled to a normative rule that values crop production above animal husbandry, poses a challenge to those desirous of stimulating market-driven production of small ruminants in the study communities. It also brings into question the contemporary push towards market integration of smallholders into value chains, seemingly irrespective of socio-cultural and other contextual factors (Dixon et al., 2001, van Rooyen and Homann-Kee Tui, 2009). Recent research indicates that there almost always exist several viable pathways for developing a farming system, even under homogeneous conditions (Van der Ploeg, 1990, Leeuwis, 2004).

2.4.3 Capitalizing upon diversity and ‘positive deviants’

The assertion that there is a low probability that market production of small ruminants might emerge spontaneously is consistent with innovation systems studies that indicate that niche developments by smallholders and other actors are unlikely unless there are changes in the institutional arrangements in the broader environment in which smallholders and their production systems are embedded (van Rooyen and Homann-Kee Tui, 2009, Hall et al., 2007, Klerkx et al., 2010). On the other hand, our study suggests that local actors in these conditions indeed may produce novelties, such as the practice of supplementary feeding and non-burning of bush at Tankyara, the *Leucaena* used as live fencing by a farmer at Tangasie, the half-acre *Stylosanthes* pasture introduced by a farmer at Oribili, the low small ruminant mortality achieved by a few farmers at Oribili and Tangasie, as well as the demand-driven sales of small ruminants by a few of the households at Tankyara and Dakyiae. Tankyara stands out in a number of ways in this list of novelties. The adoption of supplementary feeding by the cooperative members indicates that the principle of minimum investment in livestock can be relaxed. The community itself attributes this to the organizing role of their cooperative society. However, they also acknowledge that they continue to experience water shortages and high livestock mortality at levels comparable to the other communities. The participants in the stakeholder workshop indicated that the institutional reasons underlying the persistence of such constraints are positioned at levels higher than the community level. To summarise, the Tankyara case illustrates that there is a role for community-level social arrangements in addressing certain institutional constraints but also indicates that institutional limitations interacting at multiple levels of social organisation can lock the small ruminant system into low performance.

There are two important implications to be derived from our observation of farmers who act as positive deviants (Ochieng, 2007) and who innovate ‘below the radar’ (Kaplinsky, 2011). One implication is that the study of how positive deviants succeed in introducing change and of the strategies they employ to change relationships in their environment in favour of the realisation of their innovative practices, could be the basis of interventions that might prove effective for many other farmers. Understanding how they durably embed their novelties in social arrangements (following (Ochieng, 2007) and (Klerkx et al., 2009)) to overcome the institutional constraints to which also the other farmers are exposed, might open up new starting points for development. The other implication is that intervention strategies need to go beyond the farm level. A number of recent studies make the case for innovation

platforms (called ‘innovation and concertation groups’ or CIGs in the COS-SIS programme) to foster the emergence of novelties and associated changes in mainstream practices so as to open up niches for transformational change (van Rooyen and Homann-Kee Tui, 2009, Hall et al., 2007), and to relax constraints embedded in institutional regimes (Kristjanson et al., 2009, Klerkx et al., 2010). The relevance of our findings to the innovation platform concept is that CIG stakeholders should allow for diversity in development pathways (following (Brooks and Loevinsohn, 2011), and not be too strongly influenced by a pre-analytic preference for market-based solutions and technology packages delivered by research organisations.

2.4.4 Reflections on methodology

The main research question posed in this study focussed on the institutions that hinder innovation and the market participation of smallholder small ruminant producers. In the course of writing the paper it became evident that an equally important question relates to what the smallholders themselves might do to address the constraints and the implications their problem-solving strategies might have for interventions by development organisations and services. In retrospect, an asset-based approach like a positive deviants enquiry (Dearden et al., 2002) might have offered additional insight.

Another issue is that one of the six communities initially selected for the study was not included because of time constraints. However, this is unlikely to affect the results because the explorative and interpretivist case study design (Erickson, 1986) seeks to understand the diversity of the perspectives of the actors rather than to generalise the results of a statistical study to a broader population.

An additional source of bias is that only six out of the 53 farmers interviewed in the five communities were women. Tradition demands that the household head or the landlord receives visitors and communicates their mission and deliberations to the rest of the household and the assets of wives and children belong to the household head and/or landlord. When our male respondents were asked about who the real owners of the sheep and goats were many seemed to think the question was irrelevant or they became irritated. The exploration of small ruminant production in future research would need to include more women respondents and would entail study of the gendered nature of the social organisation of small ruminant ownership.

2.5 Conclusions

This study shows that crop farming is co-dependent on small ruminant production and marketing. The main constraints experienced by the smallholders are water shortages during the dry season, high ruminant mortality rates, and the theft of small ruminants. The constraints persist because of institutional and structural factors interacting at a range of levels and they block further developments by the majority of the smallholders. The study indicates in the harsh conditions in which they live the smallholders seek resilience through diversifying their sources of livelihood, by low input investment in small ruminant production, and by keeping their animals as a capital stock and insurance. However, a few positive deviants have developed novel practices that enable them to overcome some of the constraints and to engage in market-oriented production of small ruminants. These novelties could provide the basis for diverse development pathways that open up a range of possibilities beyond purely market-led or purely technology-led change.

CHAPTER 3

INSTITUTIONAL DIMENSIONS OF VETERINARY SERVICES REFORMS: RESPONSES TO STRUCTURAL ADJUSTMENT IN NORTHERN GHANA

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Submitted to International Journal of Agricultural Sustainability

Abstract

Following the financial crisis in the early 1980s and the subsequent adoption of structural adjustment policies, most sub-Saharan African country governments embarked on decentralisation and privatization by transferring authority and resources to local entities. This study examines the effect of these reforms for the case of the delivery and smallholders' use of veterinary services in two districts in Northern Ghana where settlements are scattered and livestock keeping is extensive. We apply a framework that distinguishes between allocative, cognitive and normative institutions to analyse the effects on four areas of service delivery: 1) prevention, 2) clinical services, 3) provision of drugs, vaccines and other products, and 4) human health protection. The results show that the reforms were accompanied by substantial reductions in the allocation of both financial and human resources to public veterinary services, which in turn induced fragmentation in service supply, preferential service to progressive (or wealthy) farmers, and non-adherence to the international protocol for livestock health reporting. The results also show self-organization in a few communities to access veterinary services. Thus, the reforms set off changes mostly in formal allocative institutions, but these triggered further changes in informal allocative, cognitive and normative institutions that structured the impact of the reforms on the diverse actors. The article concludes that institutional change is not a one-off outcome of an intervention. Such an intervention triggers new dynamics, which policymakers and analysts need to take into account. This asks for regular monitoring of anticipated and unanticipated effects of privatization and decentralisation to allow adjustment of policies.

Key words: institutions; public goods; veterinary services; smallholder livestock keeping; structural adjustment; Ghana

3.1 Introduction

As did other rural services such as extension, in recent years veterinary services in developing countries have undergone major reforms including decentralisation and privatization (Sen and Chander, 2003). These reforms of public agricultural services were the direct result of Structural Adjustment Policies (SAP) promoted by the International Monetary Fund (IMF) and World Bank over the past two decades (World Bank, 2009a). SAP were based on the argument that many developing countries had failed to create incentive systems for the efficient delivery of goods and services in the agricultural sectors, and that market mechanisms would do a better job (Smith, 2001). Hence, the SAP sought to reduce the role of the public sector in the provision of goods and services and enhance that of the private sector (Woodford, 2004). As a result, services were decentralised and/or privatized. Decentralisation concerns the transfer of administrative responsibility, fiscal resources, and political authority from central government agencies to sub-national government entities, to non-governmental organizations, or to the private sector (Robinson, 2007). Privatization is the transfer of power, resources and functions from government to the private sector, non-governmental organizations and civil society (Rondinelli, 1981). These reforms have affected a broad spectrum of rural development strategies and activities, including agricultural research, input supply, rural financial services, agricultural extension, veterinary services and water resources management (Smith, 2001).

In the case of veterinary services, the reforms aimed to increase the role of private markets in services delivery, lower public expenditures, improve the quality and coverage of the services provided to livestock owners, and enhance effective control of animal diseases that endanger human health (Smith, 2001). In developing countries, the reforms resulted in privatisation of selected tasks, decentralization of veterinary organizations, and a move towards confining the state veterinary services to delivery of public goods services (Cheneau et al., 2004). From a review of the literature it appears that the reforms of veterinary services delivery have yielded mixed results.

On the positive side, some studies indicate that the availability and use of veterinary drugs are significantly higher in developing countries that have privatized services and drug supplies than in countries maintaining government monopolies (Sen and Chander, 2003). After reforms, tsetse-fly control in Zimbabwe and Botswana and vaccination in Morocco have significantly improved and the corresponding cost has been considerably reduced (Holden, 1999). A number of studies indicate that poor

people are willing to pay for clinical and preventive veterinary services (Ahuja, 2004, Leonard, 2004). Reforms appear to have benefited lower-skilled veterinary service providers such as para-veterinarians, technical assistants and community animal health workers. According to Woodford (2004) in subsistence and extensive livestock production systems, less qualified personnel adapted better to reforms in delivery of services than veterinarians. Such para-veterinarians acquire skills through practice, are often members of the same ethnic group as their clients, reside in communities where livestock is found, have lower income aspirations, and can handle 80 - 90% of the veterinary interventions in extensive livestock production systems.

On the negative side, Turkson and Brownie (1999) reported that there is limited evidence that privatization has improved veterinary services delivery in developing countries. The SAP were often regarded as imposition by donors; policy makers often saw them as a cause rather than a solution to financial problems (Woodford, 2004). Animal health policy makers were technically oriented and had limited change management skills. The deregulation and deployment of para-veterinarians induced by the reforms were perceived as a threat by veterinarians. Furthermore, service delivery by less qualified staff was constrained by unresolved issues such as how to supervise and resupply them and how to maintain effective two-way communication with supervisory veterinarians (Ahuja, 2004). Privatization also resulted in a high concentration of private veterinary practices in urban centres leaving rural areas uncovered (Woodford, 2004). Moreover, in many developing countries, in the absence of a formal system, unregulated informal animal health delivery systems have evolved. Thus, in many sub-Saharan countries including Ghana, the SAP-induced reforms have brought about a reduction in quantity and/or quality of veterinary services to poor communities (Woodford, 2004, Turkson and Brownie, 1999).

Though previous studies report on both pros and cons of decentralisation and privatization, there are few in-depth studies of the interactions among the diverse stakeholders and the transformations of formal and informal institutions that result from decentralisation and privatization. Nonetheless, as some studies indicate (Awortwi, 2010, Robinson, 2007), the outcomes of decentralisation reforms often are mediated by a number of institutional factors that are beyond the control of local officials, such as the prevailing political context, power dynamics at the local and national levels and lack of financial resources. All too often, the reforms were pursued without due attention to complementary changes in the broader governance structures and socioeconomic conditions. Also for the case of Ghana, there is little recent

information on how the diverse actors reacted to the reforms of the public veterinary services.

The present study aims to fill this gap by examining the effects of the privatization and decentralisation on veterinary services delivery in Northern Ghana by assessing 1) the changes in delivery of animal health services, and 2) responses of stakeholders to the reforms. To provide an analytical lens for the analysis, the following section outlines a conceptual framework to understand the different elements that constitute veterinary service provision, and the kind of institutions that influence provision. Section 3 describes the case and the research methods. In section 4 the findings are presented. The article ends with a discussion and conclusions.

3.2 Conceptual framework

3.2.1 Institutional dimensions

In this study, we look at privatization and decentralization as a form of institutional change that has allocative, cognitive and normative dimensions (Scott, 1995, Elzen et al., 2012). Institutions are informal and formal rules or norms actually used by a set of individuals to organise repetitive activities that produce collective outcomes (Ostrom, 1992). *Allocative* institutions deal with the way scarce resources are distributed and/or exchanged (Weimer, 2006) and relate for example to payment through market arrangements, but also allocative mechanisms used by the state, e.g. subsidies. *Cognitive* institutions refer to the common interpretive framework of meaning (Scott, 1995). In the context of this study, cognitive institutions relate to the way knowledge and skills or expertise are (re)organized. For example, the transfer of technology model is a cognitive view of research and development “that many agricultural scientists assumed and used to plan and manage the innovation process” (Douthwaite et al., 2001, p. 820). *Normative* institutions comprise the values, norms, and roles which an actor experiences as social expectations, prescriptions, or moral obligations. These include regulations, enforcement mechanisms and adherence to standards (Scott, 1995). The different institutions are connected to each other in defining practices, standards and policies (Pacheco et al., 2010).

3.2.2 Types and nature of veterinary services

In this study, the term service provision refers to the execution of a process intended to enhance the productivity of resource use in on-farm operations. Examples are technological and business advisory work, and regulations aimed at plant and animal

disease control. Goods, on the other hand, refer to provision of material goods, for example, fertilizer distribution (Smith, 2001). Smith (2001) distinguishes four main categories of veterinary services:

- (i) Preventive services (avoiding the outbreak of diseases);
- (ii) Clinical or curative services (treatment of diseased animals and control of production- limiting disorders);
- (iii) Production and distribution of drugs, vaccines and other products (such as artificial insemination); and
- (iv) Human health protection (inspection of marketed animal products including live animals in markets, on transport and on farm).

Prior to decentralisation and privatization, in most sub-Saharan African (SSA) countries veterinary services were predominantly delivered by the public sector. Changes brought about by the reforms include assigning the private sector the responsibility for delivery of services considered to be private goods, such as clinical services (e.g., diagnosis and treatment) and production and distribution of drugs and vaccines. On the other hand, the public sector would retain responsibility for human health protection services (i.e. meat inspection, quarantine and quality control). Several preventive services have spill-over effects. Hence, they are either delivered by the public sector or funded collectively by the affected livestock owners (Smith, 2001). However, certain goods and services have mixed public and private characteristics. For example, vaccination to control zoonotic diseases such as anthrax and rabies has a strong private service component but has beneficial effects on human health. Consequently, public veterinary services often take responsibility for control of these zoonoses. Thus, the reforms distinguish between public and private goods to prescribe channels of veterinary services delivery (Umali et al., 1994).

Using the above categories of veterinary services (Smith, 2001), we shall describe stakeholder responses to the decentralisation and privatization dynamics for each of the categories of veterinary services. Then, we examine how the diverse responses to the categories of veterinary services are connected to the institutional dimensions.

3.3 Research setting and research methods

Multiple methods of qualitative and quantitative (Neuman, 2000) design were employed to examine the provision of veterinary services to smallholder crop–livestock farmers in the Upper West Region (UWR) of Ghana. The Region (and two districts within) was selected as the study area because it has the highest number of

food insecure households in Ghana (Quaye, 2008) who are likely to suffer from change in fully funded veterinary services from public to partly private provision. The region is located in the north-western corner of Ghana stretching from Longitude 9° 35' N to 11° N and Latitude 1° 25' to 2° 50' E.

Exploratory interviews with staff of the Ministry of Food and Agriculture (MoFA) in Lawra and Nadowli in UWR resulted in the purposive selection in each district of two communities noted for livestock production.. Tables 3.1 and 3.2 provide farming system characteristics of the study communities.

Table 3.1: Population, households, and percentage of households keeping livestock in four communities

Community	Population* (n)	Household (n)	Percentage of households keeping livestock (%)					
			Cattle	Sheep	Goats	Pigs	Chicken	Guinea fowls
Orbili	302	52	15.4	55.8	94.2	57.7	96.2	9.6
N.Tankyara	321	66	34.8	39.4	84.8	39.4	80.3	27.3
Tangasie	1186	131	6.1	24.4	71.0	97.0	81.7	24.4
Tabiasi	2773	171	70.8	47.4	77.2	11.7	77.8	28.7

*Ghana Statistical Service, 2010 population approximation.

Source: Field 2012

Table 3.2: Average farm size (acres) of households in four communities

	Households (n)	Mean (n)	Standard deviation (n)
<i>Orbili</i>			
Grain crops*	51	5.9	2.79
Leguminous crops**	51	3.2	1.18
<i>N. Tankyara</i>			
Grain crops*	66	4.8	2.40
Leguminous crops**	55	1.1	0.77
<i>Tangasie</i>			
Grain crops*	97	5.7	4.16
Leguminous crops**	93	4.9	3.72
<i>Tabiasi</i>			
Grain crops*	144	10.7	5.12
Leguminous crops**	63	2.5	1.19

*Millet, sorghum, maize and rice

**groundnut and cowpea

Source: Field survey, 2012

All the four communities belong to the same tribe, Dagaaba. The majority of the households at Orbili, N.Tankyara, and Tangasie, and Tabiasi are Traditionalist,

Christian and Moslem respectively. Of the household heads 82% are illiterates. From Table 1, the main types of livestock kept are goats and sheep, cattle, pigs, chickens and guinea fowls. Few households at Orbili and Tangasie possess cattle largely due to theft. Over 60% of the households possessed cattle about 20 years ago (ICRA and NAES, 1993). Tabiasi has deployed measures that had helped to minimise theft.

The ecological zone is mainly Guinea Savannah characterised by low vegetative growth of grasses, shrubs and sparsely distributed trees. Rainfall is unimodal and occurs from May to October with a dry season the rest of the year. The dominant farming system of the study area is crop-livestock mixed farming. The crops are cereals (millet, sorghum and maize) and legumes (groundnut and cowpea) (see Table 3.2). From Table 3.2, N. Tankyara and Tabiasi have the least and largest farm sizes respectively. The farm sizes reflect on availability of arable lands. Apart from Tabiasi, all the other communities cultivate both compound and bush farms. Compound farm is cultivation of the plot around the homestead. Compound farms compel the farmers to tether animals to prevent grazing on cropped fields during the farming season from May to October. Tethering restricts animal movement and feeding with consequent increases in diseases and mortalities. In contrast to compound farms, bush farms are further away from residences i.e. 0.5km or more). Tabiasi has adequate arable land so they do only use bush farms and hence do not tether animals. In the dry season, animals free range or roam freely in all the communities and are exposed to theft and predators such as dogs. Communal grazing land is the principal resource for livestock feeding. The characteristics of the other key stakeholders, MoFA staff, are shown in Table 3.3.

Table 3.3: Characteristics of key Ministry of Food and Agriculture staff who play an active role in the veterinary services reforms

Staff category	Qualification or training	Main role
Technical Assistant (TA)	6-weeks training	Assists TO in providing services to clients/farmers
Technical Officer (TO)	3-year certificate	Veterinary services to clients/farmers
District Veterinary Officer (DVO)	Veterinary medicine degree	Supervises veterinary TO at district level
District Director	BSc or higher degree	Head of district
Deputy Director and Director of Veterinary Services Department/Directorate (VSD)	BSc or higher degree	Policy advisors at VSD and MoFA headquarters

Table 3.4: Overview of research methods and sample categories in the study

Research method	Study sample unit	Total respondents
Survey	Household heads in 4 villages	355
Focus Group Discussion	Groups of 12members in 3 villages	36
In-depth Interviews	Farmers in 4 villages	20
	Technical Officers	12
	Deputy Directors (VSD Headquarters)	4
	Deputy Directors (MoFA Headquarters)	2
	Senior Staff MoFA (Upper West Region)	7
	Traders	10
	Fulani herdsmen	3
	Community animal health workers	2
	License veterinary store operators	4
	Unlicensed veterinary store operators	2
		457

TAs and TOs are lower-skilled technicians who work directly with smallholder farmers. The rest of the staff plays supervisory or advisory roles.

Data collection and analysis

In order to have an overview of the study area, a quantitative survey was employed in January 2012 to characterise the farming systems. Focus group discussion were conducted in the first half 2012 in each of the four communities about how they experienced the veterinary services delivery before and after the decentralization and privatization reforms. In the second half of 2012, in-depth interviews in local language (through an interpreter) were conducted with five elderly farmers per community on personal experiences of the reforms (Table 3.4). In both the focus group discussion and in-depth interviews, farmers compared the period before and after the reforms. The topics discussed included who the veterinary TOs were, types of veterinary services they accessed, requests made to the TOs and responses received, charges, vaccination regimes, and mortality rates. In-depth interviews were also conducted with traders, Fulani herdsmen, and licensed and unlicensed veterinary drug store operators identified through snowball sampling on their viewpoints on changes in veterinary services they employ and/or deliver. MoFA staff from national headquarters, regional and district level were interviewed about their experiences of the changes before and

after the reforms. Documents about MoFA's decentralisation and privatization (Amezah, 2007, Humado, 2003) were reviewed. Direct observations were also used to collect data. For example, the lead author spent about 10 hours observing customers who purchased veterinary drugs from four licensed stores and two hours at one unlicensed store watching customers. He interviewed 10 livestock traders and traced eight of them from Babile Market (biggest livestock market in Lawra District) to the two main southern Ghana markets (i.e. Kumasi and Accra). An overview of the methods and numbers of actors interviewed are shown in Table 3.4.

Qualitative data (from field notes and transcripts) were analysed using Atlas.ti version 5. The data was coded using the questions 'what is the actor doing or saying in this data segment', 'what salient factors affect the actor's actions and what are the consequences.' Guided by these analytical questions, concepts were identified and short notes or memos written for each concept. Patterns in terms of recurrent and concurrent concepts were identified and narrative summaries using the memos were composed (Neuman, 2000). The quantitative survey data were summarised using descriptive statistics.

3.4 Findings

The findings are organized into four sections: first we will give an overview of the evolution of the reforms, followed by crosscutting changes introduced by the reforms. Then, we will present salient changes in the four types of veterinary service (preventive, clinical, drug provision, and human health protection) and an institutional characterisation of the diverse actors' responses to the changes in the different categories of veterinary service.

Table 3.5: Reforms in Ghana: Chronology of events from 1960 – 2012

Year	Event
1960-1966	Centralised governance system adopted during the first republic. The State pursued extensive investment in infrastructure and large-scale industries which proved unprofitable.
1970-1980	Ghana transformed itself from a middle-income country into a low-income country on the brink of bankruptcy.
1981-1982	New government (PNDC) declared commitment to decentralisation in stated policy position: to promote participatory democracy by introducing “truly decentralised government system.”
1983	Adoption of structural adjustment programmes (SAP) due to collapse of the economy and few options available to the PNDC.
1987-1995	Privatization of veterinary services
1987-1997	Unified Extension System implemented nationwide.
1988	Local Government Law, PNDCL 207 promulgated: District assemblies established as basic local government units.
1989-1993	Programme of Action to Mitigate the Social Cost of Adjustment and Development (PAMSCAD) to mitigate hardships suffered by poor people due to SAP.
1993	Local Government Act 462 and Civil Service Law PNDCL 327 promulgated to back establishment of decentralised departments of district assembly including MoFA, Ministry of Health, and Ministry of Education and Ghana Education Service.
1996-2000	Ghana Vision 2020 to guide Ghana into middle-income country by 2020.
1997	Decentralisation of agricultural services and Unified Extension System
2003	New government (NPP) promulgated Local Government Service Act 656: Department of agriculture and others retained as Departments of the District Assemblies; Ministry of Health, and Ministry of Education and Ghana Education Service excluded and placed under Central Government.
2003-2005;	Ghana Poverty Reduction Strategy (GPRS I) to accelerate growth and reduce poverty
2007-2009	Growth and Poverty Reduction Strategy (GPRS II) to consolidate gains in GPRSI and to reduce further poverty.
2012	Fiscal decentralisation of district assembly scheduled to begin but not effected by September 2012.

Source: Ahwoi (2010), Toye (1990), Field interviews, 2012.

3.4.1 Overview of the evolution of the reform

There have been over five decades of reforms, and Table 3.5 traces the evolution of the agricultural reforms within the context of the national policies and programmes. As Table 3.5 shows, the Provisional National Defence Council (PNDC) Government took over a country saddled with economic crisis and consequently had few options and

turned to the World Bank and the International Monetary Fund (IMF) and subscribed to their policy conditions in 1983 (Toye, 1990). However, before adoption of SAP, the PNDC already made explicit as its basic policy position in 1982: ‘to promote participatory democracy through decentralised government system’ (Ahwoi, 2010, p. 1). The architects of local government decentralisation in Ghana posited that this involved “the transfer of functions and powers, skills and competence and means and resources from Central Government to local government authorities” (Ahwoi, 2010, p. 7). They employed decentralisation as a process with political, administrative and fiscal elements. The political aspect involved establishment of district assemblies or local government structures; the administrative component related to establishment of decentralised departments such as MoFA and Ministry of Health as part of the district assemblies; and the fiscal aspect entailed arrangement to transfer resources to district assemblies to enable them perform to expectation (Awortwi, 2010, Ahwoi, 2010).

Thus, the government’s main objective for decentralisation of MoFA was to accommodate the ministry as one of the departments under the district assembly (i.e. local government service). MoFA’s reforms entailed merging 11 parallel departments under one administrative head i.e. the district or regional director (Humado, 2003). Table 3.5 also shows that MoFA’s reforms is one out of a number of interventions induced by SAP and other programmes. It is striking that the SAP interventions apparently worsened the plight of poor people in society as indicated by interventions such as Programme of Actions to mitigate the Social Costs of Adjustments and Development (PAMSCAD, a US\$90 million donor-supported intervention) that sought to lessen hardships experienced by the poor and vulnerable groups due to the SAP (Ahwoi, 2010). The foregoing forms the backdrop to decentralisation and privatization of veterinary services in Ghana. This study focuses on how the various actors responded to the MoFA reforms.

Table 3.6: National trends in public veterinary service performance

Period	Employed veterinary technical staff	TLU* to veterinary technical staff ratio
Pre-reform (1990-1995)	1009	1245.3
Early-reform (1996-2000)	786	1819.6**
Post-reform (2001-2010)	755	2242.7**

*TLU (Tropical Livestock Unit): cattle = 0.70; sheep/goats = 0.10 (Otte and Chilonda, 2002).

**TLU values from 1997 were based on projections.

Source: Staff list, Veterinary Services Directorate (2012); (ISSER, 2000, ISSER, 2011) .

3.4.2 Crosscutting changes introduced by the reforms

The reforms set in motion a number of fundamental changes in the allocation of public expenditures, supply of technical personnel, participation of private practitioners in service delivery, control of resources for veterinary activities, and demand for veterinary services. The changes simultaneously aimed to scale down public sector involvement and increase private sector participation. These changes are described below.

Dwindling public funding of veterinary services

The reforms of the public veterinary service were driven by the financial crisis in the early 1980s (Turkson and Brownie, 1999). For instance, the proportion of the national budget allocated to the VSD (i.e. nationwide) declined steadily from 0.4% in 1990 to 0.1% in 1994, followed by a rise in 1995 (Turkson and Brownie, 1999, p. 35). In the past five years, a similar decline has been recorded for VSD (i.e. headquarters; figures for nationwide not available): from 0.08% in 2007 to 0.02% in 2011 (MoFA, 2007-2011). In the post reform period, the government did not invest in construction, equipment and vehicles but continued to pay salaries. For example, comparing 1990 and 1995, public expenditure for investment and staff salaries in veterinary services fell by 20.5% and 3.6% respectively (Turkson and Brownie, 1999). The data available from 2008 to 2011 show that investment expenditure was zero (VSD, 2009-2011).

In addition to reduction in funding, the number of public veterinary technical staff (veterinarians and technicians) has decreased in relation to the livestock population since the reforms (see Table 3.6). The staff reduction was achieved by ending the automatic employment of graduates from agricultural colleges and universities, and by retrenching veterinary technical assistants. The reduction in staff was prompted by implementation of structural adjustment and economic recovery programmes (SAP/ERP) in Ghana from 1983 onwards (Turkson and Brownie, 1999). The staff reduction reflects on availability of technical officers for veterinary service delivery in rural communities.

Private practice offered by veterinarians and community animal health workers

In the mid-1990s, the government encouraged and supported veterinary professionals to enter private practice. In 1997, there were two private veterinarians in Ghana (Staff list, VSD, 2012); in 2011 there were 18 (Diop et al., 2012). According to a deputy

director of VSD, private veterinarians were only able to establish in major cities such as Accra and Kumasi where they focused on pets (e.g., cats, dogs).

The government also promoted a Community Animal Health Workers (CAHWs) scheme. CAHWs were selected by communities, trained in basic animal health care and provided with starter kits by VSD. Between 1995 and 2000, 1007 CAHWs were trained nationwide (Staff list, VSD, 2012). They charged nominal fees for their work in their respective communities and were supervised by the TO and DVO in the District. The licenses of CAHWs were renewed annually by VSD. The consensus among the veterinary personnel whom we interviewed was that the scheme worked for a few years and then broke down. Only one of our four study communities (Tabiasi) had an active CAHW. He told us that only few farmers consulted him because the majority had learnt to treat their animals themselves. Farmers in a second community (N.Tankyara) said they made use of their CAHW but that the person has stopped.

One other important factor that contributed to the collapse of the CAHW scheme was that, over time, the scheme lost the support of both veterinarians and para-veterinarians. A deputy director at VSD headquarters and a district veterinary officer (TO by rank) in the study area explained that the CAHWs were restricted to provide basic animal health care treatment but many went beyond that and provided injections and even engaged in surgery. According to the deputy director,

“We [VSD] trained CAHWs to treat wounds, de-tick and arrange meetings. They were not supposed to inject or do surgery. When they did inject, other farmers saw it and copied them. Thus, we brought self-medication by farmers upon ourselves.”

The VSD officers implied that they began to perceive CAHWs as competitors and cooperation with them waned. However, in the two of the communities in this study with records of CAHWs activities, the CAHWs did not perceive themselves in competition with the veterinary TOs. For example, at Tabiasi, the CAHW said he always referred cases beyond him, e.g. vaccination, post-mortem, to the TO but he was not getting the backstopping from the (new) TO since 2007. He concluded that TOs are not supervised and monitored so they do not deliver services expected from them. Similarly, at Tankyara, the CAHW said the main reason he stopped practicing was that the TO he used to work with was transferred and the new TO discontinued the working relationship. Apparently, VSD staff might have undermined the scheme by withdrawing support even in instances where the CAHWs operated within limits.

Control of resources for veterinary activities at district and regional levels

One of the main changes that decentralisation imposed on public veterinary services was a new organizational structure. Before the reform, a direct chain of command linked the Director of VSD and field staff through the Regional Veterinary Officer (RVO) as shown in Figure 3.1a. After the reforms, communication was channelled through the District Director, Regional Director and the Chief Director and copied to the RVO and Director of VSD along the path (see Figure 3.1b).

The new organizational structure of MoFA meant that the District Director became the cost centre manager with discretionary control over the quarterly budget allocation for district veterinary activities. Among the veterinary and other staff of MoFA whom we interviewed, the consensus was that giving control over public veterinary services to the MoFA District Director is the most significant constraint inhibiting animal health services delivery in the post-reform period, as illustrated by the viewpoint of a non-veterinarian. A regional director who had been district extension officer and district director before and after decentralization explained that *"there are issues [in veterinary services] that require use of money. Because its money is subsumed under DADU and RADU [district and regional agriculture development unit respectively], the director can take the money allocated to veterinary work and use and by so doing deny veterinary services of its share at the time they might request for money."* This connects to findings by Humado (2003) who reported that many District Directors used funds meant for veterinary service activities for other purposes and that reflected on incomplete decentralisation in that the District Directors were neither accountable to their former headquarters bosses in Accra nor to the district assembly because the Local Government Service had not been operationalized.

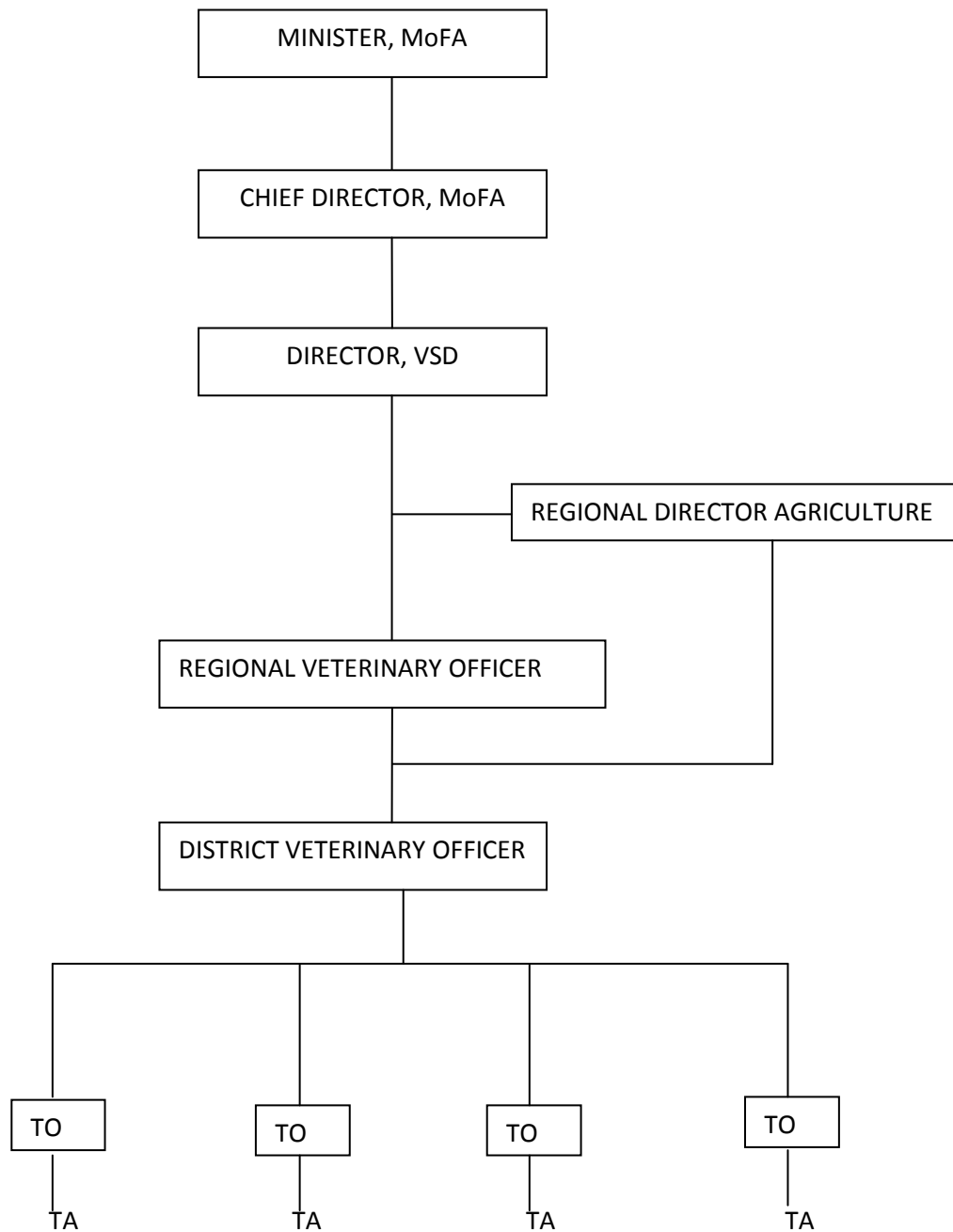


Figure 3.1a: Line of communication in Veterinary Services Department (VSD) before decentralisation

Key:

TA: Technical Assistant; TO: Technical Officer; VSD: Veterinary Services Department; MoFA: Ministry of Food and Agriculture

Shifting demand for veterinary services

The broader social context affected veterinary delivery over the course of the reforms. For example, demand for public veterinary services shifted from cattle farmers to owners of both small ruminants and cattle due to incessant theft of cattle. In the early 1990s, over 80% and 60% of households possessed small ruminants and cattle respectively in UWR (ICRA and NAES, 1993). Table 1 shows that excluding Tabiasi, 79.5% and 15.7% of households keep goats and cattle respectively in three communities in 2012. This reflects on the change in demand for veterinary services by households keeping small ruminants and cattle in the communities.

In two (Tabiasi and N. Tankyara) of our four study communities we observed an increase in the demand and use of public veterinary services (Table 3.7). Two inter-related factors contributed: first, in these two communities, groups of farmers self-organized to create access to veterinary services. For example, at Tabiasi, respondents told us that during the past five years the incumbent veterinary TO was almost always absent from the community. In response, the farmers organized themselves into groups and use the services of the previous veterinary TO who had been transferred to another district, about 80 kilometres away. The farmers explained that they willingly pay a higher price for this TO's services because he is very effective.

Table 3.7: Percentage of smallholder households with livestock in each community that uses public veterinary services

Community	Number of households with ruminant livestock	Percentage (%) of households with livestock using veterinary services
Tangasie	100	9.0
Tabiasi	148	61.5
Orbili	51	9.8
Nandom Tankyara	56	74.4

Source: Field interviews, 2012

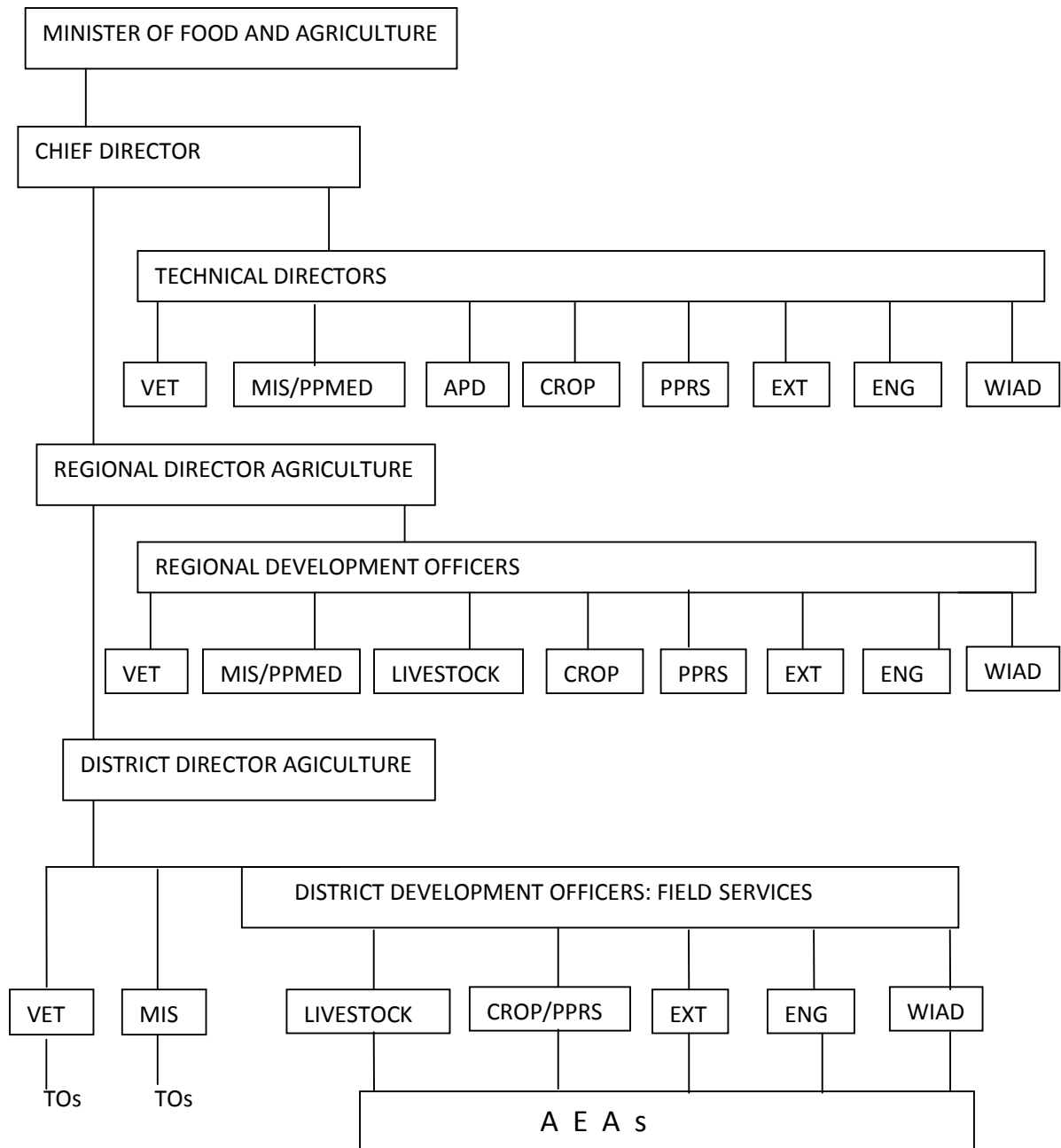


Figure 1b: Line of communication in MoFA after decentralisation

Key:

TOs: Technical Officers; AEA: Agricultural Extension Agent; VET: Veterinary; MIS: Management Information System; PPRS: Plant Protection and Regulatory Services; EXT: Extension; ENG: Engineering; WIAD: Women in Agricultural Development; PPMED: Policy, Planning, Monitoring and Evaluation Directorate; APD: Animal Production Directorate.

The TO at Tabiasi (from 1997 to 2007) explained his approach as follows: *“My main goal is to satisfy the farmer. When he is satisfied, tomorrow he will look for you. You see the only thing is to make sure you do effective work for them to see. If they have confidence in you, they are prepared to pay”*.

Another TO (retired in 2004) was also convinced that farmers will pay for satisfactory veterinary services. Farmers in Kumalsa (in the Lawra District) remembered that his services helped to reduce livestock mortality in their community.

In the two other communities, Orbili and Tangasie, most farmers said they only used clinical services when they observed illness in their flocks, and this information from focus group discussions was confirmed by the respective TOs. This is consistent with an earlier study (Amankwah et al., 2012) that most farmers keep livestock for purposes of security in bad times, for sale during food shortage but not as a business for profit. Hence, they limit costs and accept disease and mortality (Amankwah et al., 2012). However, nine out of 12 TOs interviewed believed that most smallholders are what Rogers (2003) called ‘laggards’ who are reluctant to change their animal health practices. Apparently, the TOs do not understand the principle of risk avoidance that characterise the smallholder farming system (Animal Research Institute, 1999).

In summary, Section 3.4.2 shows that the allocation of financial and human resources for the delivery of public veterinary services was considerably reduced. In addition, theft reduced the demand for veterinary services for cattle. The reduced resource allocation affected the quality of service delivery. The government’s reaction boiled down to ‘let’s wait and see what happens’ or ‘let’s see how people cope.’ The next section examines ‘what happens’ in the delivery of the four categories of veterinary services.

Table 3.8: Changes in categories of veterinary services and typology of institutional responses

Category of veterinary service	Allocative institutions	Cognitive institutions	Normative institutions
Preventive vaccinations	<ul style="list-style-type: none"> - In the post-reform period, VSD arranged with private traders to import vaccines. Reduction in public funding; 	<ul style="list-style-type: none"> - Recurrent shortages in vaccine supply at national level; - Team of TOs for mass vaccination disbanded; - Individual TOs deliver services in limited number of villages. 	<ul style="list-style-type: none"> - Public Procurement Act 663 of 2003 made it cumbersome for VSD to secure funds in time to import vaccines.
Clinical services	<ul style="list-style-type: none"> - A service charge was introduced, which requires clients to pay for services; - Private practice of veterinarians and community livestock workers (CAHWs) was introduced. 	<ul style="list-style-type: none"> - CAHWs were trained in basic animal health care by VSD; - Many Fulani herdsmen and farmers have learnt through try-and- error to practice self-medication; - TOs complain about lack of in-service training in post-reform period. 	<ul style="list-style-type: none"> - Annual renewal of license of CAHWs by VSD initially made the scheme effective, but later the arrangement broke down; - Quality standards not upheld: public personnel engage in private practice (Diop et al., 2012), treat animals and under-report.
Drug supply	<ul style="list-style-type: none"> - Privatization of drug distribution and sale shifted responsibility from the public to the private sector; - Increase in number of Fulani herdsmen and farmers who purchase veterinary drugs from stores (for self-medication). 	<ul style="list-style-type: none"> - Only 30% of operators of drug stores have veterinary training (Gyabaah-Yeboah, 2005); - Drug store operators educate customers that drug administration is based on body weight. 	<ul style="list-style-type: none"> - Regulation of veterinary drug supply and stores by Food and Drugs Board is nebulous; - Only 44% of veterinary drugs on Ghanaian market had been registered with Food and Drugs Board (Gyabaah-Yeboah, 2005).
Public health	<ul style="list-style-type: none"> - District Director designated sole spending officer at district level. - Reduction in public funding. 	<ul style="list-style-type: none"> - Many technical staff has left VSD; there is inadequate staff for disease surveillance, meat inspection in many urban slaughter slabs and monitoring movement of animals. - The general public is often sensitized in media to avoid meat from unhygienic abattoirs (Mensah, 2013). 	<ul style="list-style-type: none"> - Decentralisation and Unified Extension System introduced; - Livestock census and branding of cattle ceased. ; - Non-adherence to international protocols and standards of Organisation of Animal Health (OIE); - The Veterinary Surgeons Bill of 2010 that seeks to grant authority for meat inspection to VSD has been prepared but not passed.

3.4.3 Changes in each of the four veterinary service categories

Table 3.8 sums up the salient changes at the national and community levels that occurred in the four categories of veterinary service due to the reforms and the responses of actors. A description and example for each service follows below.

Preventive vaccinations: Shift in procurement from public to private sector and cessation of mass vaccinations by organized teams of technicians

Preventive vaccinations were the main focus of veterinary interventions in the pre-reform period. The reform changed two important aspects of preventive vaccination. The first change relates to procurement of vaccines (for diseases such as *Peste Des Petits Ruminants* (PPR), anthrax, and Newcastle disease in poultry). Respondents from VSD headquarters reported that, prior to the reforms, VSD imported vaccines without having to go through lengthy procurement procedures. However, for the greater part of the post-reform period it has become impossible to access government funds in time to procure vaccines. Consequently, VSD has made alternative arrangements with private traders to import vaccines. However, due to frequent changes in VSD directors (almost every two to four years because of retirement) and due to the unofficial nature of the arrangements, vaccine procurement at the national level has fallen short. For instance, according to officials at the Central Laboratory at Pong Tamale (the unit responsible for distribution and sale of vaccines in Northern Ghana) and the TOs in the study area, from June 2011 to August 2012, in the whole of Ghana no routine PPR vaccinations took place.

The second important change in preventive vaccination relates to the organizational arrangements for the delivery of vaccination services. During the pre-reform period annual mass vaccinations of livestock were administered by teams of veterinary technicians. In the post-reform period, vaccinations have been provided on an ad-hoc basis or in selected communities by individual TOs. Vaccination teams are now only mobilised when serious disease outbreaks occur in the districts and emergency disease control is required.

TOs at the community level have responded in diverse ways to the changes in procurement and organization of vaccination services. Six out of nine veterinary TOs

in the study area only deliver vaccination services to progressive (rich) farmers or to a few communities that are ready to pay for animal health care interventions. Three out of nine TOs do not provide vaccinations at all. Interviews with farmers suggested that two of the three were absent from their post most of the time, using office hours to engage in personal affairs. The third TO explained that he does not undertake late vaccinations because the animals may be sick already and vaccination might contribute to livestock mortality. The changes reflect on mortalities of livestock in the communities. For example, Orbili, N. Tankyara and Tangasie ranked high livestock mortality rates as a priority constraint, next to water shortage in dry season. Mortality rates in 2010 were 63% among kids (less than 1 year); 59% among lambs (less than 1 year); 47% among goats (over 1 year); and 12% among sheep (over 1 year)(Amankwah et al., 2012).

Clinical services at district level and cost of farm gate clinical services

Two changes in clinical services recurred in the interviews with most of the veterinary personnel: the cost of farm gate clinical services and treatment of ill animals by farmers themselves. Before the reforms, the allowances for fuel and maintenance allowed the TOs to use their motorbikes to attend to reported ill animals and conduct disease surveillance. Veterinary drugs were issued to the TOs from the district office store and at the end of the month returns were submitted to the office. However, after the reforms, the allowances were often delayed and a quarter (three months) or more might pass before allowances are paid.

Many TOs report that they have to buy drugs directly from the market rather than through the District Veterinary Officer who often mark-up the price. In addition to the mandated service charge for attending to ill health animals, many TOs charge farmers for fuel because they do not receive the transport allowance in time. A VSD Deputy Director observed that due to the hardships, many TOs under-reported the services they provide in order to avoid payment of service charges. For example, since 2009, farm visits and house calls attract service charge of GH¢2.0 and GH¢3 per treatment of a sheep/goat and cattle respectively (Fees and Charges Act 793, 2009). A TO said that in 2011, his "*monthly service charge sometimes was GH¢3 or GH¢5.*" He reasoned that it is not worthwhile to use his own funds to buy drugs and pay service to the government. This is typical of TOs who paid service charges.

In response to the reduced number of veterinary staff, the increased cost of accessing public service, coupled to the increased importance of livestock as 'savings' for

meeting needs and emergencies in households, many smallholders have taken up self-medication. “Self-medication is a practice whereby clients purchase drugs and vaccines and administer these to their animals without consulting veterinary staff” (Turkson, 2008, p. 19). Cattle owning farmers especially indicated that self-medication has risen after the reforms as indicated at focus group meeting at Tabiasi. As one of them indicated: *“at first, people didn't realize the importance of animals, but today everything you do involves money. Examples are health insurance, school fees, fertilizer and naming ceremony, just a few. More to the point there isn't any vet. So if you do not treat your own, [whiles] the means are numerous, a time will come you will be at risk. So this is the major reason why farmers are forced to learn some of these issues.”* The most common form of self-medication is treatment of wounds and skin diseases using either herbs or orthodox products such as iodine solution and insecticides). The second is prophylaxis and curative treatments using herbal preparations notably common salt solution with dawadawa (i.e. fermented condiment prepared with beans of a tree legume, *Parkia biglobasa*) for drinking by animals. Thirdly, farmers inject ill animals using antibiotics such as oxytetracycline and procaine penicillin. The fourth type is top-up treatment when the TO has failed to cure an ill animal. Most smallholders cannot afford a follow-up visit by the TO so they monitor their animals and provide the needed follow-up treatment themselves. The top-up treatment often involves both herbal preparations and orthodox products. The first and second types of self-medication were common in all the four communities studied. The third and fourth types were observed mostly at Tabiasi.

Drug supply: Privatization of veterinary drug sale and lax enforcement of quality controls

The main change in drug supply relates to privatization of veterinary drug distribution and sale that began in the mid-1990s. Prior to this privatization, VSD procured and distributed all veterinary drugs in Ghana mainly through its field staff. After privatisation, VSD withdrew from marketing veterinary drugs and chemicals (excluding vaccines) and private individuals or companies took over these functions. An outcome of privatization is that licensed shops now sell veterinary drugs in the country's major cities and towns. Increasingly, however, unlicensed itinerant traders sell veterinary drugs in towns and rural communities with little or no quality control. For instance, in Tabiasi Fulani herdsmen are the main source of veterinary drugs. In an interview, the Chief Fulani herdsman in that village indicated that he buys drugs from stores in the regional capital, Wa. Two other Fulani herdsmen said that the cattle owners often do not make provision for veterinary treatment but hold them responsible in case of mortality. Hence, they are compelled to treat the animals using both

conventional and herbal preparations in cases of ill-health so as to prevent mortality and keep their herding job. Interviews with four of the six licensed veterinary store operators in Wa revealed that traders who cross the border from Burkina Faso also are important sources of veterinary drugs for Fulani herdsman and farmers. One of the operators concluded that Fulani herdsman have taken over the job of veterinary officers. In Nandom, which is close to N. Tankyara, another of our study communities, veterinary drugs are sold on unlicensed table-top shops on weekly market days. Two Deputy Directors of VSD said that by law, the Food and Drugs Board has responsibility over sale of drugs on the open market and there is not much VSD can do about it.

Public health service: Non-adherence to international protocols

The most important change with respect to public health services relates to difficulty to collect data on livestock diseases, stock movement and animal numbers. The reforms have affected VSD's reporting on disease surveillance to the World Organisation for Animal Health (OIE), the FAO, the International Bureau of Animal Resources (IBAR), and the International Livestock Research Institute (ILRI) (Humado, 2003). A gap analysis of public veterinary service in Ghana conducted by OIE consultants (Diop et al., 2012) blamed the new structure of MoFA introduced by the reforms.

According to Humado (2003), the new structure placed emphasis on extension services delivery and led to reduction in capacity of veterinary staff to deliver services due to lack of staff. Besides, impediments in budget allocation resulted when district directors often committed a disproportionate percentage of the funds to their area of specialisation and administrative expenses (especially vehicle repair and fuel), to the disadvantage of technical services such as veterinary services delivery.

Additionally, a number of public services ceased including annual national livestock census, and branding of cattle before issuing movement permits to traders to enable them transport animals across district boundaries. Meat inspection has also been affected by the changes. For example, visits to the central abattoirs in Accra and Kumasi during this study showed they have qualified veterinary officers to conduct meat inspection. However, visits to two slaughter slabs attached to small ruminant markets in Kumasi and another in Accra showed that they did not have veterinary officers for meat inspection. A VSD official stationed at one of the central markets in

Accra lamented over the growing number of slaughter slabs in the city where the department cannot conduct meat inspection for lack of manpower.

To sum up, Section 3.4.3 shows that the reforms gave the public and private sectors shared responsibility for delivering veterinary services. One of the four service categories, drugs distribution and sale, was shifted entirely to the private sector. For the other three categories (prevention, clinical, and human health protection), the public sector retained responsibility for production and distribution while funding was shifted to the private sector. However, the public sector had to improvise in order to continue to provide these services. The gaps were persistently renegotiated and filled by activities of various actors in response to dynamics in the institutional elements.

3.5 Discussion

Our findings allow us to reflect on the theoretical and policy implications of our work. We raise three main issues: allocative institutions and coverage of veterinary services; the interconnectedness of the institutional elements in veterinary service reforms; and the implications for the sustainability of animal health service delivery in Ghana and beyond.

3.5.1 Allocative institutions and coverage of veterinary services

Our findings indicate that changes in allocation of resources were the major contributor to reduction in coverage and delivery of veterinary services. Allocative institutional issues come to fore in two significant changes: a substantial reduction in the allocation of financial and human resources to public veterinary services; and placing the Veterinary Service Department under a non-veterinarian director at the district level. The response of the public sector included unequal service delivery in communities, focus on progressive (rich) farmers, farmers' increased transaction cost in accessing services, cheating by public veterinarians and para-veterinarians through private practice and under-reporting. Consequently, the quality of service declined and non-adherence to international protocol for reporting livestock diseases prevailed. In the private sector, many farmers and Fulani herdsmen purchased and administered veterinary drugs that had not been subject to quality control. Only a few communities self-organised to access veterinary services indicating limited willingness of farmers to pay for effective veterinary services. We call attention to the fact that the process of shifting responsibility from the public to the private sector was not guided. Consequently, the reforms resulted in unintended negative responses from both public

and private sector actors. Our findings reinforce earlier studies of veterinary service reforms in Ghana (Turkson and Brownie, 1999, Turkson, 2008) and The Cameroon (Gros, 1994) as well as in several other developing countries (Woodford, 2004). These studies also show that governments substantially reduced public expenditure on veterinary services and passively engaged in the reform process. The public sector proved unable to respond to the emergence of informal animal health delivery system characterised by the prevalence of self-medication and absence of quality control.

3.5.2 The interconnectedness of the institutional elements in veterinary service reforms

Our findings also show that the responses of the diverse actors to the reforms can be structured according to three categories of institutions (allocative, cognitive and normative) that are inter-linked or explain further changes. For example, reductions in public funding and staff numbers led veterinary TOs to mark-up the price of service provision (i.e. changes in allocative institutions induced further change). Breakdown of public sector controls (change in normative institution) led to easy access to veterinary drugs on the open market. Such changes within the veterinary service domain, in turn, interacted with other institutional elements and forces outside the reforms. For example, increased dependence of farmers on livestock for meeting livelihood needs led many farmers to appropriate knowledge and skills for self-treatment (i.e. change in cognitive institutions). This widespread self-medication cannot be captured in public sector reports, which contributes to non-observance of the international protocol for reporting livestock diseases (a normative issue). The institutional analysis of the responses to the reforms indicate the need to consider emergent cognitive and normative institutional changes that are triggered by changes in allocative institutions. The reforms introduced changes primarily in formal allocative institutions. The analysis of the responses to these changes shows that they are not the one-off outcome of the reforms. Instead, they interact with a whole set of other institutional changes at national, district and community levels. This suggests that policy makers who implement change in one institutional dimension can expect the emergence of a new institutional setup that involves other institutional dimensions.

Our findings reflect on a number of studies not only in veterinary service provision but also in other disciplines that show that institutional elements interact in unforeseen ways, with unintended consequences for the outcomes of reforms (Gros, 1994, Munyua and Wabacha, 2003, Harrington et al., 2001). For example, integrated natural

resource management research shows that there are inter-linkages among policies and institutions, farm-level practices, plant and animal growth, biophysical process and impacts and outcomes with consequences for food security, poverty alleviation and environmental protection (Harrington et al., 2001). Our study shows that changes in allocative institutions are inter-linked with changes in cognitive and normative (including regulative) institutions. These changes prompted both public and private sector actors to engage in practices which may have negative externalities and may undermine efficacy of disease management (Liebenehm et al., 2011).

3.5.3 Implications for the sustainability of veterinary service provision to smallholders

The outcomes of the reforms raise a number of issues about sustainability of the present animal health delivery system in Ghana, and possibly also have implications for similar systems elsewhere. We define sustainability as the ability of the animal health promotion system to dependably provide essential goods and services not only in response to effective demand, but also as required by a healthy livestock production industry. To assess sustainability in this sense, (i.e. without direct reference to ecological sustainability), we apply the World Bank's (2009a) suggestion that five essential actors need to interact for a sustained successful delivery of veterinary services: (1) livestock producers and their organizations, (2) a national public veterinary service, (3) a private veterinary sector, (4) a legislative framework and statutory regulatory body, and (5) a veterinary professional association. For Ghana, our findings suggest that the actors 1 – 4 are not capable of playing their envisaged roles. For example, while the majority of smallholders in Northern Ghana are livestock producers, they are hardly organised in effective producer associations; the public sector is the dominant service provider but is under-resourced and under-staffed as a result of the reforms; there is a regulatory body, the Veterinary Council, and regulations do exist (i.e. the Veterinary Surgeons Law of 1992 and the Diseases of Animals Act 83, of 1961) but both the public and private sectors are not adequately regulated as is evident from the break-down of the quality control of veterinary services and drugs. With respect to Actor 5, the Ghana Veterinary Medical Association (GVMA) is functional as shown in its recent press release (GVMA President, 2012). However, taking all five actors into consideration, Diop et al (Diop et al., 2012) suggest that there is no regular formal interaction among the entities that make-up the animal health promotion system. Thus, the current system does not meet the World Bank's (2009a) criteria of sustainability.

3.6 Conclusions

This study examined the outcomes of the decentralisation and privatization reforms for the delivery of veterinary services and smallholders' use of these services in two districts in Northern Ghana, where the settlements are scattered and an extensive system of livestock keeping prevails. The study shows that these outcomes have not been altogether positive. The sharp reductions in financial and staff resources allocated for public sector veterinary services has led to irregular mass vaccinations against contagious animal diseases, to greater inequity of service delivery, to collapse of quality controls of drugs, to proliferation of drugs from informal sources on the market, to often inadequately informed self-medication, and to moonlighting of public (para) veterinarians for private purposes. This 'litany of woes' does not necessarily imply a return to the public sector system installed by the British colonial power. The public sector still has a relevant role to play, e.g., for surveillance and control of infectious or zoonotic diseases; guarantee of quality control of drugs and vaccines; and adherence to international protocols for livestock reporting system. Our study shows that the public sector requires urgent action to enable it to play these essential roles. On the other hand, the self-organization of a few communities to effectively use veterinary staff, and the apparent willingness of farmers to pay for effective services suggest that strategies to mainstream delivery of customer-oriented services by private para-veterinarians to groups in rural areas may hold prospects. The study also shows that measures to implement agency-driven change, such as economising on public sector costs (we called it change in allocative institutions) triggers unforeseen and inter-linked institutional changes in other domains with unintended consequences. Awareness of such dynamics might help policy makers and analysts to better understand the issues involved in co-ordinating multiple fronts of change and could help in assessing where government could act as a market or system facilitator (Carney, 1998, Klerkx and Leeuwis, 2008) in order to counteract undesirable effects of reforms, through e.g., quality control or by facilitating a match between the demand and supply side of the veterinary services system.

CHAPTER 4

SCALING OUT LIVESTOCK SUPPLEMENTARY FEEDING TECHNOLOGIES IN NORTHERN GHANA: CO-LEARNING AND ADAPTATION CHALLENGES

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Under construction

Abstract

Agricultural scientists and development agents face challenges in scaling out small scale successes or local impact to wider coverage and socioeconomic impact in crop-livestock farming systems. The present study employed the learning selection model comprising 1) awareness creation; 2) deciding to try out options; 3) adapting, learning and selecting; and 4) sustaining and/or promulgating selections, to examine efforts to scale out proven technologies (i.e. *Cajanus cajan*, *Stylosanthes hamata* and groundnut crop residue for supplementary feeding) as part of small ruminant improvement interventions in Northern Ghana (1996 to 2009). Multiple methods including a quantitative survey, in-depth interviews and direct field observations were employed to collect data at Nandom (N.) Tankyara and Orbili communities in Lawra District. During this study (April 2010 to December 2012) all farmers (except one) did not cultivate fodder *Cajanus* or *Stylosanthes* as fodder bank in the two communities; and 35% and 6% of farmers at N. Tankyara and Orbili respectively had adopted crop residues for supplementary feeding. The non-adoption of fodder technologies were attributed to a number of elements including: household labour constraint during harvesting of food crops and preparation of dry season vegetable production (which is a principal commercial enterprise), inflexibility in planning and implementation of projects, and inadequate attention for non-market institutional constraints that inhibited competitiveness of smallholder producers. The moderate adoption observed reflected on learning selection strategies i.e. farmers sustained aspects of the interventions that they found relevant: N. Tankyara opted for groundnut haulm crop residue (and improved livestock housing) whereas Orbili sustained a livestock farmer group formed as part of the interventions. This is an important contribution to the diffusion and learning selection literature in that it is not only technologies ('hardware') that are adapted but also the group organizing capacities ('orgware') are adapted during scaling out process depending on needs.

4.1 Introduction

Strategies for expanding the coverage and socioeconomic impact of development interventions are of increasing concern to agricultural scientists and development agents (World Bank, 2003). Governments, civil society and donors are demanding evidence that agricultural research and development (R & D) contribute to improvement in the livelihood of poor households. However, agricultural scientists and development agents face challenges in scaling out small scale successes or local impact to wider coverage and socioeconomic impact (Douthwaite and Gummert, 2010, Millar and Connell, 2010, World Bank, 2003). Scaling out refers to the geographical expansion of a technology, practice or systems change over time. Scaling up, on the other hand, refers to expansion of beneficial institutions and capacity building practices within and across organizations and networks at local to international levels (Pachico and Fujisaka, 2004). Millar and Connell (2010) have observed that scaling out and scaling up have been employed by research and development organizations to express their desire to achieve more widespread impact from proven technologies (after trialling with farmers). They continue that both processes are required to achieve widespread and significant systems change. This study is concerned with scaling out proven technology in livestock supplementary feeding. Scaling out is defined here as a bottom-up interactive process of adaptation and learning whereby intervention outcomes are widely shared and/or used (CGIAR, 2000, Harrington et al., 2001).

One of the hindrances to scaling out impacts relates to shortcoming in transfer of technology (ToT) approach which many agricultural scientists employed and used to plan and manage the innovation process for decades (Douthwaite et al., 2001). The ToT approach assumed that ‘scientists can learn enough about the farming system and then incorporate this knowledge in a new technology (hardware) and operating instructions (software)’ (Douthwaite et al., 2001). The technology output is then assumed to require little or no subsequent local adaptation. However, several studies demonstrated that smallholder farmers actively adapt technologies to fit into their farming system and the wider socio-institutional environment (Leeuwis and Aarts, 2011, Mekoya et al., 2008, Sumberg, 2002).

Several studies have also indicated that failure to scale out proven technologies relates to inadequate understanding about the nature of innovation and how it can be

facilitated, among others (Douthwaite and Gummert, 2010, Millar and Connell, 2010, Harrington et al., 2001). Innovation is currently understood as a co-evolutionary process that requires simultaneous changes in the technological, social, economic and institutional (órgware') domains (Klerkx et al., 2012). As a process, three main iterative phases of innovation have been identified for heuristic purposes: idea generation, execution and promulgation (Douthwaite et al., 2002a, Kastle, 2012). Douthwaite et al (2002a) have posited that the innovation process entails repeated interactive and experiential learning cycles which they call as learning selection. "In learning selection stakeholders engage with a new technology, they individually play evolutionary roles of novelty generation and selection, and in their interactions create recombinations of ideas and experiences and then promulgate the beneficial novelties' (Douthwaite et al., 2002a, p. 109).

Additionally, Millar and Connell (2010, p. 224) have observed that promulgating novelties or scaling out R & D outputs goes beyond increasing adoption of proven technologies. It is a facilitation process that enables "farmers in different locations to identify their problems, trial a range of options and make informed decisions about improving their livelihoods (one of which may be not to adopt the recommended technology!)" (emphasis in the original). It requires a joint definition of problems and solutions between facilitators and farmers, which is a fundamental principle of participatory approach (Faure et al., 2013). In other words, it relegates scientists, extension workers and other experts to the role of co-learners, and requires them to be guided by the principle that 'learning, innovation and other desirable outcomes are emergent properties of interactive systems' (Koutsouris, 2008, p. 212-213). Thus, widespread use of R & D outputs i.e. innovation, requires facilitation of concurrent changes in many domains over time (Klerkx et al., 2012).

Previous studies indicate that processes of learning selection and scaling out are hindered in smallholder agriculture in most West Africa countries due to institutional constraints (Hounkonnou et al., 2012, Tarawali et al., 2005). For example, in the case of mixed crop-livestock production system which over 80% of the population in West Africa may depend for their livelihood, shortage of feed supply is the most widespread constraint (Elbasha et al., 1999, Tarawali et al., 2005). Many researchers have established that leguminous fodder and crop residues such as groundnut haulms are important sources of high protein feeds for ruminant livestock. However, with the exception of few success stories (see Pretty et al., 2011, Wambugu et al., 2011), most smallholder farmers have not adopted supplementary feeding in West Africa and other parts of the continent even though research has been on-going over the past 80 years

(Mekoya et al., 2008, Tarawali et al., 2011, Sumberg, 2002). This pattern reflects on the situation in Northern Ghana. Livestock, especially, small ruminants (i.e. sheep and goats) are kept by almost all smallholder households (Amankwah et al., 2012, IFAD, 1995). However, farmers make little investment in supplementary feeding even though the practice was promoted by the staff of Ministry of Food and Agriculture (MoFA) as part of small ruminant improvement interventions in Upper West Region (UWR) in Ghana in recent projects like the Upper West Agricultural Development Project (UWADEP, 1996 to 2004) and the Animal Research Institute and MoFA Small Ruminants Project (ARI-MoFA, 2004 to 2009) (Amankwah et al., 2012).

Thus, there is information on low adoption of supplementary feeding practices after the UWADEP and ARI-MoFA projects. However, little is known about the efforts interventionists made in facilitation of learning, adaptation and selection by farmers in the supplementary feeding interventions. The present study contributes to fill the gap in knowledge by analysing the extent to which farmers and interventionists co-learned and adapted in 1) the identification of problems and opportunities in the smallholder small ruminant system; and 2) the implementation of selected technologies in field settings during the supplementary feeding interventions in Northern Ghana. In the next section, a conceptual framework based on learning selection is described. Then, the methods are outlined followed by the results and discussion sections.

4.2 Conceptual framework

In this study, we look at supplementary feeding interventions as a form of scaling out proven technologies through a learning selection process with four elements: 1) creating awareness of opportunities; 2) deciding to try out options; 3) learning, adaptation and selecting; and 4) sustaining and/or promulgating selections (Douthwaite et al., 2009, Douthwaite et al., 2002a, Millar and Connell, 2010). Douthwaite and associates' (2002a) learning selection (LS) model built upon the diffusion model (Rogers, 1995) and the evolutionary perspective of innovation (Nelson and Winter, 1983). The LS model was derived from study of participatory interventions on agricultural engineering (i.e. rice harvesting and rice drying technologies introduced to the Philippines and Vietnam after 1975, Douthwaite et al., 2002a). The formulators suggested that the LS model was suitable for evaluating participatory interventions. They employed it to examine adoption of alley cropping and *Mucuna pruriens* and to evaluate several interventions (Douthwaite et al., 2009, Douthwaite et al., 2002b).

In the LS model, creating awareness of opportunities entail interaction between support organization and farmers to prioritise constraints being experienced by the farmers and to identify opportunities (i.e. a situation in which a potential profit can be formulated from means and ends relationship, Shane, 2000). Strategies and tools employed to prompt awareness of opportunities include active dissemination of good ideas, peer networks, trade fairs, conferences, field days, advertising, and training courses among others (Douthwaite et al., 2009).

Deciding to try out options largely involves assessing the relative advantage and trialability of selected options over existing technologies and practices (Pannell et al., 2006, Rogers, 2003). Common strategies include talking to others who have already adopted (e.g. during exchange visits, or seeing the idea put to practice in field trials) and experimenting with new technologies (Douthwaite et al., 2009).

The learning, adaptation and selection phase entails interactive and experiential learning cycle. The learning cycle comprises experience, making sense, drawing conclusions, planning for implementation, and taking action which begins another iterative learning process (Barnett, 1989, Kolb, 1984). Many of the stakeholders involved in the innovation process go through their own learning selection. For example, a manufacturer may modify a machine to work better under smallholder farmers' conditions. Farmers may change practices e.g. replace use of cutlass or hoe for land preparation with tractor plough. Often, each stakeholder evaluates previous experience and select what worked from what did not work (Douthwaite et al., 2009).

Sustaining and/or promulgating ideas occurs when after selecting what worked, a farmer tells people in her social network about the benefits of her novelty and they decide to try it by going through their own learning cycles. Multiple simultaneous learning cycles may create the conditions for the recombination of diverse observations and experiences that may result in generation of novelties with 'hybrid vigour'. Over time, there is co-evolution of the technology, network of actors and their cognitive frameworks and organizational arrangements that sustain and promote the technology (Douthwaite et al., 2009).

Our adapted LS model is shown in Figure 4.1. Using the elements in our LS model, we shall, for each element, describe the events in the supplementary feeding interventions of the UWADEP and then ARI-MoFA projects.

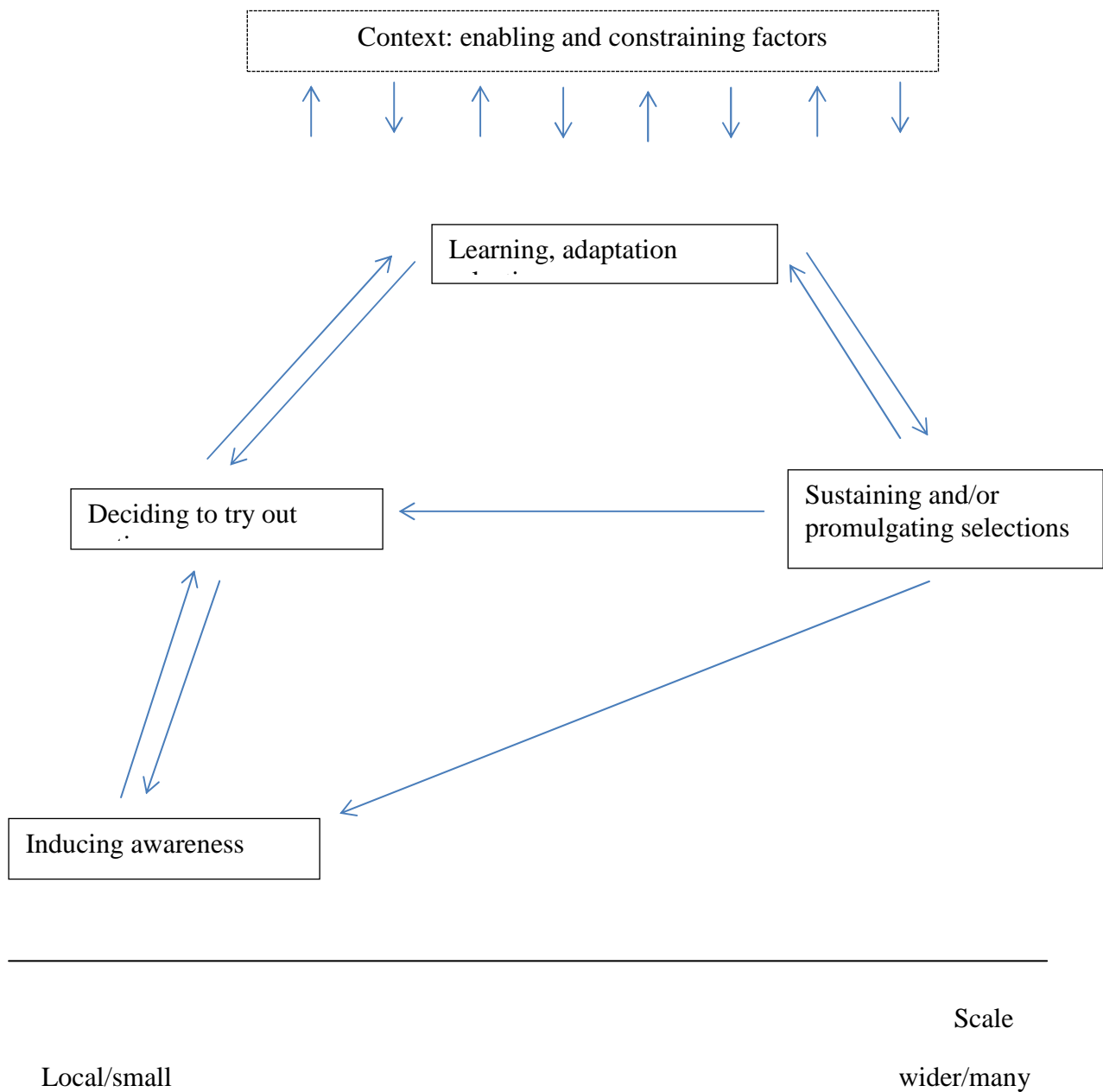


Figure 4.1: Scaling out through learning selection processes (adapted from Douthwaite et al. (2009)).

4.3 Methods

4.3.1 Research design and sampling

Multiple methods of qualitative and quantitative case study design (Yin, 2003) were employed to collect data about the components of our conceptual framework in Upper West Region of Ghana. The Lawra District in Upper West Region was selected as the

study area because it has very high number of food insecure households in Northern Ghana (ICRA and NAES, 1993, Quaye, 2008). Within the district, purposive sampling (Yin, 2003) was employed to select two communities noted for livestock production and that also participated in the UWADEP and ARI-MoFA projects: N. Tankyara and Orbili (see Tables 4.1 and 4.2 for characteristics of household heads and farming system in the two communities).

Table 4.1: Population, households, and characteristics of household heads in two communities

	N. Tankyara	Orbili
Population (n)*	321	302
Households (n)	66	51
Average age of household head (years)	56.7	46.3
<i>Religion</i>		
Christians (n)	61**	1
Traditionalists (n)	0	49
Moslems (n)	0	1
<i>Education</i>		
No formal education (n)	40	51
Primary (n)	13	0
Secondary (n)	4	0
Post-secondary (n)	4	0

*Ghana Statistical Service, 2010 population approximation.

**Excludes 5 households that did not complete survey.

Source: Field survey, 2012

Table 4.2: Farming system characteristics of the two communities

	N. Tankyara			Orbili		
	Households (n)	Mean (n)	Standard deviation (n)	Households (n)	Mean (n)	Standard deviation (n)
<i>Household composition</i>						
Under 5 years		2.0	1.65		2.1	1.93
5 to 15 years		2.0	1.79		3.2	2.02
16 to 60 years		5.3	3.29		2.1	2.38
Over 60 years		0.8	0.72		0.4	1.15
Total	61	10.1	4.90	51	7.8	5.38
<i>Farm size (acres)</i>						
Millet	61	2.6	1.56	49	2.8	1.68
Sorghum	0	0	0	9	1.9	1.13
Maize	58	1.6	1.10	48	3.0	1.24
Groundnut	53	1.1	0.76	51	3.0	1.19
Cowpea	4	0.2	0.10	7	1.1	0.45
Total	61	5.2	2.51	51	9.0	3.24
<i>Livestock</i>						
<i>Cattle</i>						
Male		0.8	0.90		3.4	4.14
Female		2.7	1.76		9.5	11.39
Total	23	3.5	2.37	8	12.9	14.93
<i>Sheep</i>						
Male		1.6	1.90		3.0	2.58
Female		6.0	5.51		14.2	19.57
Total	26	7.5	6.78	29	17.2	21.48
<i>Goats</i>						
Male		2.1	1.82		3.3	2.50
Female		6.6	5.05		8.5	4.75
Total	56	8.8	5.81	49	11.8	6.44

Source: Field survey, 2012

The majority of the households at N. Tankyara adopted Christianity since the 1930s and 34% received education at different levels (see Table 4.1) as a result of activities of the Roman Catholic Missionary during the colonial administration and after independence of Ghana in 1957. Through church-based development programmes, Tankyara farmers formed and registered a Cooperative group in 1977 for the purpose of grain banking and credit savings. Most smallholders at Orbili remain Traditionalists in religion. The Missionary development programmes did not extend to Orbili until the 1980s. Orbili does not have a registered cooperative.

N. Tankyara farmers have smaller farm sizes (and only three households are active in dry season vegetable production) than Orbili. Thirty-five per cent (35%) and 15% of households at N. Tankyara and Orbili respectively keep cattle. Members of the Tankyara Cooperative adopted bullock plough and became the leading animal traction group in the late 1970s in the study area. Six households maintained bullocks at N. Tankyara during the time of this study (2010 – 2012). Bullock plough relied on dry season supplementary feeding using materials such as maize chaff and stalk, rice straw treated with common salt solution, groundnut haulms, and fruits and leaves of *Feidherbia albida* tree. Thus, N. Tankyara farmers were exposed to supplementary feeding before UWADEP and ARI-MoFA interventions. Orbili farmers have a larger farm size. Their flock (sheep) size was more than twice the number at N. Tankyara. Also, over 50% of the households at Orbili actively engage in dry season vegetable production by the banks of the River Black Volta, at a distance of 2 Kilometres from the community. The bulk of vegetables that are produced are sold at the market.

4.3.2 Data collection and analysis

Data was obtained from available documents on UWADEP (ICRA and NAES, 1993, IFAD, 1995, IFAD, 2006, UWADEP, 2000) and ARI-MoFA Project (MoFA, 2004, MoFA, 2005, MoFA, 2009, Ojingo, 2008). Official letters of communication (i.e. memos) were also examined. Scientists whose research might have informed the projects were not available for interview. However, their publications on forage research were examined (Agyare et al., 2002, Karbo et al., 1996, Karbo et al., 1998, Barnes and Addo-Kwafo, 1996). Discussion was organized on three occasions in each community with the livestock farmers' group that participated in the two interventions (i.e. UWADEP and ARI-MoFA). The average attendance was 35 and 17 at N. Tankyara and Orbili, respectively. A quantitative survey of all households with livestock was conducted in the two communities in early 2012 to characterise the crop-livestock farming system of the communities. A second household survey was

conducted in late 2012 at N. Tankyara which recorded moderate adoption of supplementary feeding with groundnut haulms (Orbili was not included because only three households adopted the practice). A snowball sampling was employed to locate farmers for in-depth interview on reasons for adoption, non-adoption and discontinued of supplementary feeding practice at N. Tankyara (7 adopters, 7 non-adopters and 2 discontinued). Manure accumulated and groundnut haulms conserved by five adopters at N. Tankyara were weighed (only the five farmers had a flock house with floor cemented through the ARI-MoFA project which made it possible to obtain weights without distortion by other materials such as sand). In-depth interviews were conducted with 10 MoFA staff to examine how they implemented the interventions. Table 4.3 shows characteristics of the MoFA staff.

Table 4.3: Characteristics of key Ministry of Food and Agriculture staff who played active role in the UWADEP and/or ARI-MoFA interventions*

Staff specialization	Qualification	Total respondents (n)
Animal production	BSc degree	2
Veterinary	3-year certificate	2
	2-year animal health diploma	1
Agricultural Extension	3-year certificate	2
	2-year extension diploma	1
	BSc degree	2

*Two staff members were retired at the time of this study

4.4 Findings

The results are organized under four sub-sections under UWADEP and then ARI-MoFA interventions in line with our conceptual framework: creating awareness of opportunities; deciding to try out options; adaptation, learning and selecting; and sustaining and/or promulgating selections

4.4.1 Case study 1: Supplementary feeding practices under UWADEP

Table 4.4 provides an overview of the small ruminant and poultry improvement project (SRPIP) component of UWADEP.

Table 4.4: UWADEP: Chronology of events from 1993 to 2013

Month/Year	Event
1993	A six-member multi-disciplinary team of scientists employed participatory rural appraisal (PRA) and survey methods to diagnose problems and identify prospects of agricultural production in UWR. Key problem was household food insecurity due to erratic rainfall and declining soil fertility that result in low yields.
	Constraints in livestock production identified were 1) diseases, 2) theft, 3) lack of water and feed during dry season, and 4) low market participation.
March/April 1995	Project formulation by Food and Agricultural Organization (FAO) based on 1993 study.
May 1995	IFAD Appraisal Mission visited Ghana.
September 1995	IFAD Board approved loan for UWADEP.
1996	UWADEP implementation began. Strategic thrust: enhance food security and incomes of smallholder farmers. Five main components: i) agricultural development (crop and livestock); ii) water resources development; iii) rural roads; iv) smallholder credit; and v) community and women development.
	Small ruminant component targeted activities: i) quality of breeding stock, ii) nutrition of livestock all year round, iii) appropriate housing, iv) basic record keeping, and v) animal health care.
	Training of MoFA staff on explanation of UWADEP concept; group formation; suitable husbandry practices and improved breeds; health care for improved breeds; and field trips to traditional smallholder farmers.
1997-1999	Sensitising campaigns in communities; Selection of livestock farmer groups; Training of farmers on livestock husbandry practices.
1998 – 1999	Upgrading of local livestock programme: 242 Sahelian rams and 90 bucks were distributed to farmer groups.
1998 – 2000	<i>Cajanus cajan</i> and <i>Stylosanthes hamata</i> seeds supplied to farmer groups. Farmers established fodder banks and stored groundnut crop residue for supplementary feeding.
2000 – 2001	Upgrading programme suspended due to high mortality of Sahelian rams, bucks and their first progeny.
2001	UWADEP Monitoring Team found most farmers practising supplementary feeding with <i>Cajanus cajan</i> and groundnut haulms.
2002	Upgrading programme restarted with refocus on farmers with sufficient resources to afford recommended health measures and improved housing

	and supplementary feeding.
December 2004	UWADEP implementation ended.
June 2005	IFAD Interim Evaluation of UWADEP.
2010 - 2012	The present study found: no adoption of fodder bank in the two communities; 35% and 6% adoption of groundnut crop residue supplementary feeding at N. Tankyara and Orbili respectively.

Source: (IFAD, 1995, IFAD, 2006, Field interviews, UWADEP, 2000, ICRA and NAES, 1993)

From inspection of Table 4.4, we see that UWADEP was informed by a farming system study that showed that food insecurity is the number one problem of most smallholder households in UWR. Two strategies stood out in coping with food insecurity: 88% of households bought food from market as immediate strategy; and 66% of households mentioned that livestock was the major source of cash to buy food when they run short (ICRA and NAES, 1993). The goal of UWADEP was to enhance food security and incomes of households through a five inter-dependent components: i) agricultural development (crop and livestock); ii) water resources development; iii) rural roads; iv) smallholder credit; and v) community and women development. The livestock component of agriculture development targeted five activities: i) quality of breeding stock, ii) nutrition of livestock all year round, iii) appropriate housing, iv) basic record keeping, and v) animal health care. The present study examines the learning selection processes regarding UWADEP activities to improve nutrition all year round.

Creating awareness

Problem identification in two districts namely Nadowli and Wa in 1993 and community sensitization in all the five districts in UWR in 1997 were done in a largely participatory manner by scientists and agricultural extension agents respectively. For example, the methods employed in the problem diagnosis emphasized qualitative data such that quantitative data was gathered at the last phase after reaching fair understanding of the farming system. The methods comprised a reconnaissance survey, a group survey, farmers' workshops, stakeholders' workshops, a questionnaire survey, and a validation workshop. Subject areas covered under crop and animal production during the group survey included major production constraints and farmers' strategies to overcome the constraints; marketing, credit, changes and innovation, agricultural knowledge and information systems (AKIS). The output of the group survey formed the basis of farmers' workshops where farmers ranked constraints to show the importance of different constraints perceived. Also, a

stakeholder workshop was organized in Wa, the regional capital, where diverse stakeholders were brought together to further discuss the results of the field studies. The main constraints identified in livestock production were diseases, theft, lack of water and feed during dry season, and low market participation (ICRA and NAES, 1993). Thus, through the field study and workshops, a general awareness was created about problems in agricultural production in UWR.

At the commencement of UWADEP in 1997, a five-day training of agricultural extension agents (AEAs) was organized. The main topics covered were explanation of UWADEP concept, group formation, suitable husbandry practices and improved breeds and health care for improved breeds. As a follow up to the training, AEAs organized meetings in communities to sensitize farmers about UWADEP and how they could become participants and carry out project activities (UWADEP, 2000). For example, on supplementary feeding using crop residue, farmers recollected the meeting and the topic discussed. A Tankyara farmer's recollection was typical. Ubaldo remembered that *"some NGO [UWADEP] came and explained to us that if we gather groundnut haulms, store and use it to feed our animals, they will not go far."* Orbili farmers also were conversant with importance of supplementary feeding even though they did not adopt the practice indicating that the awareness was created by the AEA responsible for their community. At a focus group meeting they said that supplementary feeding induces the animals to move around the homestead and this helps to avoid stealing. Besides, it adds fertility to the land around the house and the farmer obtains more manure if the animals are housed.

Deciding to try out options

Though the awareness creation was participatory, decisions about what options to try out were mostly made by the project management based on constraints identified in 1993. The main activities that the project management (i.e. MoFA officials) targeted were: 1) quality of breeding stock; 2) nutrition all year round; 3) appropriate housing; 4) basic record keeping; and 5) animal health care (UWADEP, 2000). The implementation plan was to upgrade the local breeds (the West African Dwarf Sheep with a mature weight of 21-26 kg) through crosses with Sahelian ram (mature weight is 35-66 kg) (Kabuga and Akowuah, 1991) and buck imported from Burkina Faso. This was to be accompanied by better feeding and husbandry practices. Fodder tree seedlings would be distributed to nurseries for propagation and sale to livestock keepers (IFAD, 1995).

The Livestock Component Head and district directors agreed on four criteria for selection of livestock farmer groups: available suitable housing; prepared to cultivate *Cajanus cajan* and conserve other crop residues; a defined mode to care for the animals; and undertaking to follow all prescribed veterinary practices. (District Director, 14 - 05 - 1998). AEAs subsequently formed livestock smallholders groups in their operational areas including N. Tankyara and Orbili.

The farmer groups were supplied Sahelian breeding rams and bucks. For example, one ram was given to Stephen Pervaan in 1998 and another ram to Donald Pervaan in 1999 on behalf of their groups at N. Tankyara. The project management also supplied farmer groups with seeds of *Cajanus* and *Stylosanthes* for establishment of fodder bank. For instance, 100 Kg of *Cajanus* seeds was given to each district for distribution to small ruminant farmer groups that received 1997 and 1998 batches of breeding males (SRPIP Head, Memo, 9 - 06 - 1999). Again, *Cajanus* and *Stylosanthes* seeds of 110 Kg and 48Kg respectively were supplied to each district for establishment of fodder bank and range improvement by existing livestock farmer groups in 2000.

In connection with the focus of this study, the only decision left to the farmer groups related to whether they will cultivate or store crop residues or not. The response of the farmers was to try the options and draw conclusions about their benefits. This can be illustrated by the experience of Culbert (Chairman of the N. Tankyara livestock farmers group) and the first person to adopt use of groundnut haulms for feeding livestock at Tankyara. He said, "*I tried it to see if it was good. The benefits were that I use the manure from the house for farming and the cattle did not go far.*"

Adaptation, learning and selection

According to a monitoring report (MoFA-Lawra, 2001), most smallholders were found practicing supplementary feeding using *Cajanus* fodder (and groundnut haulms) for dry season feeding of animals during the SRPIP period. However, during this study, we did not encounter any farmer in the two study communities who cultivated *Cajanus* as fodder. Also, we observed that only one farmer at Orbili had maintained *Stylosanthes* fodder bank and integrated it with teak trees on one (1) acre plot behind the homestead where he and his neighbours tethered their animals during the dry season. Besides, it was observed that three (3) out of 51 households at Orbili and 23 out of 66 households at N. Tankyara use crop residue (groundnut haulms) for supplementary feeding. Table 4.5 shows details about crop residue adoption at N. Tankyara.

Household labour or other community members had to be organized for gathering and storing of groundnut haulms. The task needs more than one person to accomplish. Experiences of two farmers from N. Tankyara are illustrative. Ubaldo said that he started gathering groundnut haulms for storage and feeding it to livestock in 2001. Yearly, he raises a wooden platform and stores the haulms on it. It involves digging holes and putting in sticks which is very difficult to do after harvest (i.e. late October to November) because the dry season had already started and this makes the ground very hard. He assigns his children to collect the groundnut haulms from his own farm (more than two acres). He has to hasten to gather the haulms immediately after harvest otherwise somebody might gather and take them away (He had already gathered and stored the haulms when this interview was conducted on 13th November 2011). After gathering, the children will convey and dump them on the platform near the house. He starts to use the haulms to feed animals in March because there is no grass for animals to feed on at that time. Regobert, is the only farmer among those interviewed who uses a donkey cart to convey the haulms for storage. In 2011, Regobert and his two sons made two trips with the donkey.

Table 4.5: Adoption of groundnut haulms for supplementary feeding at Tankyara

Household (n)	Adoption from start of UWADEP to 2012 (%)	Adoption in 2012 (%)	Dis-adoption (%)	Adoption before start of UWADEP (%)	Adoption during UWADEP (1996 - 2004) (%)	Adoption after end of UWADEP (%)
66	53.0	34.8	18.2	3.0	21.2	28.8

Source: Field data, 2012

There was a clear pattern in the responses of both adopters and non-adopters. Five out of seven adopters said that their first reason for supplementary feeding practice is that ‘the animals do not go far.’ Four out of seven said manure accumulation is their second reason. Only one person mentioned weight gaining as a second reason for adoption. Also four out of six and two out of six of non-adopters at N. Tankyara attributed supplementary feeding to ‘animals do not go far’ and manure accumulation respectively.

The main reason for non-adoption of groundnut haulms related to labour constraint. At N. Tankyara, most of the households who do not use groundnut haulms said they cannot afford the requisite labour. These reasons were re-echoed by the Orbili smallholders who mostly dis-adopted the practice due to labour constraints and demands on their time to speed up crop harvesting (September – November) and commence dry season gardening.

In contrast to farmers, MoFA staff attributed difference between N. Tankyara and Orbili farmers to attitude, leadership and religion. The viewpoint of the Livestock Component Head (during UWADEP) is representative of most MoFA staff. He said that "in the Lawra area, it is difficult to adopt due to attitude of smallholders." His second reason was ineffective leadership at the community and district level. Similarly, Simon, (an AEA whose operational area included Tankyara from 1996 to 2004 but is now a District Development Officer of MoFA at Lawra office) attributed differences between N. Tankyara and Orbili in adoption of crop residue for supplementary feeding to attitude and religion. Simon emphasized that at Orbili "the smallholders' attitude is different. If you tell them [something at group meeting], they will say they will do but individually they don't. Vaccination, for example, is very difficult here at Orbili". Simon continued that traditional believes also contributes and it is not easy to adopt in the Lawra area. In contrast, at N. Tankyara in the Nandom area, they adopt technologies easily because of their religion (i.e. Catholic Church) and the presence of NANDIRDEP (NGO started by the church). NANDIRDEP often convey information on improved practices to smallholders through the church and/or the Tankyara cooperative and that belongingness helps adoption.

There were some feedbacks from farmers' practices that the project management ignored. For example, health monitoring in 1998 (memo dated 22-06-1998) showed that only 40% of the groups had constructed pens according to project specifications; some of the rest improved upon their existing pens by providing more ventilation and the others used their old pens for the supplied small ruminants because of theft. The old pens were located in the corner of the living quarters and did not conform to the project specification in terms of space and ventilation. The general health condition of all the animals except three were adjudged as very good. The conclusion was that AEAs should step up their supervisory role to minimize the health problems. Clearly the project specified prototype pen or housing was inadequate to prevent livestock theft. Theft was persistent but the project management did not do anything concrete about it. Their focus was on technical solutions.

Sustaining and/or promulgating selection

Direct observation of benefits of adoption of groundnut haulms contributed to a few more adoptions. For example, Paul Dang visited Ubaldo's house in late 2010 and noticed manure had piled up in the sheep pen. He inquired whether Ubaldo did not apply the manure on his field during the rainy season. Paul learned that Ubaldo used the manure that had accumulated before the rainy season for farming and that the piled up started afterwards to be used during the next cropping season. In the case of Paul, his animals were not housed previously. Hence, he started housing his animals and used the haulms to attract the animals around the house. Diaanata, on the other hand, was induced to treat maize stalks with common salt for supplementary feeding. According to Diaanata, *"I personally went to the house of Gervase and saw he had gathered the manure that he has been using on crop fields and getting more yield."*

4.4.1 Case study 2: Supplementary feeding practices under ARI-MoFA Project

Table 6 provides an overview of ARI-MoFA small ruminant project. Table 6 shows that ARI-MoFA project identified constraints and implemented activities similar to those in UWADEP.

Awareness creation

The awareness creation entailed participatory technology development (PTD) exercises led by a MoFA Team in three communities including Tankyara and Orbili. The main constraints identified at Orbili were theft, diseases, poor housing. Farmers suggested solutions to the constraints were 1) use of herbs for treatment of diarrhoea, 2) use of processed tobacco for treatment of wounds, and 3) use of common salt for treating conjunctivitis. The MoFA PTD Team, on the other hand, proposed 1) Peste Des Petits Ruminants (PPR) and clostridia vaccination between February and April; 2) supplementary feeding with groundnut haulms, leave of *cajanus*, *mucuna*, and *stylosanthes*; and 3) demonstration with the prototype housing using local materials. The MoFA PTD team also prepared a resource flow diagram with the farmers to examine the importance the community attaches to rearing of sheep and goats. The resource flow diagram showed linkages among the household, crop farm, livestock, markets, and types of household expenditure. However, the PTD Team did not employ the diagram that showed inter-dependencies among the elements to examine opportunities and how farmers could capitalise on them (MoFA, 2004).

Table 4.6: ARI-MoFA project: Chronology of events from 2004 – 2009

Month/Year	Event
2003	ARI scientists formulated project which was approved by Canadian International Development Agency (CIDA). ARI liaised with MoFA to implement project in Lawra District.
June 2004	MoFA team conducted participatory technology development (PTD) problem identification in three communities in Lawra District. 11 farmer groups were formed with 132 male and 19 female members. Key problems identified (at Orbili): livestock theft, diseases, and poor housing.
August – September 2005	Activities carried out by farmer groups: i) establishment of <i>Cajanus cajan</i> fodder banks; ii) improved housing (i.e. demonstrate prototype house); iii) vaccination and deworming; iv) monitoring and group meetings.
2006 - 2007	Funding of project activities was put on hold.
2008	Review meeting in Tamale.
November 2008	Activities carried out by farmer groups same as in 2005. In addition, farmer groups urged to open group bank account. By 2008, 21 farmers had received 2 bags of cement each to floor and plaster their flock house.
January 2009	Monitoring of activities: 10 groups in 3 communities; 7 groups opened bank account but 3 did not. Tankyara farmer group members did vaccinate their flock on time; but Orbili and the third community delayed in vaccination (they were reluctant to pay for veterinary services) and recorded high mortalities.
2010 - 2012	The present study found no adoption of fodder bank in the two communities; 16.4% of Tankyara farmers constructed detached prototype house; Orbili livestock farmers sustained their group after end of project.

Source: (Ojingo, 2008, MoFA, 2004, MoFA, 2005, MoFA, 2009, Field interviews)

Deciding to try out options

The options that were tried out mirrored the proposed solutions by the MoFA PTD Team. The activities were: 1) fodder bank with *Cajanus*; 2) improved housing (prototype structure of small ruminant housing); 3) PPR vaccination; and 4) monitoring and group meetings.

Adaptation, learning and selection

Table 4.7 shows the patterns in the *Cajanus* trials after 10 livestock farmer groups (i.e. including three groups from third community not included in this study) were supplied with 80 Kilograms of *Cajanus* seeds and 15 Kilograms of stylosanthes seeds. The stylosanthes seeds failed to germinate because the farmers reported that they did not know how to plant them. The farmers complained that they received the *Cajanus* seeds late and therefore the yield was low. From Table 7, more than half of the farmers (58.9%) did not plant the *Cajanus* seeds supplied to them. Four out of five farmers who planted the seeds at Orbili did not harvest with the explanation that their animals did not find the fodder palatable. However, all farmers who planted the seeds at Tankyara harvested and used the fodder for supplementary feeding.

Table 4.7: *Cajanus cajan* fodder bank establishment in two communities in 2008*

Community	Groups (n)	Membership (n)	Members who planted fodder (n)	Members who harvested fodder as percentage of members who planted fodder (%)	Members who did not plant fodder as percentage of total members in group (%)
N.Tankyara	5	52	17	100	67.3
Orbili**	2	16	11	9.1	54.5

*Source: Adapted from MoFA (2009)

**Orbili started with 3 groups but 1 group was dissolved because the leader was a laggard (according to Simon, MoFA staff, name has been changed).

Besides, the fodder bank trials, the farmers were encouraged to open group bank accounts. Report showed that each of the five groups at Tankyara opened an account; one of the two Orbili groups opened an account. Also, 16.4% of households at N. Tankyara constructed the detached prototype pen. At Orbili, one farmer constructed the prototype pen and two other farmers adapted existing structures in the main living quarters as pen for their animals. The groups at Orbili complained bitterly about high mortality due to late vaccination. According to Simon (extension supervisor), most Oribili farmers did not understand the importance of preventive veterinary services

and are reluctant to pay for it. In contrast, the N. Tankyara group did not complain; they vaccinated their animals on time.

Sustaining and/or promulgating selections

During this study (April 2010 to December 2012), no farmer was encountered who cultivated the *Cajanus*. Two farmers (Pervaan and Cletus) explained that they start the main farming season land preparation in May and sow their food crops first before they had time to attend to the cultivation of *Cajanus*. Thus *Cajanus* was planted late and it did not bear seeds. However, Cletus' son pointed out that the farmers did not want to use food crop field to cultivate fodder for livestock.

It was observed that the N. Tankyara livestock farmer groups had become inactive i.e. they no longer meet as group. The farmers explained that the community already had a functional cooperative and so there was no need for an additional livestock farmer group. However, those who adopted the prototype livestock pen have maintained the structure. They observed that it helps to keep mosquitoes and flies that pester the livestock out of the living quarters. On the other hand, Orbili livestock farmers had sustained the group. For example, for two years, 2011 and 2012 farming season, the farmers organized and deposited money in their group account. Then, they used group savings as a basis to negotiate for tractor services which was difficult to obtain on individual basis.

4.5 Analysis

4.5.1 Transfer-of-technology model of innovation and fodder interventions

Problem identification in both UWADEP and ARI-MoFA were largely participatory. The constraints identified had both technical and institutional dimensions, however, the activities selected for trial focused on technical solutions which reflected on the interventionists' cognitive view of transfer-of-technology model of innovation. The priority constraints farmers experienced and ranked namely diseases, theft, lack of water and feed during dry season, low market participation were fairly consistent with other studies in the area (Amankwah et al., 2012, Animal Research Institute, 1999). In response to the constraints, the objectives of the livestock component of UWADEP were to improve 1) local breed of small ruminants through crosses with Sahelian rams and bucks; 2) nutrition all year round; 3) housing based on a prototype built at a

holding facility; 4) basic record keeping; and 5) animal health care. Similarly, in the ARI-MoFA ruminants project, the activities that were tried out mirrored the solutions implemented during UWADEP and as well those proposed by the participatory technology development (PTD) team during the problem analysis phase i.e. 1) fodder bank with *Cajanus*; 2) improved housing (demonstrate prototype structure of small ruminant housing); 3) PPR vaccination; and 4) monitoring and group meetings. These prescribed solutions appeared to be based, not on on-farm research findings, but on on-station research outputs that were channelled through the classical linear model through agricultural extension agents to smallholder farmers.

Most of the published studies at the time appeared on-station based. For example, on-station studies by ARI scientists have concluded that under northern savannah conditions, a farmer planting *Cajanus* at a spacing of 0.75 m by 0.4 m on a 0.4 ha plot would get first year harvest enough dry matter (DM) to supplement 20 Djallonke sheep at 0.2 kg/head/day for five months in the dry season (Karbo et al., 1998). Also, a hectare of land of *Cajanus* short fallow could supplement the feeding of 56 sheep over a period of one year at the rate of 300 g head⁻¹ day⁻¹. (Agyare et al., 2002). Our findings show that these on-station results hardly translate into useful outcomes for smallholder farmers due to dynamics in the social and institutional contexts.

Our finding reflect on work by scientists at International Livestock Research institute and (ILRI) and International Institute of Tropical Agriculture (IITA) that show that the bulk of the early research across West Africa was on-station and focused on forage as introduced pastures. They conceded that the fodder bank concept was quite “stringent “recipe” for farmers to manage and use the legume “bank” for strategic ruminant supplementation in the dry season” (Tarawali et al., 2005, p. 211). Thus, the non-adoption of *Cajanus* and stylosanthes in the study communities interrogated scientific knowledge on the state-of-practice of supplementary feeding and highlighted the need for addressing combined technical and institutional problems simultaneously (Tarawali et al., 2005).

4.5.2 Understanding the trade-off between production of food crop and fodder for livestock

Adoption of groundnut haulms for supplementary feeding resulted from two inter-related factors: it was perceived as a solution to the problems of livestock theft and low soil fertility; and it was compatible with the crop production system and labour

requirement. The non-adopting were attributed largely to household labour constraint during harvesting of food crops and/or preparation of dry season vegetable production (which is a principal commercial enterprise). However, the cultivation of fodder ceased immediately after the end of the project largely because farmers did not find it useful to use food crop fields to grow livestock feed. Even at N. Tankyara where over 50% have ever practiced supplementary feeding with groundnut haulms and are conversant with its importance did not adopt fodder cultivation. Apparently, the trade-off between foregoing food crop cultivation on a piece of land in order to cultivate fodder was not acceptable to farmers. How farmers do these calculations is little understood by agricultural extension agents. This is evidenced in the explanation by MoFA staff that the difference between N. Tankyara and Orbili regarding adoption of supplementary feeding with crop residue arises from differences in attitude, leadership and religion. They meant that the former are Christians and some have received formal education while the latter are Traditionalists and mostly illiterates.

In contrast to the explanation by MoFA staff, our findings show that the farmers' objective of ensuring household food security in the context of limited arable land, labour intensive crop production system, the threat of erratic rainfall and livestock theft, and unavailable veterinary services, among others are apparently the driving forces behind non-adoption of fodder bank in Upper West Region for now. It is noteworthy that the ICRA and NAES (1993) study that informed UWADEP emphasized that any technology that takes labour away from farmers primary objective of producing food for the household will not work. Millar and Connell (2010) have also noted that fodder intervention is likely to be adopted if it can provide tangible benefits for smallholder farmers in the shortest possible time.

4.5.3 Selection of useful outcomes by farmers and implications for interventions

Our findings show differential selection of elements in an innovation process between the two communities. This difference can be attributed to the extent of usefulness of the outcomes of the interventions in the communities. N. Tankyara farmers found the groundnut haulm technology very useful. Consequently, more than half of the population have used the technology from the time it was introduced under UWADEP in 1997 to 2012 and 35% were still using it as at 2012. However, the livestock farmer groups that were formed under UWADEP and ARI-MoFA interventions were not sustained because already they had functional cooperative which more than half the population of the community belongs to. Orbili farmers could not spare labour to

organize supplementary feeding because of engagement with dry season vegetable production which is a market-driven production (ICRA and NAES, 1993). However, they found the group organization useful and already have employed it to access tractor services for bulk ploughing.

The selection of the relevant technology by the farmers is consistent with the literature on learning selection and actor-oriented perspective of agrarian development (Douthwaite et al., 2002a, Douthwaite et al., 2009). For example, Douthwaite et al (2002a) reported that farmers in Benin adopted mucuna but rejected alley cropping technology. Our finding about the selection of social organization i.e. the livestock farmer group was not expected. This is an important contribution in that it is not only technology or hardware that is selected but also organizational arrangement or the 'orgware' element innovation could also be selected. The finding also reflects on studies that show that prescribed solutions contribute substantially to unbeneficial results in several interventions including conservation agriculture and commercialization of smallholder agriculture (Douthwaite et al., 2001, Kilelu et al., 2013, Koutsouris, 2008).

4.6 Conclusion

By way reflection, the elements in the learning selection model are useful in several ways (Douthwaite et al., 2009). As a process model, it helps to identify specific points that are not functioning as expected and therefore needs attention. For example, the findings showed that the *decisions to try out phase* in the projects were done by MoFA staff in a top-down manner. Also, the model was clearly helpful in separating useful outcomes from unbeneficial results. Thus, it interrogates interventionists to think through problem identification and seek to address issues that target group cares about. A related point is that the model calls on interventionists to adopt co-learning stance and be ready to adapt objectives and activities based on feedback.

A drawback of the learning selection model relates to the way innovation is visualized. Innovation is generally understood as a process of co-development of technology and related institutional factors (Klerkx et al., 2012). Even though the model include motivating and constraining contexts, it does not portray how institutional factors change in relation to technology (i.e. artefact and strategy). Our study showed that the wider social and institutional factors such as theft is linked with change in technology

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i.e. adoption of supplementary feeding. Hence, there is the need for awareness of how technology and institutional changes occur simultaneously.

CHAPTER 5

DEVELOPMENT OF LIVESTOCK KEEPING AMONG POSITIVE DEVIANT HOUSEHOLDS IN NORTHERN GHANA

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Submitted to *Animal: An International Journal of Animal Bioscience*

Abstract

This study examined how smallholder households characterised as positive deviants could be more effective in flock or herd growth and market participation than their non-positive deviant peers with access to similar resources in Northern Ghana. Multiple methods including a quantitative survey, in-depth interviews and direct field observations were employed in three communities in Lawra and Nadowli Districts to collect data. A total of nine out of 295 livestock keeping households were perceived by their community members as positive deviants. The results show that five of the positive deviants had herd sizes (i.e. sheep, goats and cattle) exceeding the population mean plus two times standard deviations. The flock growth recorded by the positive deviants was induced by critical experiences of cattle theft and/or interaction with colleagues and development organizations, which led to a steady shift from minimal to increased investment of resources in livestock rearing. In pursuit of flock growth, the positive deviants moved to settle on new previously unused land and also relied on non-livestock enterprises such as crop farming (when soils were fertile) or off-farm trading for consumption needs. The extensification and specialization on livestock included organized herding, regular use of preventive and curative animal health care, organized household or community efforts to prevent livestock theft, and selling animals during high-value market seasons. In the light of the current debate on stimulating entrepreneurship and commercialization of smallholders, an important finding is that positive deviants were not driven by profit maximization but by accumulation of livestock assets for multiple purposes including food security, walking banking, retirement and prestige. This indicates that interventions promoting 'farming as business' need to take into account how smallholders align production and profit goals with household objectives, resources and farm viability.

Keywords: Herd growth, Food security, Smallholder farmers, Institutions, Commercialization

5.1 Introduction

Smallholder market participation has been advocated as crucial to economic growth and poverty reduction in most developing countries since the 1980s. To date, however, the majority of dry land sub-Saharan African smallholders are not market-oriented, especially with regard to their livestock activities (Swanson, 2006, Barrett, 2008). Only a few smallholders are able to take advantage of the significant local demand for livestock products (Udo et al., 2011, Amankwah et al., 2012).

Recent studies that examined market participation of smallholder livestock keepers have pursued three main lines of enquiry. A first line is how innovation platforms (IPs) comprising relevant stakeholders can be employed to relax the institutional constraints to enhance market integration of smallholders (Hall et al., 2007, van Rooyen and Homann-Kee Tui, 2009). A second is how governance of supply or value chains can be strengthened for the benefit of the smallholder group of actors (Kocho et al., 2011, Kyeyamwa et al., 2008). The point of departure for both IPs and value chain interventions is constraints analysis. Such interventions often connect with and benefit a minority of farmers, and there is the risk of overlooking the majority (Vorley et al., 2012). A third line is the positive deviant (PD) approach that is part of the solution-focused tradition that emphasizes identifying successful existing practices as basis for interventions to achieve a desired state. (Ochieng, 2007, Biggs, 2008).

Positive deviance refers to intentional behaviour that departs from a reference group in honourable ways and that generates innovative solutions which may be embraced by the reference group (Ochieng, 2007). The PD approach is perceived as a tool to development interventions on the basis of endogenous design (Mirk, 2012). Van der Ploeg and Long (1994) argued that interest in endogenous design is a response to shortcomings in the model of modernization, which created ignorance about patterns in endogenous development, and resulted in growth in certain times and places but underdevelopment in other areas. The PD approach has been employed to contribute to fill the gap in knowledge about endogenous development in fields such as health and nutrition, business management and rural development (Marsh and Schroeder, 2002, Saco, 2005, Biggs, 2008).

So far, few studies have examined the prospects of PDs in agricultural and rural development (Biggs, 2008, Ochieng, 2007, Pant and Odame, 2009) and there is little knowledge about how PDs manage and grow their enterprises in the context of

institutional constraints. This study, therefore, has the aim to examine how PD smallholder livestock households manage and grow their enterprise in Northern Ghana despite numerous institutional constraints.

5.1 Methods

5.2.1 Research design and identification of positive deviants

Multiple methods of qualitative and quantitative design (Neuman, 2000) were employed to examine herd growth by smallholders in the crop-livestock farming system in Upper West Region of Ghana. The region is located in the north-western corner of Ghana stretching from Longitude 9° 35' N to 11° N and Latitude 1° 25' to 2° 50' E. The region and two districts within (Lawra and Nadowli) were selected as the study area in a bigger programme to study livestock and food security (Amankwah et al., 2012). Within the districts, purposive sampling (Patton, 2002) was employed to select communities noted for livestock production: Tangasie and Tabiasi in Nadowli District and Orbili in Lawra District. At meetings with farmer groups (formed as part of interventions that preceded this study (Amankwah et al., 2012)), participants mentioned households in their community who had exhibited successful strategies in dealing with constraints that bother the majority of community members and who are well-known for relatively high market offtake of livestock. Nine households out of a total of 299 households that keep livestock were identified as PDs in the three communities: two households possess over 300 cattle each; one person kept local poultry; and the rest rear small ruminants (sheep and goats).

5.2.2 Data collection and analysis

A quantitative survey was employed in two stages. A household survey was conducted in January 2011 to list all households and the kind and number of livestock they possessed at the end of 2010. The households with livestock (i.e. households without livestock were excluded) were interviewed in January 2012 to characterise their farming systems at the end of 2011. In-depth interviews in local language (through an interpreter) were conducted with the PDs to enquire about how they developed their livestock and coped with technical and institutional constraints. From April 2010 to December 2012, the lead researcher visited each PD at least once in every three months to observe their actions with the livestock. In-depth interviews were conducted

with opinion leaders, elders, those aspiring to be PDs as well as staff of MoFA (identified through snowball sampling) on their viewpoints on how the PDs achieved herd growth.

Qualitative data (from field notes and transcripts) were analysed using Atlas.ti version 5. The data was coded using the questions ‘what is the actor doing or saying in this data segment’, ‘what salient factors affect the actor’s actions and what are the consequences.’ Guided by these analytical questions, concepts were identified and short notes or memos written for each concept. Patterns in terms of recurrent and concurrent concepts were identified and narrative summaries using the memos were composed (Charmaz, 2012). The quantitative survey data were summarised using descriptive statistics. PDs with household characteristics (e.g. herd size, farm size) exceeding the population mean plus two times the standard deviations were identified. We refer to them as “statistical PDs.” To examine patterns in market offtake, flock size at end of 2010 was plotted against offtake during 2011. Then, based on Bosman (1995) we postulated that market offtake of 20% - 50% is sustainable in terms of ability of household to maintain constant flock size under field conditions.

5.2.3 *Community characteristics*

Community characteristics with regard to population and livestock keeping are described in Table 5.1. From Table 5.1, few households at Orbili and Tangasie possess cattle largely due to theft; Tabiasi has deployed measures that have helped to minimise theft. All the three communities belong to the same tribe, Dagaaba. The majority of the households at Orbili, Tangasie and Tabiasi are Traditionalist, Christian and Moslem respectively. Of the household heads 82% are illiterates. Most compounds (i.e. residences) consist of one household with a husband, wife and young children. Few compounds are composed of two or more households; each household in a compound has its own yard. The various household heads in a compound are members of an extended family. Often, the eldest household head is the head or landlord of the compound. Source of labour are household members and organized groups of community members.

The ecological zone is mainly Guinea Savannah characterised by low vegetative growth of grasses, shrubs and sparsely distributed trees. Rainfall is unimodal and occurs from May to October with a dry season the rest of the year. The dominant farming system of the study area is crop-livestock mixed farming. The crops are

cereals (millet, sorghum, maize and rice) and legumes (groundnut and cowpea). The main types of livestock kept are goats and sheep, cattle, pigs, chickens and guinea fowls. Communal grazing land is the principal resource for livestock feeding.

Table 5.1: Population, households, and percentage of households keeping livestock in three communities

Community	Population* (n)	Household (n)	Percentage of households keeping livestock (%)					
			Cattle	Sheep	Goats	Pigs	Chicken	Guinea fowls
Orbili	302	52	15.4	55.8	94.2	57.7	96.2	9.6
Tangasie	1186	131	6.1	24.4	71.0	97.0	81.7	24.4
Tabiasi	2773	171	70.8	47.4	77.2	11.7	77.8	28.7

*Ghana Statistical Service, 2010 population approximation.

Source: Field survey, 2011 and 2012

5.3 Results

5.3.1 Farming system characteristics of households

Tables 5.2a to 5.2c sum up the farming system characteristics of households in the three study communities. Table 5.2a show that only one household is statistical PD in household size. Table 5.2b and 5.2c show some non-positive deviants (NPDs) also exceeded two standard deviations above the means but they were not perceived by their community as PDs. The tables reveal that five out of nine individuals who were perceived by their community members as positive deviants exceeded the average flock sizes of sheep, goats and cattle by two standard deviations i.e. statistical PDs in herd size are five. Similarly, statistical PDs in farm size are two.

Table 5.2a: Household composition of three communities

Household composition	Households (n)	Mean (n)	Standard deviation (n)	Statistical PDs* (n)	Perceived PDs among statistical PDs (n, name)
Orbili					
Under 5 years		2.1	1.93		
5 to 15 years		3.2	2.02		
16 to 60 years		2.1	2.38		
Over 60 years		0.4	1.15		
Total	51	7.8	5.38	0	0
Tangasie					
Under 5 years		2.8	2.55		
5 to 15 years		3.5	2.40		
16 to 60 years		4.5	4.46		
Over 60 years		0.7	1.06		
Total	98	11.4	7.9	1	1(Banda)
Tabiasi					
Under 5 years		1.5	1.64		
5 to 15 years		3.1	1.82		
16 to 60 years		3.7	1.79		
Over 60 years		1.5	1.37		
Total	146	9.8	4.47	0	0

*Households exceeding mean plus two times the standard deviation.

Source: Field survey, 2012

Table 5.2b: Average farm size (acre) of households in three communities

Farm size (acre)	Households (n)	Mean (n)	Standard deviation (n)	Statistical PDs (n)	Perceived PDs among statistical PDs (n, name)
Orbili					
Grain crops	51	5.9	2.79	2	1 (Menem)
Leguminous crops	51	3.2	1.18	2	0
Tangasie					
Grain crops*	97	5.7	4.16	5	1(Banda)
Leguminous crops**	93	4.9	3.72	3	0
Tabiasi					
Grain crops	144	10.7	5.12	2	0
Leguminous crops	63	2.5	1.19	2	0

*Millet, sorghum, maize and rice

**groundnut and cowpea

Source: Field survey, 2012

Table 5.2c: Herd size of household in three communities

	Households (n)	Mean (n)	Standard deviation (n)	Statistical PDs (n)	Perceived PDs among statistical PDs (n, name)
Orbili					
<i>Cattle</i>					
Female		3.4	4.14		
Male		9.5	11.39		
Total	8	12.9	14.93	0	0
<i>Sheep</i>					2 (Menem, Goru)
Male		3.0	2.58		
Female		14.2	19.57		
Total	29	17.2	21.48	2	
<i>Goats</i>					
Male		3.3	2.50		
Female		8.5	4.75		
Total	49	11.8	6.44	2	0
Tangasie					
<i>Cattle</i>					
Female		30.0	63.12		
Male		10.3	18.89		
Total	12	40.3	82.12	1	1(Banda)
<i>Sheep</i>					
Male		8.8	9.48		
Female		2.7	2.26		
Total	26	11.5	11.34	1	1(Banda)
<i>Goats</i>					
Male		9.2	7.81		
Female		4.4	3.79		
Total	81	13.6	10.86	10	1(Banda)
Tabiasi					
<i>Cattle</i>					
Female		12.7	30.45		
Male		3.9	7.57		
Total	115	16.5	37.53	2	1(Musa)
<i>Sheep*</i>					
Total	81	6.6	8.43	2	1(Konor)
<i>Goats*</i>					
Total	133	8.7	9.80	5	1(Konor)

*Sex ratio not available.

Source: Field survey, 2012

Table 5.3 shows data on personal characteristics, farm size and herd size of the PDs in 2012 during a household survey. The presentation devotes more attention to the five statistical PDs because their experience shed more insight on processes of herd growth

than the other four PD with lower flock/herd size. Also, the PD in poultry, even though interesting, does not receive attention due to our focus on ruminant households. All the five statistical PDs claimed ownership of the livestock in their household. However, some of the sheep (i.e. about 20%) in Menem's kraal belong to neighbours.

Table 5.3: Characteristic of positive deviants

Village	Name of PD*	Age (years)	Main source of livelihood	Acreage grain crops (acres)	Acreage leguminous crops (acres)	Livestock (n/hh)		
						Cattle	Sheep	Goats
Orbili	Menem**	70	Farming	13.5	3	0	86	12
	Goru**	75	Farming	7	4	0	79	14
	Bator	69	Farming	8	3	40	40	21
Tangasi	Loba	51	Farming	8.5	3	25	7	10
	Biney***	45	Farming	6	3	0	0	7
	Seidu	46	Trading	7.5	3.5	0	13	22
	Banda**	86	Trading and butchering	19	7	308	60	60
Tabiasi	Musa**	76	Agricultural extension agent	10	0	376	26	29
	Konor**	64	Teacher in agriculture	4	4	5	35	80

*Names have been changed

**Statistical PDs with regard to herd size

***Positive deviant for poultry (rears 53 chicken and 90 guinea fowls)

5.3.2 Start-up of positive deviant livestock enterprise

Two key aspects of start-up experiences were common for both PDs and NPDs. First, most male children and teenagers up to about 15 years undergo training in rearing by caring for the livestock in the family. Caring for livestock involves rainy season management (tethering rotation, watering and herding care) and looking for the animals every evening to bring them to the house during the dry season. When there was herd growth, some are sold and the income is used to buy the next valuable animal (i.e. from chicken to goat and sheep in that order) and the child is often given an animal as share of the benefits. When male children transit into youth and adulthood,

they stop shepherding and spend most of their time in crop farming. Then, when males grow older and can no more engage in active crop farming, they return to shepherding of the household livestock.

All the PDs indicated that they experienced rearing during childhood. In transiting into adulthood, the PDs pursued three tracks of primary livelihood activities: five pursued farming; two engaged in trading in livestock and/or butchering; and two worked as elementary school agriculture teacher and agricultural extension agent (AEA) (after attending post-elementary and post-secondary education in agriculture), respectively. The farmers and traders were illiterates.

The second important start-up experience is that most males start their own livestock rearing to support crop farming in their farm system. This need for insurance as a young person transits into adulthood is typified by Goru's viewpoint. Goru said that "*in our tradition, if you grow to some age, there is the need for you to buy an animal to protect yourself*" (Orbili, 28-12-2012). Goru sold groundnut from his farm to buy his first female goat to rear. Similarly, the four other PD farmers and one of the traders started rearing goats that they purchased with income from sale of groundnut. Banda started with a sheep obtained from the traditional training of children in rearing. The agricultural teacher started with two fowls (received as gift from a Fulani herdsman). The poultry expanded and he was able to sell some to buy his first goat. Generally, keeping livestock for capital stock and insurance as a principal goal is characterised by low input husbandry practices including free-ranging, absence of preventive veterinary service, lack of supplementary feeding, accepting mortality, and keeping livestock not for profit (Amankwah et al., 2012, Animal Research Institute, 1999). There was only one exception to the common start-up of livestock rearing with few small ruminants: One PD household (Musa) started livestock rearing with 75 cattle inherited from his late father.

This section shows that most PDs (and NPDs) have common start-up experience in small ruminant rearing and aimed at using it to support their primary livelihood activity namely crop farming. The next section details the conditions that induced the PDs to embark on herd growth.

5.3.3 Factors influencing the decision-making pathways of PDs for herd growth outcomes

Four patterns can be identified in the conditions that induced herd growth by the PDs: critical experience of livestock theft; exposure to off-farm trading in livestock; interaction with development organizations and/or formal education; and reliance on crop production and trading activities for consumption need. First, critical or non-routine events prompted three of the PD farmers to re-examine their goal of keeping livestock. This is illustrated by the case of Menem. Menem said he was induced to embark on flock expansion after his 16 cattle were stolen. Menem explained that "*I wanted the sheep to become many to replace the cattle*" (Orbili, 15-03-2012). In order to realize his aim to expand flock size, Menem started changing his husbandry practices namely housing, watering, and herding. He assigned his son to herd the sheep for nine years (and the flock expanded from 10 to 40) before he took over herding to allow the son to attend school. When Menem's flock started expanding, it created a conflict with his elder brother. Consequently, Menem separated from the extended family compound to settle on a parcel of land about 300 metres away (i.e. to the north of the village). He was the first to settle at that part of the village. It was surrounded by large grazing ground. (Since Menem's resettlement, 12 more households have settled there).

Similar to Menem's experience, Goru lost about 60 cattle through theft and subsequently made changes in sheep husbandry practices and resettled. In addition, Goru said that he sacrificed a male sheep to ancestral spirits (i.e. deceased father and grandfathers) and requested them to protect and guide the pathway of flock expansion.

The second pattern of herd growth was induced by exposure to livestock trading and/or butchering activities. This pattern reflects on the experience of Banda, the substantive Chief Butcher at Tangasie. According to Banda's son, his father started trading in fowls. He used to buy chicken and guinea fowls from Tangasie and travel to Yamfo in Brong Ahafo (Southern Ghana) to sell. He also started living and butchering at Yamfo. When he came back to settle at Tangasie, he continued with butchering. Other butchers were rearing cattle and that made him interested so that when he buys a cow and perceives that he can profit more from raising it, he does not slaughter but rears it. Thus, Banda started with two cattle about 40 years ago. When Banda embarked on rearing cattle, he moved out of the extended family compound and resettled at the outskirts of the town. He has three wives and a household size of 44. A butcher told the researchers that he is learning from the example of Banda and has resettled at the outskirts of town in order to enhance the expansion of his herd size.

Banda himself said that he has been following the advice of veterinary staff (MoFA) to expand his herd size and enjoy the benefit. He declared that *“I am interested in rearing because problems can emerge anytime and because I am not a salary earner and entitled to retirement benefits, I use the income from livestock to solve problems particularly health issues and education”* (Tangasie, 26-12-2012). Banda is not an exception as a trader/butcher who accumulates livestock assets. Butchers we (i.e. researchers) interviewed at Kumasi (second largest city in Ghana) Abattoir market indicated that the well-established butchers routinely accumulate livestock assets.

The third means to herd growth was induced by interaction with development organizations and/or formal education. This can be illustrated by the case of Konor. He attended post-elementary agricultural school (Farming Institute) and taught as elementary school agricultural teacher for a while. In 1998, Konor was nominated by Tabiasi community to undergo training for community animal health worker (CAHW) as part of reforms to increase private sector participation in veterinary services delivery. After the training, Konor was given Sahelian breeding buck and a ram (imported from Burkina Faso) through a small ruminant improvement project (i.e. Upper West Agricultural Development Project (UWADEP)). Konor used the breeding stock to cross his own animals (i.e. West African Dwarf sheep and goats). When the flock started expanding, Konor moved out of the extended family compound to settle at his own place about 500 metres away. Konor said that in their culture, it was not allowed for a relative to separate himself. So, he provided an animal and drinks to the compound head to pacify the gods before he was granted permission to move to his own place. According to Konor, his herd growth begun in the year 2000 as a result of the resources UWADEP provided i.e. the CAHW training and breeding stock.

Similarly, Musa relied on his education and family resources. He completed a three-year agricultural college. He (and his younger brother, Asuma) inherited 75 cattle from their father. When Musa completed agricultural college, he tried to establish crops farm to complement cattle rearing under the care of Asuma. Musa said that *“when I started, I realized that livestock business was better than tilling the land. So, I and my brother decided to focus on livestock”* (Wa, 3-01-2013). Like the other PDs, Musa moved and occupied a bigger piece of land with the herd.

A fourth condition that enabled positive deviants to pursue herd growth was reliance on non-livestock livelihood enterprise to meet immediate consumption needs in households. For example, both Konor (Tabiasi) and Banda (Tangasie) were emphatic that they never sold livestock to purchase food for their households. Konor explained

that during the time that he was trying to expand his herd size (i.e. goats), he was engaged in crop farming to obtain food for household as well as income when needed. He emphasized that *"if livestock is your only livelihood, you can't expand. You will even be compelled to sell your breeding stock"* (Tabiasi, 28-05-2012). At Orbili, Menem also said that he used to farm vast acreages of millet and groundnut and his household depended on his farm produce during the years of herd growth. However, in recent years (including 2011), he sold sheep to buy food because he could not farm as he used to. Similarly, Goru purchased food with income from sale of sheep which he refers to as benefit from his retirement (from active farming).

This section shows that ruminant herd growth resulted from interaction of social and personal factors. The diverse social settings such as livestock theft, butchering activities and interaction with public veterinary staff, or formal education and access to resources induced the PDs to devote more attention and resources than NPDs to livestock rearing. The PDs also showed determination to pursue herd growth when they strategically pacified the ancestral spirits and resettled in order to have access to larger area for livestock production. In the next section, we examine how the PDs responded to emergent constraints during herd growth.

5.3.4 Responses to technical and institutional constraints

This section outlines key constraints from the PDs perspective and how they responded to them. After embarking on herd expansion, it took many years before the illiterate PDs in particular learned to employ routine preventive veterinary services. This is typified by Goru's experience. Goru recalled that when he started giving attention to his herd, there was a particular year a lot of his sheep died. (The District Veterinary Officer remembered that once Goru lost over 20 sheep due to outbreak of Peste Des Petits Ruminants (PPR)). Goru invited the public veterinary officer who came to attend to the animals and those belonging to his friend, Menem. According to Goru, *"it is from the veterinary people that I learnt that if you continue to treat [vaccinate] your animals, the flock size will increase. From there, I have never stopped treating animals annually. Now, if I realize two or three ill-health animals, I invite the veterinary officer to come and treat them"* (Orbili, 22-11-2012). Goru's pathway to flock growth is a common knowledge in the community. For example, one young man said that he wants to emulate Goru's example. He explained that when he hears that Goru has invited the veterinary officer, he will ask for his animals to be treated [vaccinated].

Besides, high mortality, livestock theft was a serious threat to herd growth. For example, Banda said his herd used to be on free range but because of theft he assigned some of his children to herd the cattle. More than four key informants also revealed that all the seven adult males in Banda household have guns. When they herd the animals in the bush, the older herdsman carry guns. It is alleged that they do not 'spare thieves' who are caught stealing their cattle. Banda also has more than 10 dogs that scare prospective thieves away. The key informants believed that Banda also employs spiritual powers to protect his cattle. For instance, the key informants said that in 2012, a Fulani stole five cattle from the Banda family but later the thief returned to confess his sins and release the animals. Besides theft, Banda annually pays for preventive and curative veterinary services.

Another constraint that surfaced especially in small ruminant husbandry is feeding. According to Konor, the main difficulty he encountered was supplementary feeding. He used to collect and store groundnut vines. Starting from March to May, the animals fed on the stored feed. He conceded that he is unable to provide sufficient supplementary feed now because the flock had become too big.

In cattle rearing, Musa observed that regular treatment of the herd is the first key to successful expansion. He deworms every three months during the rainy season and treats for other diseases every six to eight months. According to Musa, the second important practice is taking good care of Fulani herdsman (i.e. health care, good accommodation, and cultivating food crops for them). Thirdly, he ensures adequate feeding during the dry season by sending part of the cattle to different communities where cattle population is lower than at Tabiasi. In addition to the strategies Musa enumerated, an extended family member and key informant strongly believed that Musa also employs spiritual powers to protect the herd.

Livestock theft was dealt with through self-organization at Tabiasi, the community where most households possess cattle. The community established an informal rule backed with sanctions in the early 1970s to minimize livestock theft. A local person who is arrested for livestock theft pays a fine of one cow, two sheep, two goats and 14 fowls in addition to an amount that the elders will specify. The fine is used to pacify the gods and ancestors. The extended families of Konor and of the village chief had to pay the stipulated fine when young men in their respective families were caught stealing sheep. The community also uses watchdogs in response to persistent livestock theft. For example, in the second half of 2012, a three-member team started stealing

cattle from Tabiasi. Within a week, four kraals lost 24 cattle. In response, the community organized a watchdog team that patrolled various kraals in the night and arrested the thieves in a couple of weeks and handed them over to the police. The self-organization has likely contributed to the rearing of cattle by over 70% of households at Tabiasi.

The most common constraint that none of the PDs resolved adequately is lack of water during the dry season (i.e. November to April). This section shows that the PD shifted to devote substantial attention and resources to livestock rearing, though they maintained crop production. The next section examines the benefits of livestock rearing to PDs in terms of market offtake.

5.3.5 Market offtake by positive deviants

Figures 5.1 and 5.2 show the market offtake of small ruminants for two communities, Orbili and Tangasie (data is not available for third community). The areas between the dashed lines indicate observations (i.e. households) with market offtake between 20 - 50 % of the herd. Those are the farms that have a sustainable offtake (meaning they can sell but maintain a constant herd size under field conditions). Observations below the dashed line indicate farmers that accumulate and those above the highest dashed line are likely to destock. Thus, based on herd size and market offtake, smallholders can be apportioned into three groups: destocking, sustainable offtake, and accumulation groups. The destocking resulted from both mortality and market offtake as evident for Orbili in Table 5 where the dataset allowed matching many households on herd size, mortality and market offtake.

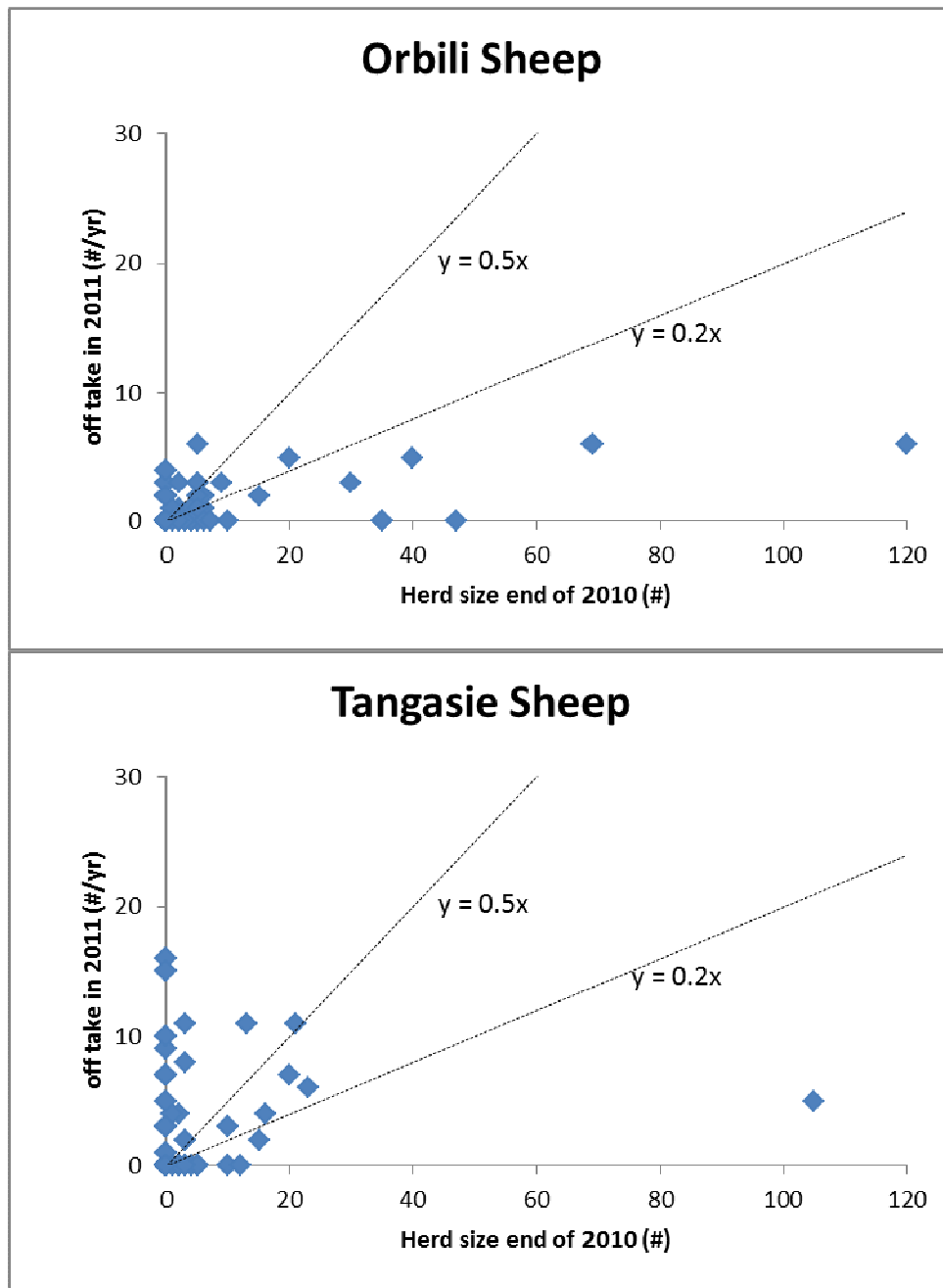


Figure 5.1: Market offtake for sheep in two communities

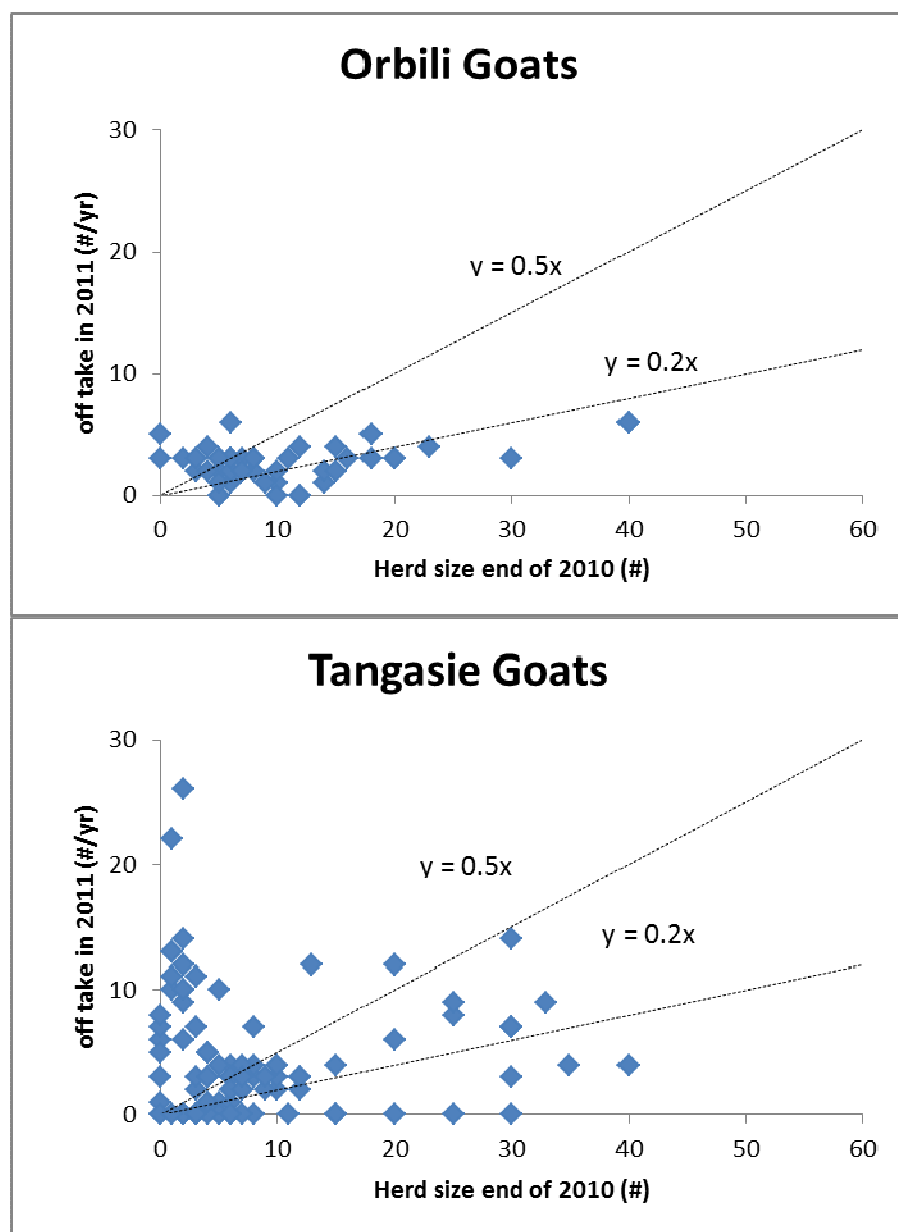


Figure 5.2: Market offtake for goats in two communities

Table 5.4: Average flock size, mortality and market offtake for sheep and goats at Orbili

	Households (n)	Mean (n)	Standard deviation (n)
<i>Sheep</i>	14		
Herd size		19.4	22.69
Mortality		3.1	1.59
Market offtake		2.6	1.78
<i>Goats</i>	33		
Herd size		11.6	6.69
Mortality		3.4	3.04
Market offtake		2.6	1.51

The statistical PDs fall in the accumulation group. The location of a household in a group is not fixed. Goru is a typical example. He said that he started selling a couple of sheep during Christmas when his flock size was 30 which implies he had sustainable offtake. Sometime after, he destocked due to mortality and later recorded flock growth as a result of annual preventive veterinary treatment. Thus, the pathway of flock growth is sequential.

Sale of livestock refers to one or a couple of animals sold by a farmer at a time (i.e. on monthly basis). Most farmers at Tabiasi and Tangasie sell their animals at the local market which is organized every six days. The buyers are composed of local traders, butchers or anybody who wants to buy. Orbili farmers mostly bicycle 12 kilometres to Babile Market where they can sell to traders from southern Ghana. The market price is often determined through negotiation between the seller and buyer. Traders at Babile Market estimate that livestock sales during festive occasions or high-value market period (such as Christmas in December or Ramadan in September) fetch higher price (about 20% to 50%) than other times. The lowest price period (i.e. low-value market) occurs during crop cultivation season (June to August) when most farmers sell their animals to get income for farm expenditure such as labour, seeds and fertilizer.

PDs are more likely to participate in high-value markets. This assertion reflects on the viewpoint of Menem. He said that he sells (uncastrated) rams at Ramadan when the price is high. He noted that many farmers (i.e. destocking and sustainable offtake groups or NPDs) mostly sell animals during the farming season (i.e. June – August). The mass selling creates market glut and consequently lowers prices. However, he sells earlier and keeps the money in the house. Then, when it is cultivation season, he uses the money to provide food and drinks for organized labour. (Menem was generalizing; the lead author observed that few of the sustainable offtake group members also sell animals during high price seasons purposely for children's school fees). Goru, on the other hand, castrates most rams to enhance weight gain and sells during Christmas. At Tangasie, Banda sells cattle to butchers from Wa (capital of Upper West Region) normally at Christmas. For example, during the Christmas of 2011, he sold 25 bulls. Musa sends his cattle to Kumasi and sold 35 bulls in September 2012. According to Konor, he sells goats after weaning to people for rearing. He explained that MoFA staff made it known to people that they can buy cross-breed goats from him. This accounts for about 60% of his sales. The rest of his sales are done during festivals and customary rites.

The benefits from livestock sales are apparent in several ways. According to Menem, he sold animals to construct a house and for bearing the annual cost of farm expenditure. Goru is one of the three households at Orbili whose eldest son received post-secondary education financed with income from sheep sales. Besides the economic benefits, key informants and Menem's son said that Menem and Goru derive much satisfaction from their popularity as owners of large flock size in Lawra District. Similarly, Banda has built a second house using income from sale of cattle. He also bought a truck for commercial use. He used income from livestock to pay for dowry of his sons' wives. School fees for the grandsons' education are also from the income from cattle. Musa has built several houses in Wa using the income from cattle sales. Musa's own residence is an 18-room house. Recently, he built one house at the cost of 30,000 Ghana Cedis (19,736.84 US Dollars based on exchange rate of GHC1.52 to \$1.00). Musa's viewpoint is that it is too risky to invest in vehicles for transportation. Hence, he invests in houses for renting.

This section shows that based on market offtake of small ruminants, smallholder farmers in the three study communities fall into three groups: destocking, sustainable offtake, and accumulation groups. The PDs are located in the accumulation group i.e. they sell less than 20% of their herd mostly during high-value markets seasons for non-consumption purposes. In the other two groups, most sell animals during cultivation; only few can afford to sell animals in high-value markets to cover wards education.

5.4 Discussion

The findings show that the positive deviants were relatively successful at flock or herd growth and specialised in selling animals in high-value markets. Community perception of PDs differed for four farmers from our statistically defined PDs. This is explained for one because he was a PD in poultry. The other three perceived PDs that were not statistical PDs must have been perceived so because they may be socially important source of information on livestock production.

We will reflect on the findings by raising three main issues: rationale for herd growth, interrelationship between land settlement and herd growth, and interrelationship between herd growth and food security.

5.4.1 The rationale for herd growth

The findings show that on transiting into adulthood, most of the positive deviants and non-positive deviants started rearing a few small ruminants to support crop farming. Keeping livestock as a support is characterised by low external input and high mortality in smallholder mixed crop-livestock farming systems (Udo et al., 2011, Amankwah et al., 2012). However, unlike the NPDs, the PDs were induced to pursue herd growth as a result of a combination of factors. For instance, the critical experience of cattle theft, and interactions with colleague and agents of development organizations prompted a steady shift from minimal to increased investment in livestock husbandry. The PDs changed from free-ranging to herding, watering and housing. They also pacified ancestral spirits for herd protection and resettled. However, it took some years before the illiterate positive deviants in particular learned to employ annual preventive veterinary services. Earlier studies show a relationship between herd growth and inputs such as physical, financial and management resources (Sumberg and Lankoandé, 2013, Udo et al., 2011). Our study shows the inter-linkage of the community belief system (or worldview) (Millar, 1996), social interactions, and individual's learning, determination and resource mobilisation as inputs into herd growth.

5.4.2 Interrelationship between land settlement and herd growth

Our analysis indicates that access to land around the homestead is necessary for herd growth. The five successful positive deviants moved from the extended family compound and distanced themselves on layer of land for grazing. The positive deviants were the first to resettle with the purpose of expanding herd size. However, over time, the positive deviants lost the advantage of larger grazing area because the land is communally owned and other people also resettled close by. This finding shows that it is not the total size of crop farm land that is important for herd growth but the location of resettlement. The relevance of this finding is that it complements earlier studies of extensification of livestock by Fulbe pastoralists who moved from the Sahel to the sub-humid zone of West Africa in order to expand their range (Amanor, 1995, Moritz et al., 2009). The PDs' extensification strategy also involved moving to settle on new rangelands in their community and herding their flock/herd to exploit pasture and minimize livestock theft. In the study area, it is insightful to consider what is likely to happen when the positive deviants' pathways are adopted and rangeland and water become scarce. This study indicates that increased adoption of livestock

extensification by smallholder farmers will require transformation of the existing livestock production system, institutions and network of relationships. This may involve intensification, changes in land tenure, self-organized communities to prevent livestock theft, and improve access to veterinary services delivery and water and concentrated feeds among others. While the literature (Udo et al., 2011, Herrero et al., 2013) indicates that smallholder livestock intensification depends on farmers priorities and resources, the salient institutional factors such as structural changes in the production system, land tenure and self-organization remain underemphasized (Klerkx et al., 2010).

5.4.3 Relationship between household food security and herd growth

The findings show that positive deviants relied on non-livestock enterprises such as crop farming or off-farm trading for consumption needs during the process of herd growth. The positive deviants indicated that a farmer whose main goal is to raise livestock to solve problems such as household food shortage is unlikely to succeed in herd growth. This suggests that few food insecure households, if any, can pursue successful herd growth characterised by participation in high-value markets. The food insecure households will find it extremely difficult to organize the resources needed to support herd growth. This assertion reflects on earlier findings that there is a minimum assets threshold level (e.g. few small ruminants) below which a household will find it impossible to pursue flock growth and asset accumulation without external help or intervention (Carter et al., 2007). The threshold argument indicates that big changes such as large herd sizes and participation in high-value markets for majority of smallholders will require 'system jumps' (Udo et al., 2011) e.g. change from non-positive deviant to positive deviant practices. In our study, the threshold for herd growth appears to be dependable on food stocks for the household, youth labour and determination of the positive deviant. However, in recent years, decreasing soil fertility and consequent recurrent household food shortages have undermined accumulation of livestock assets by means of crop farming (Bruce and Karbo, 2005). Hence future positive deviant livestock households are likely to be characterised by off-farm trading activities.

5.5 Implications for smallholder commercialization

The findings show that positive deviants increased resource allocation to livestock production such as herding and payment for veterinary services, possess significantly larger herd sizes but sell proportionately fewer livestock in high-priced Christmas and Ramadan markets than non-positive deviants. Our finding about sedentary crop-livestock smallholders in northwest of Ghana reflects on West African pastoralists who adapt to pressures on rangeland in the Sahel zone by moving to where there are abundant pastures (extensification) and targeting particular segment of the market such as Ramadan for livestock products (specialisation). However, unlike the pastoralists who are responsive to market forces and adjust their herd structures to environmental factors and market opportunities (Amanor, 1995, Moritz et al., 2009), the PDs accumulate livestock assets for multiple purposes including walking bank, household food security, retirement benefit and prestige. The accumulation of livestock assets interrogates the drive towards commercialization which assumes that agricultural growth will translate into smallholder market participation (FAO et al., 2012). This study, thus, highlights the importance of a broader range of institutions (land tenure, self-organization for addressing livestock theft, and interaction with support services) in addition to economic institutions (i.e. asset, infrastructure and incentives (Barrett, 2008)) as pertinent to smallholder extensification and specialization.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

6.1 Introduction

In this chapter, I draw out the main findings and examine how smallholder livestock production relates to some pertinent global development issues such as food security, innovation and commercialisation (FAO et al., 2012, ILRI, 2011). Like in many other countries, food security is the primary objective of smallholder farmers in Upper West Region in Northern Ghana. Over 50% of the predominantly rural population often run short of food before the next harvest as a result of erratic rainfall and declining soil fertility. Over 60% of households use income from livestock to buy food when they run short of food (ICRA and NAES, 1993, Quaye, 2008). Besides, livestock is the major source of finance during crop farming, payment of school fees and other immediate need for cash income. It is also a source of manure for replenishing declining soil fertility. However, the potential of livestock, especially small ruminants, to fulfil its multiple roles in the crop-livestock systems has not been achieved due to combined technical and institutional constraints that have persisted over the past 20 years (Animal Research Institute, 1999, ICRA and NAES, 1993, Quaye, 2008). This study sought to shed insight on how the constraints can be resolved in order to enhance smallholder small ruminant production and marketing. It adds to previous studies by showing that the way interventions were conceived and implemented years ago reflect on outcomes being experienced presently.

Thus, this study aimed:

- 1) to examine the salient technical and institutional constraints that hinder innovation in smallholder ruminant production and marketing, and
- 2) to analyse how previous interventions as well as smallholder farmers themselves sought to address the combined technical and institutional constraints in the environment of ruminant production in Upper West Region of Ghana.

Specific research objectives were derived from the general objectives to guide the case studies that were explored in Chapters 2 to 5 of the study. The next section (6.2) provides an overview of each of the chapters. Section 6.3 addresses the general objectives of the study and Section 6.4 examines salient crosscutting issues from the

chapters and draws implications for policy, reflects on methods and makes suggestions for further research.

6.2 Overview of the main findings

6.2.1. Chapter 2: 'Diagnosing constraints to market participation of small ruminant producers in Northern Ghana: An innovation system analysis'

Chapter 2 was motivated by the observation that there is significant local demand for livestock products in Ghana, but then, smallholder farmers in Northern Ghana do not fully exploit the available market opportunities. To provide a descriptive understanding of the reasons for smallholders' low production and participation in livestock markets, this study investigated 1) the prevailing practices of small ruminant production and marketing in crop-livestock smallholder households in Upper West Region of Ghana, and 2) the farm level and higher level constraints related to technical, infrastructural and institutional that hinder improved small ruminant production and market participation by smallholder farmers.

The findings showed that combined technical and institutional constraints restrict most smallholder farmers to non-commercial animal husbandry practices. However, few individuals and communities were successful to a certain extent in addressing the constraints. The livestock production system is characterised by tethering in the rainy and cultivation season, from May to October, and free-range management in the dry season, from November to April. Tethering is marked by weight loss due to restricted movement and feeding as well as high mortalities due to exposure to elements of the weather and unavailable veterinary services. Free ranging or releasing animals to roam on their own takes place after harvesting of field crop in October. Free ranging is linked with inadequate feeding during late dry season when communal pastures are routinely burnt as well as high rates of theft. These practices were connected with the constraints farmers experienced namely inadequate feeding, diseases, lack of water during dry season and theft. Further analysis at stakeholder workshop showed that these constraints persisted largely due to institutional reasons. These included structural limitation of arable land, communities' values that are skewed towards crop production more than towards animal husbandry, weak support systems for animal production and health services delivery, and ineffective traditional and formal structures for justice delivery. The combined technical and institutional constraints reflected on market participation. Most farmers sell animals during cultivation in low-

value markets to cater for labour, fertilizer and seeds. Only few smallholders could afford to sell animals in order to take advantage of high market demand (high-value markets) on occasions such as Christmas, Easter or the Ramadan festival. It was concluded that market production or intensification requiring high use of external inputs is not practical for most smallholder farmers.

6.2.2. Chapter 3 'Institutional dimensions of veterinary services reforms: Responses to structural adjustment in Northern Ghana'

One of the important institutional constraints that hinder smallholder farmers is high livestock mortality that results from inadequate provision and the weak organization of veterinary services. This institutional constraint was linked to decentralization and privatization reforms of veterinary services since the mid-1990s as part of structural adjustment policies implemented by most sub-Saharan African country governments including Ghana. I examined the effects of these policy changes on delivery and smallholders' use of veterinary services in Lawra and Nadowli districts in Northern Ghana by assessing 1) the changes in delivery of animal health services, and 2) the responses of stakeholders to the reforms.

The veterinary service reforms were accompanied by two significant changes: a substantial reduction in the allocation of financial and human resources to public veterinary services and the placing of the Veterinary Service Department under a non-veterinarian director at the district level. Besides, the broader social context in addition to the veterinary reforms affected farmers' use and delivery of veterinary services. For example, demand for public veterinary services shifted from cattle farmers to owners of both small ruminants and cattle due to incessant theft of cattle brought about by ending cattle branding for identification and weak structure of informal and formal justice delivery system. The Procurement Act 663 of 2003 made it cumbersome for Veterinary Services Directorate (VSD) to access Central Government funds for importation of vaccines. The consequences of the reforms on public sector delivery of veterinary services included irregular mass vaccinations against contagious animal diseases, greater inequity of service delivery, collapse of quality controls of drugs, proliferation of supply of drugs from informal sources on the market, and moonlighting of public (para) veterinarians for private purposes. In the private sector, many farmers and Fulani herdsmen purchased and administered veterinary drugs that had not been subject to quality control. Only a few communities self-organised to access veterinary services indicating limited willingness of farmers to pay for effective veterinary services. Thus, institutional change is not a one-off event. It triggers further

changes in other levels of social organization with unintended consequences. This calls for policy makers and analysts to monitor and coordinate changes in several fronts.

6.2.3. Chapter 4: 'Scaling out livestock supplementary feeding technologies in northern Ghana: Co-learning and adaptation challenges'

Animal production systems literature indicates that, next to health, nutrition is the most important constraint in smallholder ruminant production. Most researchers have established that supplementary feeding with leguminous fodder and crop residues such as groundnut haulms is important to provide high quality protein that can offset limitations of scanty and low-quality natural pastures and crop residues during the dry season. This study examined the extent to which interventionists and farmers co-learned and adapted during the process of supplementary feeding interventions (using *Cajanus cajan*, *Stylosanthes hamata* and groundnut crop residues) that were part of projects (1996 to 2009) to improve smallholder small ruminant production in Upper West Region of Ghana.

The findings showed that scientists and MoFA officials employed participatory methods during identification of problems and opportunities phase. However, implementation decisions were mostly made by MoFA officials. After the end of the projects no farmer in the two communities adopted *Cajanus cajan* as fodder because they were concerned about allocating land and labour for its cultivation; only one farmer maintained a *Stylosanthes* fodder bank. Of the farmers in N. Tankyara and Orbili, 35% and 6% respectively, adopted supplementary feeding with crop residues. Even though groundnut crop residue supplementary feeding practice was labour intensive, the N. Tankyara farmers adopted it due to persistent theft (they could keep their livestock at the homestead) and declining soil fertility. In contrast, the agriculturists attributed non-adoption to farmers' attitude, formal educational background, community leadership and religion. Thus, in the non-adoption of fodder bank technologies, the agriculturists did not adjust their cognitive and linear view of R & D to take on board household and institutional factors that shaped farmers actions namely labour constraints, concerns about food security, scarcity of arable land, and livestock theft. This chapter showed that it is pertinent for interventionists to consider whether outcomes of activities will be useful or not for farmers or local target group. Otherwise scarce resources may be wasted on unbeneficial results.

6.2.4. Chapter 5 'Development of livestock keeping among positive deviant smallholders in Northern Ghana'

Consistent with agricultural innovation system literature, the first study in this thesis indicated that smallholder farmers characterised as positive deviants produced novelties by accumulating livestock assets and participating in high-value markets. This study, therefore, examined how positive deviants succeeded to introduce change and the strategies they employed to overcome technical and institutional constraints in their environment.

The results show that 9 out of 295 livestock keeping households were perceived by their community members as positive deviants. Five of the positive deviants had herd sizes (i.e. sheep, goats and cattle) exceeding the population mean plus two times standard deviations. The flock growth was induced by critical experience of cattle theft, interactions with colleagues and agents of development organizations, and reliance on non-livestock enterprises such as crop farming or off-farm trading for consumption needs. The accumulated experiences by the positive deviants resulted in a steady shift from minimal to increased investment in livestock husbandry. The changes included moving from free-ranging to organized herding, regular use of preventive and curative animal health care, organization of household or community efforts to prevent livestock theft, and selling animals during high-value market seasons. Though they possess large flock size, the positive deviants sell proportionately fewer livestock than non-positive deviants. This indicates that agricultural growth does not translate into higher market participation.

6.3 Analysis of the general objectives

In this section, I pull together Chapters 2 to 5 in order to address the general objectives of this study. The general objectives relate to 1) the salient technical and institutional constraints that hinder innovation in smallholder ruminant production system; and 2) what previous interventionists and farmers themselves do to resolve the constraints experienced in the ruminant production system.

6.3.1. Constraints that operate at different levels of social organization over time

The findings show that the technical constraints experienced in the small ruminant system had institutional dimensions that operate at different levels of social organization over time. Chapter 2 shows that the constraints farmers experienced are water shortages during dry season, diseases and theft. The corresponding institutional limitations can be ordered from community through district to national levels. These include limited gaps in interaction between community and district and national level organizations for water provision, weak support systems for animal production and health services delivery, and weak traditional authority for ensuring justice. Chapter 3 shows that reduction in public expenditure following implementation of decentralization and privatization reforms at the national level prompted emergence of informal animal health delivery system characterised by the prevalence of self-medication and absence of quality control which may have negative externalities and may undermine efficacy of disease management not only in communities but also in district and regional capitals. Moreover, the constraints farmers experienced in the crop-livestock system have persisted without effective resolution for about twenty years (Animal Research Institute, 1999, ICRA and NAES, 1993). The geographical coverage and persistence of the constraints prompt the need for spatial and temporal coordination of interventions. The need for temporal coordination complements earlier studies that advocate for coordination of development in several domains of the economy simultaneously (Dorward and Kydd, 2004, Leeuwis, 2004).

The findings are consistent with the consensus that institutional innovation is required for any meaningful change in smallholder livestock production (FAO, 2012, ILRI, 2011). However, institutional context in sub-Saharan Africa (SSA) favours export crop production but discriminate against smallholder food and livestock production (Animal Research Institute, 1999, Hounkonnou et al., 2012, Wright et al., 2012). There is therefore a call to strengthen the capacity of SSA countries to formulate and implement policies and institutional changes in order to enhance the livelihood of a large number of livestock-dependent poor people (FAO, 2012). Other studies show that appropriate technology and information and access to markets supported by policies are the keys to sustainable livestock productivity and incomes (Udo et al., 2011, Wright et al., 2012).

6.3.2. Interventionists inability to make a difference in smallholder husbandry practices

The findings show development interventionists have made little impact on animal husbandry practices of most smallholder farmers in Northern Ghana. In response to the

joint technical and institutional constraints, the majority of smallholders seek to be resilient through diversified livelihood strategies, and invest more labour and capital resources in crop production than in animal husbandry even though the two enterprises are co-dependent. Only a few farmers and communities have changed from minimum to moderate investment in livestock husbandry. These changes included routine use of preventive and curative veterinary services, adoption of supplementary feeding, and organized herding (Chapters 2, 3 and 5). However these improvements were not leading to active participation in the marketing of small ruminants.

Interventionists' inability to adapt and their tendency for prescriptive solutions are largely responsible for unbeneficial outcomes of development interventions on the livestock production system. For instance, when there was substantial reduction in funding and staff strength after the decentralisation and privatization reforms, the veterinary staff did not adjust their normative position that they were the only competent people to deliver animal health care. This was evidenced in withdrawal of support for community animal health workers whom they blamed for having contributed to self-medication by farmers. Consequently, they could not respond to the emergence of informal animal health delivery system characterised by the prevalence of self-medication and absence of quality control. In contrast to veterinary staff, smallholder farmers adjusted to the dynamics in the contexts. For example, due to reduction in coverage by veterinary technicians and mark-up in the price of treatment, many cattle owning households learnt to treat animals themselves. Also, lack of awareness of the functioning of the mixed farming system lead to misalignment of the feeding interventions. Despite being examined on station and showing promising results, the agriculturists overlooked the farmers' priority for food crops, labour requirements and appropriate timing of planting of the forages. Thus, we see a situation in which agriculturists were reluctant to adapt to changes in the contexts whereas farmers were striving to move on.

The findings reflect on a number of studies that show that the dominance of transfer-of-technology (ToT) cognitive view of innovation have contributed to inability to scale out proven technologies to a wider socio-economic impact (Douthwaite et al., 2001, Sumberg, 2002, World Bank, 2003). Our study shows the persistence of the ToT model among management and field level agriculturalists even though they employed participatory methods in identification of constraints experienced by farmers. This might relate to the tendency to employ participatory methods to provide legitimacy for interventions rather than as tools to help address felt need of local people (Leeuwis, 2004). A related issue is that the agriculturists do not have practical exposure to other

frameworks such as innovation system perspective or institutional analysis that stress the complementary role of technology and institutions as pertinent to sustainable development (Klerkx et al., 2010). As a consequence, the agriculturists stuck to the tools, methods and cognitive view of ToT model of innovation but which are not effective in dealing with above-farm-level institutional constraints such as livestock theft, weak structure of veterinary services or on station experimentation (Hounkonnou et al., 2012).

6.4 Crosscutting issues

In the foregoing, I addressed the specific and general objectives of this study. In this section, three issues are raised: relationship between livestock and food security, potential for commercialization of the smallholder production system, and potential for innovation of the system.

6.4.1. Relationship between smallholder livestock production and food security

The findings show that farmers' concerns about household food security is a significant driver of current (non-commercial) practices as well as of the only modest changes in animal husbandry strategies that were observed. The joint technical and institutional constraints experienced by smallholder farmers induced low input use and risk avoidance behaviour (Chapter 2). On the other hand, declining soil fertility and getting manure that will accumulate from housing animals partly induced adoption of supplementation of crop residues (Chapter 4). Similarly, flock growth was pursued not for maximization of profit, but for insurance and capital stock (Chapter 5). The central role of food security in smallholder systems has been highlighted in a number of studies (Dorward and Kydd, 2004, Douthwaite et al., 2001, ICRA and NAES, 1993). For instance, the study that informed UWADEP (ICRA and NAES, 1993) was emphatic that food security is the primary objective of smallholder farmers in the Upper West Region. In this crop-livestock system and elsewhere in developing countries, livestock is kept and relied on to support crop farming (Animal Research Institute, 1999, Delgado et al., 2001). The present study shows that some farmers capitalized on changes in the context that threaten household food security in order to improve husbandry practices. One of the implications of this assertion is the need for joint development of crop and livestock enterprises in future interventions. The simultaneous development of crops and livestock to exploit their energy flows among the components of the farming system may be more appealing than either one alone.

Complementary changes in the farming system have been shown in the combination of food crop and commercial horticulture in the dry season. Unfortunately this study does not show major openings for complementarity of crops and livestock, thus confirming that food security is prioritized (Poole et al., 2013). This finding reflects on studies that argue that smallholder farmers are risk averse and hence interventions should aim for incremental improvement and help to secure the livelihood of the poor (Hella et al., 2001, Kristjanson et al., 2009, Udo et al., 2011).

6.4.2 Commercialization of smallholder livestock production system

The findings indicate that commercialization of smallholder livestock system is not currently appropriate for majority of smallholder farmers. The majority of smallholder farmers pursue the strategy of risk-avoidance rather than return maximization. They also abide by a normative rule that values crop production above animal husbandry. These characteristics of smallholder producers pose a challenge to those desirous of stimulating market-driven production of small ruminants in the study communities. This challenge is pertinent because the primary purposes for keeping livestock in crop-livestock systems are insurance and capital stock (Chapter 2). Once these purposes pertain, smallholder farmers select minimum investment in livestock husbandry as means to that end. Consequently, increased use of external inputs or intensification is inconsistent with the purpose for which majority of smallholder farmers keep livestock. Even the farmers characterized as positive deviants who increase resource allocation to livestock production such as herding and payment for veterinary services, and possess significantly larger herd sizes, sell proportionately fewer livestock in high-priced Christmas and Ramadan markets than non-positive deviants. Apparently, the PDs accumulate livestock assets for multiple purposes including walking bank, household food security, retirement benefit and prestige. The accumulation of livestock assets interrogates the drive towards commercialization which assumes that agricultural growth will translate into smallholder market participation (FAO, 2012, ILRI, 2011).

The assertion that there is a low probability that market production of small ruminants might emerge spontaneously is consistent with innovation systems studies that indicate that developments by smallholders and other actors are unlikely unless there are changes in the institutional arrangements in the broader environment in which smallholders and their production systems are embedded (Dormon et al., 2004, Klein Woolthuis et al., 2005, van Rooyen and Homann-Kee Tui, 2009). Also, the claim that

keeping livestock for subsistence purposes translates into low potential for commercialization reflects on the investment pattern between subsistence and cash crops. For instance, the commercial horticulture in the dry season in few communities shows that the farmers respond to interesting markets (Chapter 4). It also explains that if water shortage can be resolved more activities would likely spring up.

The findings of this study complement the argument that intensification of smallholder agriculture cannot be assumed even when demand is rising (Douthwaite et al., 2001, Savadogo et al., 1998). Changes are needed in the existing patterns of interaction, in the broadest sense. Thus, innovation of the smallholder small ruminant system requires changes in non-market institutions including re-organising veterinary service delivery, improving law enforcement and the organisation of water management.

6.4.3 'Below-the-radar' innovation of smallholder livestock production systems

The findings show that the policy and development interventionists fall short in competencies to facilitate innovation of the smallholder small ruminant system. A number of local level or niche innovations were uncovered, but then, they have not been mainstreamed indicating the need for higher than farm and community level institutional innovations. The niche-level innovations included non-burning of bush and supplementary feeding in one community, flock growth and participation in high-value markets attained by the few positive deviant farmers, and organized household or community efforts to prevent livestock theft. However, local actors have been unable to resolve a number of the constraints including persistence of diseases, theft and lack of water during the dry season over the past twenty years (ICRA and NAES, 1993).

It is worthy of note how changes from minimum to moderate investment in livestock husbandry occurred in the study area. First, the crop residue supplementation adoption by farmers and successful flock growth by positive deviants were responses to changes in the surrounding conditions namely increased livestock theft and declining soil fertility. Similarly, sustaining the livestock farmer group after cessation of intervention activities (i.e. ARI-MoFA project) was driven by food security concerns. Thus, farmers selected intervention outcomes that were useful to resolving the constraints they cared about. This implies that interventions may capitalise on changes in the biophysical and institutional contexts in order to enhance the likelihood of achieving useful outcomes for farmers.

Secondly, the study showed that self-organization by communities was key to resolving a number of institutional constraints. For example, in the few communities where an increase was observed in the demand and use of public veterinary services, groups of farmers self-organized to create access to veterinary services. Also in the community where most households kept cattle, livestock theft was dealt with through self-organization. The community leaders (consisting of the chief, the earth priest, the head of Fulani herdsman, and leaders from various sections of the community) established an informal rule backed with sanctions in the early 1970s and also organized watchdogs to minimize livestock theft. Again, in the community where demand-driven sales were relatively high, the cooperative society (established as a church-based group) bought food during the harvesting period from its members and resold this to anyone in the community when needed, with only a modest price mark-up and so the community members were not compelled to sell animals under distress.

The pattern in the self-organized examples is that the people worked together to collectively solve problems that were relevant to each household. Thus, they were characterized by shared purpose and collective action, which resulted in useful outcomes for all. This implies that in communities where there exist established self-organized groups, the potential to sustain development initiatives could be exploited by interventionists.

A general principle that has been demonstrated by the self-organization in this study is that social organizational arrangements are a necessity in resolving institutional constraints. However, there are no self-organized groups in place at higher-than-community levels, for example, district, regional and national levels to work together to address corresponding institutional constraints. These constraints include weak structure of veterinary services, livestock theft, annual bush burning, and absence of transparent mechanisms at the district assembly level for provision of community water facilities. Especially, water access in the dry season seems to be a very basic and primary problem. Yet it has not been sufficiently addressed in the last 20 years (ICRA and NAES, 1993). Other Sahelian countries like Burkina Faso seem to have done so given their success in livestock production and marketing in urban centres like Kumasi and Accra in Ghana.

A way forward may lie in sensitizing and facilitating existing groups at the various levels to appropriate and resolve institutional constraints hindering livestock development in Northern Ghana. This study suggests that the structures at the district

assembly and regional levels that are responsible for development coordination could provide a forum for addressing institutional constraints in livestock development.

Our recommendation for employing existing groups complements a gap analysis of public veterinary service in Ghana conducted by World Organization of Animal Health (OIE) consultants (Diop et al., 2012). Diop et al (2012) reported that there is no regular formal interaction among the entities that make-up the animal health and production system and hence recommended the formation of a livestock development forum (or innovation platform) to fill the gap at the national level. The present study shows, given the structural problems in the veterinary services delivery system, a forum will require working on equity of the participants including veterinarians, drug store operators, farmers and Fulani herdsman recognizing each other's expertise. This may motivate the actors to play complementary roles at each level and foster joint achievement for desirable outcomes.

The recommendation for a more inclusive approach to livestock development is consistent with a co-creation approach which entails shared purpose and diverse stakeholders working together in order to achieve useful outcomes in the long-term for all. A key requirement for successful co-creation is trust among parties and once a shared purpose is attained by stakeholders working together, it enhances not only development of a single enterprise but other enterprises as well (Leeuwis, 2004, Merchant, 2012).

6.5 Reflections on methodology

This study was guided by social science research principles (Neuman, 2000). At the conceptual level, the point of departure was an assumption or an idea perceived to be a 'cause' or solution to a problem of societal importance (i. e. institutions hinder innovation and smallholder market participation). The introductions to the thesis chapters demonstrate that various aspects of the idea were also important to the scientific community by relating them to the relevant literature. The multiple methods (qualitative and quantitative interviews, documents reviews, and direct observations) employed aimed at finding evidence to ascertain the initial assumption. The analytical tasks involved probing for patterns, with respect to the research questions, in the salient recurrent and concurrent concepts in the data that were collected.

Interview data dominated the accounts in all four empirical chapters (i.e. Chapters 2 to 5). However, I complemented the interview data with direct observation data which provided deeper insight on how institutions affect actions and practices of smallholder livestock producers in this study. Instances of experiences of direct observations were summarized in the narratives: Fulani herdsman were observed at drug store purchasing veterinary drugs (likely for self-medication) (Chapter 3), a positive deviant farmer providing common salt to a flock of sheep to supplement nutrient intake (indicating increased investment in livestock husbandry) (Chapter 5), manure accumulated in sheep pens and spreading it on farm lands around homestead to improve crop yield, and smallholders who sold their rams that were weighed in a previous month due to concerns about theft (Chapter 4). Apparently, diverse institutions prompted the actions of the herders and smallholder farmers. Thus, triangulating the reconstructions of experiences as in interviews and direct observation of practices enhanced the quality of the study (Atkinson, 2013).

My data collection focused mainly on farmers and their experiences with interventions during the last 20 years. To understand co-creation processes similar investments for data collection should be made in partners like scientists, MoFA staff and other stakeholders. This process of information gathering should start from the scoping study all the way through.

6.6 Implications and suggestions for further studies

6.6.1 Policy implications

In the light of the crosscutting finding that smallholder farmers are more concerned about food security and self-organized groups are helpful tools for them, the following recommendations are made. First, there is the need for co-development of crops and livestock enterprises in order to exploit energy flows among the components of the farming system and to meet farmers' priority of ensuring household food security. This study shows that co-development of crop and livestock enterprises have to be pursued within the context of co-creation approaches such as learning selection model and a guiding principle of usefulness of outcomes for farmers.

There is also the need to build the capacity of existing groups from the community through the district to the national levels to be the means for resolving technical and institutional constraints in livestock production system. In order to achieve this,

support organizations need to be identified to brokerage institutional building processes.

Given that competencies of development agents for innovation of the smallholder small ruminant is not adequate for resolving the joint technical and institutional constraints, the following recommendations are made. Ministry of Food and Agriculture requires urgent capacity building in institutional analysis (including value chain and innovation system analysis). Besides, the staff should be prepared to participate in platforms at equal level with community members, district, provincial and national staff and contribute to joint analysis and learning through intervention experiments.

The persistence of constraints farmers experienced in livestock production system over two decades indicates that improving livestock husbandry practices through health care and feeding interventions are long-term undertakings that require committed and long-term institutional support at local, district and national level.

The veterinary services need to strengthen their regulatory capacity and implement quality control as the country moves into public and private partnership for animal health service delivery. Fortunately education and training at academic and paraveterinary level has recently been revived and opens up new opportunities for a broad based competent service to farmers groups.

Animal Research Institute and the livestock related departments of universities should be resourced to undertake on-farm research as follow up of research at stations so that they can provide the needed technical backstopping to smallholder livestock production and simultaneously learn about institutional constraints.

The CoS-SIS approach that was employed in this study may be a useful model that can be adapted for education of extensionists, crop and animal scientists, economists and other development related professionals in Ghana. The point of departure for the CoS-SIS approach is constraints farmers experience and then exploration of reasons for the persistence of the constraints (i.e. institutional reasons). The resulting insights provide a basis for organizing and coordinating the activities of all the relevant stakeholders to resolve the salient technical and institutional constraints. Adapting the education of development professionals in Ghana and elsewhere to the CoS-SIS approach may help to focus resources on addressing institutional issues that local people and farmers care

about but cannot resolve on their own and thus enhance the likelihood of outcomes useful to them.

6.6.2 Suggestions for further research

Participatory approaches were not sufficient for MoFA staff to relate to non-technical constraints in livestock farming and consider their effects on farmers' decisions. How do the management and field staff of MoFA understand and employ principles of innovation in their activities? Another area of research relates to interdisciplinary awareness of scientists whose work have direct bearing on development of smallholder livestock production systems as well as other agricultural commodity value chains. There is the need to examine the extent to which scientists and development agencies (including MoFA and non-governmental organizations) share the purpose of smallholders they interact with during interventions.

Given the success of the Burkinabe at marketing small ruminants in Ghana at the Kumasi and Accra markets, a comparative study about their small ruminant systems and the role development interventions played since 1990 could shed light on the potential for development in Northern Ghana. Questions that may be explored include: Did the Burkina Faso farmers benefit from the large scale development of agro-pastoral dams, supporting livestock (and horticulture and forage crops) during the dry season? And if so did the Burkina Faso farmers follow up this innovation with adoption of supplementary feeding interventions, health improvements and marketing knowledge?

6.7 Conclusion

This study adopted a diagnostic stance to examine the salient technical and institutional constraints that hinder smallholder small ruminant production and market participation. Then, detailed case studies were conducted on how interventions and farmers themselves sought to address the constraints. The constraints farmers experienced were water shortage during dry season, diseases and theft. The interventions examined were: decentralisation and privatization of veterinary services; UWADEP and ARI-MoFA ruminants project. The pattern in the interventions was that they were largely implemented in a top-down and technical manner and their outcomes were not altogether useful for farmers. The constraints have persisted for about twenty years largely unresolved. Most farmers keep and rely on small ruminants for insurance

and as capital stock. Due to their purpose and the persistence of joint technical and institutional constraints, farmers invest minimally in small ruminants. The exceptions were few farmers and cases of self-organization since the early 1970s such as grain bank for members of cooperative group, accessing effective veterinary services in groups, and organized community to prevent livestock theft.

Self-organization as a form of co-creation at different levels from community through the district to national level holds prospects as means to developing smallholder small ruminant production. There are two related key messages. First, people who control resources such as officials, responsible for development interventions often do not share the purpose of farmers and they employ tools and methods that limit their understanding of the complexity of the farming system and livelihood pursuits of farmers. This study suggests that useful outcomes for farmers are largely co-created i.e. through shared purpose, self-organization, and institutional innovation processes. Participation in joint-learning and co-creation will result if development officials would build up their capability to understand and share farmers insights and strengthen farmer group initiatives with appropriate technical and institutional findings. Then a real innovation system would emerge supporting the livelihoods of the mixed crop-livestock farming communities in Upper West Region of Ghana and elsewhere in sub-Saharan Africa.

REFERENCES

- Addah, W., Baah, J., Tia, S. and Okine, E. (2009) 'Knowledge and practices of smallholder farmers and herdsmen in the use of acaricides and gastrointestinal anthelmintics in Ghana', *Livestock Research for Rural Development*, 21(198): [online] URL: <http://www.lrrd.org/lrrd21/11/adda21198.htm>
- Adjei-Nsiah, S., Leeuwis, C., Giller, K. E., Sakyi-Dawson, O., Cobbina, J., Kuyper, T. W., Abekoe, M. and Van Der Werf, W. (2004) 'Land tenure and differential soil fertility management practices among native and migrant farmers in Wenchi, Ghana: implications for interdisciplinary action research', *NJAS - Wageningen Journal of Life Sciences*, 52(3-4): 331-348.
- Adu-Gyamrah, E. and Donkor, M. (2011) 'PAC orders MoFA to probe the whereabouts of animal vaccines', *Daily Graphic* Accra, Ghana, Graphic Communications Group Ltd.
- Agyare, W. A., Kombiok, J. M., Karbo, N. and Larbi, A. (2002) 'Management of pigeon pea in short fallows for crop-livestock production systems in the Guinea savanna zone of northern Ghana', *Agroforestry Systems*, 54(3): 197-202.
- Ahuja, V. (2004) 'The economic rationale of public and private sector roles in the provision of animal health services', *Revue Scientifique et Technique. Office International des Epizooties*, 23(1): 33-45.
- Ahwoi, K. (2010) *Local government & decentralisation in Ghana*, Accra, Ghana: Unimax Macmillan Ltd.
- Amankwah, K. (2009) 'Summary of findings from scoping study on food security domain in Northern Ghana', pp. 3. Wageningen, The Netherlands, Convergence of Sciences - Strengthening Innovation Systems (CoS-SIS) Project, Wageningen University, The Netherlands.
- Amankwah, K., Klerkx, L., Oosting, S. J., Sakyi-Dawson, O., van der Zijpp, A. J. and Millar, D. (2012) 'Diagnosing constraints to market participation of small ruminant producers in Northern Ghana: An innovation systems analysis', *NJAS - Wageningen Journal of Life Sciences*, 60-63: 37-47.
- Amanor, K. S. (1995) 'Dynamics of herd structures and herding strategies in West Africa: a study of market integration and ecological adaptation', *Africa*, 65(03): 351-394.
- Amezah, K. (2007) 'Re - MoFA decentralization, unified extension and services delivery within the ministry'. Accra, Department of Agricultural Extension Services, Ministry of Food and Agriculture.
- Anandajayasekeram, P., Puskur, R. and Zerfu, E. (2009) 'Applying innovation system concept in agricultural research for development. A learning module', pp. 321 Nairobi, Kenya, International Livestock Research Institute (ILRI).
- Animal Research Institute (1999) 'Livestock systems diagnostic survey: Lawra District, Upper West Region, Ghana', *Technical Report*, pp. 58. Accra, Animal Research Institute (C. S. I. R.).
- APD, VSD, LPIU, SRID and GTZ-MoAP (2009) 'Review of MoFA's activities in support of livestock development in Ghana', in Animal Production Directorate (APD), V. S. D. V., Livestock Planning and Information Unit (LPIU),

- Statistical Research and Information Directorate (SRID) and Market Oriented Agricultural Programme (GTZ-MoAP) (ed), pp. 84. Accra, Ministry of Food and Agriculture (MoFA).
- Atengdem, P. B. and Dery, A. B. (1997) 'Title'. Tamale, Ghana: Northern Ghana LEISA Working Group (NGLWG), ACDEP.
- Atkinson, P. (2013) 'Ethnography and craft knowledge', *Qualitative Sociology Review*, 9(2): 56-63.
- Awortwi, N. (2010) 'The past, present, and future of decentralisation in Africa: A comparative case study of local government development trajectories of Ghana and Uganda', *International Journal of Public Administration*, 33(12-13): 620-634.
- Barnes, P. and Addo-Kwafo, A. (1996) 'Research note: Evaluation of introduced forage accessions for fodder production at a subhumid site in southern Ghana', *Tropical Grassland*, 30: 422-425.
- Barnett, B. G. (1989) 'Reflection: The cornerstone of learning from experience ', paper presented at the The University Council for Educational Administrators Annual Convention, Scottsdale, Arizona.
- Barrett, C. B. (2008) 'Smallholder market participation: Concepts and evidence from eastern and southern Africa', *Food Policy*, 33(4): 299-317.
- Biggs, S. (2008) 'Learning from the positive to reduce rural poverty and increase social justice: Institutional innovations in agricultural and natural resources research and development', *Experimental Agriculture*, 44(01): 37-60.
- Bosman, H. G. (1995) 'Productivity assessments in small ruminant improvement programmes. A case study of the west african dwarf goat', PhD Degree, Wageningen University
- Brooks, S. and Loevinsohn, M. (2011) 'Shaping agricultural innovation systems responsive to food insecurity and climate change', *Natural Resources Forum*, 35: 185-200.
- Bruce, J. and Karbo, N. (2005) 'The Ibrahim Yidana Family: A portrait from Ghana', in Tan, S. F. and Gueye, B. (eds) *Portrait of family farming in West Africa*. London, International Institute for Environment and Development (IIED) Dryland Programme.
- Budisatria, I. G. S. (2006) 'Dynamics of small ruminant development in Central Java, Indonesia', PhD Thesis, Wageningen University.
- Carney, D. (1998) *Changing public and private roles in agricultural service provision*, London, UK: Overseas Development Institute.
- Carter, M. R., Little, P. D., Mogues, T. and Negatu, W. (2007) 'Poverty traps and natural disasters in Ethiopia and Honduras', *World Development*, 35(5): 835-856.
- CGIAR (2000) 'Going to scale: can we bring more benefits to more people more quickly? ', *CGIAR NGO Committee and the Global Forum for Agricultural Research, 10-14 April 2000*. International Institute of Rural Reconstruction, Silang, Cavite, Philippines, Consultative Group on International Agricultural Research (CGIAR), Washington, D.C., USA.

- Chambers, R. and Jiggins, J. (1986) 'Agricultural research for research poor farmers: A parsimonious paradigm', *Discussion Paper 220*. Brighton, England, Institute of Development Studies, University of Sussex.
- Charmaz, K. (2012) *Constructing grounded theory* London: Sage.
- Cheneau, Y., El Idrissi, A. H. and Ward, D. (2004) 'An assessment of the strengths and weaknesses of current veterinary systems in the developing world', *OIE Revue Scientifique et Technique*, 23(1): 351-359.
- Crane, T. A., Roncoli, C. and Hoogenboom, G. (2011) 'Adaptation to climate change and climate variability: The importance of understanding agriculture as performance', *NJAS - Wageningen Journal of Life Sciences*, 57: 179-185.
- De Vries, J. (2008) 'Goats for the poor: Some keys to successful promotion of goat production among the poor', *Small Ruminant Research*, 77(2-3): 221-224.
- Dearden, K. A., Quan, L. N., Do, M., Marsh, D. R., Schroeder, D. G., Pachon, H. and Lang, T. T. (2002) 'What influences health behavior? Learning from caregivers of young children in Viet Nam', *Food and Nutrition Bulletin*, 23(4 (supplement)): 117-127.
- Delgado, C., Rosegrant, M., Steinfeld, H., Ehui, S. and Courbois, C. (2001) 'Livestock to 2020: the next food revolution', *Outlook on Agriculture*, 30: 27-29.
- Diop, B., Daborn, C. and Schneider, H. (2012) 'PVS gap analysis report: Ghana, 8-16 August, 2011'. Paris, World Organisation for Animal Health (OIE).
- Dixon, J., Gulliver, A. and Gibbon, D. (2001) *Farming systems and poverty: Improving livelihoods in a changing world*, Rome and Washington D.C.: FAO and World Bank.
- Dormon, E., Debrah, K. A., Adjei-Nsiah, S. and Sakyi-Dawson, O. (2010) 'Opportunities for enhancing food security in Ghana: A case study of the Nadowli and Sissala West Districts of the Upper West Region of Ghana. ', pp. 18. Convergence of Sciences Project, Wageningen University.
- Dormon, E. N. A., Van Huis, A., Leeuwis, C., Obeng-Ofori, D. and Sakyi-Dawson, O. (2004) 'Causes of low productivity of cocoa in Ghana: farmers' perspectives and insights from research and the socio-political establishment', *NJAS - Wageningen Journal of Life Sciences*, 52(3-4): 237-259.
- Dorward, A. and Kydd, J. (2004) 'The Mala wi 2002 food crisis: The rural development challenge', *Journal of Modern Afri'can Studies*, , 42(3): 343-361.
- Douthwaite, B., Beaulieu, N., Lundy, M. and Peters, D. (2009) 'Understanding how participatory approaches foster innovation', *International Journal of Agricultural Sustainability*, 7(1): 42-60.
- Douthwaite, B. and Gummert, M. (2010) 'Learning selection revisited: How can agricultural researchers make a difference?', *Agricultural Systems* 103: 245-255.
- Douthwaite, B., Keatinge, J. D. H. and Park, J. R. (2001) 'Why promising technologies fail: the neglected role of user innovation during adoption', *Research Policy* 30: 819-836.
- Douthwaite, B., Keatinge, J. D. H. and Park, J. R. (2002a) 'Learning selection: an evolutionary model for understanding, implementing and evaluating participatory technology development', *Agricultural Systems*, 72: 109-131.

- Douthwaite, B., Manyong, V. M., Keatinge, J. D. H. and Chianu, J. (2002b) 'The adoption of alley farming and Mucuna: lessons for research, development and extension', *Agroforestry Systems* 56(193-202).
- Elbasha, E., Thornton, P. K. and Tarawali, G. (1999) 'An ex post economic impact assessment of planted forages in West Africa', *ILRI Impact Assessment Series 2*. Nairobi, Kenya, International Livestock Research Institute.
- Elzen, B., van Mierlo, B. and Leeuwis, C. (2012) 'Anchoring of innovations: Assessing Dutch efforts to harvest energy from glasshouses', *Environmental Innovation and Societal Transitions*, 5(0): 1-18.
- Engel, P. G. H. and Salomon, M. (1997) *Facilitating innovation for development: A RAAKS resource box*, Amsterdam: Royal Tropical Institute.
- Erickson, F. (1986) 'Qualitative methods in research on teaching', in Wittrock, M. (ed) *Handbook of research on teaching*, pp. 119-161. New York, Macmillan.
- FAO (2001) 'Mixed crop-livestock farming: A review of traditional technologies based on literature and field experience', *FAO Animal Production and Health Papers* 152. Rome, FAO.
- FAO (2005) 'Responding to the "livestock revolution"', *Livestock Policy Brief 01*, pp. 7. Rome, Livestock Information Sector Analysis and Policy Branch, Animal Production and Health Division, FAO.
- FAO (2012) *Livestock sector development for poverty reduction: an economic and policy perspective – Livestock's many virtues* Rome: FAO.
- FAO, WFP and IFAD. (2012) 'The State of Food Insecurity in the World 2012: Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition'. Rome, FAO.
- Faure, G., Penot, E., Rakotondravelo, J. C., Ramahatoraka, H. A., Dugué, P. and Toillier, A. (2013) 'Which advisory system to support innovation in conservation agriculture? The case of Madagascar's Lake Alaotra', *The Journal of Agricultural Education and Extension*, 19(3): 257-270.
- Feldman, S. and Biggs, S. (2012) 'The politics of international assessments: The IAASTD process, reception, and significance', *Journal of Agrarian Change*, 12(1): 144-169.
- Geels, F. W. and Schot, J. (2007) 'Typology of sociotechnical transition pathways', *Research Policy*, 36: 399-417.
- Gildemacher, P. R., Kaguongo, W., Ortiz, O., Tesfaye, A., Woldegiorgis, G., Wagoire, W. W., Kakuhenzire, R., Kinyae, P. M., Nyongesa, M., Struick, P. C. and Leeuwis, C. (2009) 'Improving potato production in Kenya, Uganda and Ethiopia: A system diagnosis', *Potato Research*, 52: 173-205.
- Gros, J. S. (1994) 'Of cattle, farmers, veterinarians and the World Bank: The political economy of veterinary services privatization in Cameroun', *Public Administration and Development*, 14: 37-51.
- GVMA President (2012) 'Press statement from the president of the Ghana veterinary medical association on world veterinary day'. Accra, Ghana Veterinary Medical Association.
- Gyabaah-Yeboah, C. (2005) 'Veterinary survey of veterinary drugs and services in Ghana and assay veterinary albendazole suspension', *12th International*

- Students Congress of Medical Sciences (ISCOMS) Book of Abstracts.*
Groningen, The Netherlands, ISCOMS.
- Hall, A. and Clark, N. (2010) 'What do complex adaptive systems look like and what are the implications for innovation policy?', *Journal of International Development*, 22: 308-324.
- Hall, A., Mytelka, L. and Oyeyinka, B. (2006) 'Concepts and guidelines for diagnostic assessments of agricultural innovation capacity', *Working Paper Series*, no. 2006-017. Maastricht, The Netherlands, United Nations University, UNU-MERIT.
- Hall, A., Sulaiman, R. V. and Bezkorowajnyj, P. (2007) 'Reframing Technical Change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity', pp. 52. ILRI, UNU-MERIT, ICRISAT, IITA and SLP-CGIAR.
- Harrington, L., White, J., Grace, P., Hodson, D., Hartkamp, A. D., Vaughan, C. a. and C., M. (2001) 'Delivering the goods: scaling out results of natural resource management research ', *Conservation Ecology*, 5(2): 19 [online] URL: <http://www.consecol.org/vol5/iss2/art19/>.
- Hella, J. P., Mdoe, N. S., Van Huylenbroeck, G., D'Haese, L. and Chilonda, P. (2001) 'Characterization of smallholders' livestock production and marketing strategies in semi-arid areas of Tanzania', *Outlook on Agriculture*, 30(4): 267-274.
- Herrero, M., Grace, D., Njuki, J., Johnson, N., Enahoro, D., Silvestri, S. and Rufino, M. C. (2013) 'The roles of livestock in developing countries', *Animal*, 7(Supplements1): 3-18.
- Holden, S. (1999) 'The economy of the delivery of veterinary services', *Revue Scientifique et Technique. Office International des Epizooties*, 18: 425-439.
- Houkononou, D., Kossou, D., Kuyper, T. W., Leeuwis, C., Nederlof, E. S., Röling, N., Sakyi-Dawson, O., Traoré, M. and van Huis, A. (2012) 'An innovation systems approach to institutional change: Smallholder development in West Africa', *Agricultural Systems*, 108(0): 74-83.
- Humado, C. K. (2003) 'Final report on review of the decentralization process of the ministry of food and agriculture '. Accra, Ghana, Republic of Ghana, Ministry of Food and Agriculture.
- Hung, S. C. and Whittington, R. (2011) 'Agency in national innovation systems: Institutional entrepreneurship and the professionalization of Taiwanese IT', *Research Policy*, 40: 526-538.
- ICRA and NAES (1993) 'Coping with uncertainty: Challenges for agricultural development in the guinea savanna zone of the Upper West Region of Ghana ', *Working Document Series 28*. Wageningen, The Netherlands, International Centre for Development Oriented Research in Agriculture (ICRA) and Nyankpala Agricultural Experiment Station (NAES) Ghana
- IFAD (1995) 'Report and recommendation of the President to the Executive Board on a proposed loan to the Republic of Ghana for the upper west agricultural development project'. Rome, International Fund for Agricultural Development (IFAD).
- IFAD (2006) 'Republic of Ghana upper west agricultural development project interim evaluation'. Rome, International Fund for Agricultural Research (IFAD).

- ILCA (1990) 'Livestock systems research manual', *Working Paper 1*, pp. 287. Addis Ababa, Ethiopia, International Livestock Centre for Africa (ILCA).
- ILRI (2011) 'More meat, milk and fish – by and for the poor'. International livestock Research Institute (ILRI).
- ISSER (2000) 'The state of the Ghanaian economy in 1999'. Accra, The Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon.
- ISSER (2011) 'The state of the Ghanaian economy in 2010 '. Accra, The Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon.
- Kabuga, J. D. and Akowuah, F. (1991) 'Reproductive performance of Djallonke × Sahelian crossbred ewes in Ghana', *Small Ruminant Research*, 5(3): 245-254.
- Kaplinsky, R. (2011) 'Schumacher meets schumpeter: Appropriate technology below the radar, ' *Research Policy*, 40: 193-203.
- Karbo, N., Barnes, P. and Rudat, H. (1996) 'An evaluation of browse forage preferences by sheep and goats in the Northern Guinea Savannah zone, Ghana', paper presented at the Sustainable Feed Production and Utilization of Smallholder Livestock Enterprises in Sub-Saharan Africa. Proceedings of the Second African Feed Resources Network (AFRNET), Harare, Zimbabwe, (6-10 December, 1993).
- Karbo, N., Bruce, J., Nyamekye, A. L. and Fianu, F. K. (1998) 'Effective management of pigeon pea (*Cajanus cajan*) in a crop/livestock integrated farming system in northern Ghana', *Ghana Journal of Agricultural Science*, 31: 161-167.
- Kastelle, T. (2012) 'What is innovation? ', *Innovation for Growth*. timkastelle.org/blog/2012/09/what-is-innovation/, Innovation for Growth.
- Kilelu, C. W., Klerkx, L. and Leeuwis, C. (2013) 'How dynamics of learning are linked to innovation support services -insights from a smallholder commercialization project in Kenya', *Journal of Agricultural Education and Extension*, x(xx): xx-xxx.
- Klein Woolthuis, R., Lankhuizen, M. and Gilsing, V. (2005) 'A system failure framework for innovation policy design', *Technovation*, 25(6): 609-619.
- Klerkx, L., Aarts, N. and Leeuwis, C. (2010) 'Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment', *Agricultural Systems*, 103(6): 390-400.
- Klerkx, L., Hall, A. and Leeuwis, C. (2009) 'Strengthening agricultural innovation capacity: are innovation brokers the answer?', *International Journal of Agricultural Sustainability Resources, Governance and Ecology*, 8: 409-438.
- Klerkx, L. and Leeuwis, C. (2008) 'Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries ', *Food Policy* 33(3): 260-276.
- Klerkx, L., van Mierlo, B. and Leeuwis, C. (2012) 'Evolution of systems approaches to agricultural innovation: Concepts, analysis and interventions', in Darnhofer, I., Gibbon, D. and Dedieu, B. (eds) *Farming Systems Research into the 21st Century: The New Dynamic*. Dordrecht, Springer Science+Business Media.

- Kocho, T., Abebe, G., Tegegne, A. and Gebremedhin, B. (2011) 'Marketing value-chain of smallholder sheep and goats in crop-livestock mixed farming system of Alaba, Southern Ethiopia', *Small Ruminant Research*, 96(2-3): 101-105.
- Kolb, D. A. (1984) *Experiential learning: Experience as a source of learning and development*, Englewood Cliffs, New Jersey: Prentice Hall.
- Koutsouris, A. (2008) 'Innovating Towards Sustainable Agriculture: A Greek Case Study', *The Journal of Agricultural Education and Extension*, 14(3): 203-215.
- Kristjanson, P., Reid, R. S., Dickson, N., Clark, W. C., Rommey, D., Puskur, R., Macmillan, S. and Grace, D. (2009) 'Linking international agricultural research knowledge with action for sustainable development', *Proceedings of the National Academy of Sciences*, 9(13): 5047-5052.
- Kudadjie, C. Y. (2006) 'Integrating science with farmer knowledge: Sorghum diversity management in north-east Ghana', PhD Thesis, Wageningen University, The Netherlands.
- Kusek, J. Z. and Rist, R. C. (2004) *Ten steps to a results-based monitoring and evaluation system. A handbook for development practitioners*, Washington, D, C: The World Bank.
- Kyeyamwa, H., Verbeke, W., Speelman, S., Opuda-Asibo, J. and Van Huylenbroeck, G. (2008) 'Structure and dynamics of livestock marketing in rural uganda: Constraints and prospects for research and development', *Journal of International Food and Agribusiness Marketing*, 20(4): 59-89.
- Leeuwis, C. (2004) *Communication for rural innovation: rethinking agricultural extension*, Oxford: Blackwell.
- Leeuwis, C. (2009) 'Lecture notes: Innovation management and cross-disciplinary design (COM 21306) '. Wageningen, Sub-department Communication Science, Wageningen University.
- Leeuwis, C. and Aarts, N. (2011) 'Rethinking communication in innovation processes: Creating space for change in complex systems', *The Journal of Agricultural Education and Extension*, 17(1): 21-36.
- Legesse, G., Abebe, G., Siegmund-Schultze, M. and ZÄrate, A. V. (2008) 'Small ruminant production in two mixed-farming systems of southern Ethiopia: Status and prospects for improvement', *Experimental Agriculture*, 44(3): 399-412.
- Leonard, D. K. (2004) 'Tools from the new institutional economics for the reforming the delivery o veterinary services', *Revue Scientifique et Technique. Office International des Epizooties*, 23(1): 47-57.
- Liebenehm, S., Affognon, H. and Waibel, H. (2011) 'Collective livestock research for sustainable disease management in Mali and Burkina Faso', *International Journal of Agricultural Sustainability*, 9(1): 212-221.
- Marsh, D. R. and Schroeder, D. G. (2002) 'The positive deviance approach to improve health outcomes: experience and evidence from the field 23(4 Suppl): 1-135.', *Food and Nutrition Bulletin*, 23 (4 (supplementary)): 1-135.
- Mekoya, A., Oosting, S. J., Fernandez-Rivera, S. and Zijpp, A. J. (2008) 'Farmers' perceptions about exotic multipurpose fodder trees and constraints to their adoption', *Agroforestry Systems*, 73(2): 141-153.
- Mensah, D. E. (2013) 'The stinking abattoir, serving 'poisonous meat' to an uncaring public'. Accra, Ghana, <http://www.myjoyonline.com/>.

- Merchant, N. (2012) 'Let your ideas go'.
http://blogs.hbr.org/cs/2012/06/let_your_ideas_go.html, Harvard Business Review Blog Network.
- Millar, D. (1996) 'Footprint in the mud: Re-constructing the diversities in rural people's learning processes', PhD Thesis PhD Thesis, Wageningen Agricultural University, The Netherlands.
- Millar, J. and Connell, J. (2010) 'Strategies for scaling out impacts from agricultural systems change: the case of forages and livestock production in Laos', *Agriculture and Human Values*, 27(2): 213-225.
- Mirk, S. (2012) 'Positive deviance', BSc, Wageningen University.
- MoFA (2004) 'P. T. D. - Report on Orbili community'. Lawra District, Ghana Ministry of Food and Agriculture (MoFA).
- MoFA (2005) 'CIDA/CSIR-ARI/MoFA small ruminants project. District project progress report Aug - Sept 2005 '. Lawra District, Ghana, Ministry of Food and Agriculture (MoFA).
- MoFA (2007-2011) 'The medium term expenditure framework (MTEF) for 2007 - 2011 and the annual estimates for 2007 - 2011'. Accra, Ministry of Food and Agriculture
- MoFA (2009) 'CIDA/CSIR-ARI/MoFA small ruminants project. District project report for December 2008 and January 2009'. Lawra District, Ghana, Ministry of Food and Agriculture (MoFA).
- Moritz, M., Kyle, B. R., Nolan, K. C., Patrick, S., Shaffer, M. F. and Thampy, G. (2009) 'Too many people and too few livestock in West Africa? An evaluation of Sandford's thesis', *The Journal of Development Studies*, 45(7): 1113-1133.
- Munyua, S. J. M. and Wabacha, K. J. (2003) 'Community-based animal health in Kenya: Kenya's policy experiences in reengineering its structural, policy and legal frameworks', in Group, T. I. (ed) *Community-based animal health workers: threat or opportunity?*, pp. 135-148. Crewkerne, Somerset, The IDL Group.
- Nelson, R. R. and Winter, S. G. (1983) *An evolutionary theory of economic change*, Cambridge, Massachusetts, USA: The Belknap Press of Harvard University Press.
- Neuman, W. L. (2000) *Social research methods: Qualitative and quantitative approaches*, Boston: Allyn and Bacon.
- Norman, D. W., Worman, F. D., Siebert, J. D. and Modiakgotla, E. (1995) *The farming systems approach to development and appropriate technology generation*, Rome: FAO.
- North, D. C. (2005) *Understanding the process of economic change*, Princeton: Princeton University Press.
- Ochieng, C. M. O. (2007) 'Development through Positive Deviance and its Implications for Economic Policy Making and Public Administration in Africa: The Case of Kenyan Agricultural Development, 1930-2005', *World Development*, 35(3): 454-479.

- Ojingo, O. A. (2008) 'Presentation of reports on the CIDA/CSIR/ARI/MOFA small ruminant farmer groups, Lawra district, November 2008', pp. 23. Lawra, MoFA, District Directorate of Agriculture.
- Ostrom, E. (1992) *Crafting institutions for self-governing irrigation systems*, San Francisco: Institute for Contemporary Studies Press.
- Otte, M. J. and Chilonda, P. (2002) 'Cattle and small ruminant production systems in sub-Saharan Africa: A systematic approach'. Rome, FAO.
- Pacheco, D. F., York, J. G., Dean, T. J. and Sarasvathy, S. D. (2010) 'The Coevolution of Institutional Entrepreneurship: A Tale of Two Theories', *Journal of Management*, 36(4): 974-1010.
- Pachico, D. and Fujisaka, S. (2004) 'Scaling up and out: Achieving widespread impact through agricultural research. ', *CIAT Publication 340*. Cali, Colombia CIAT.
- Pannell, D. J., Marshall, G. R., Barr, N., Curtis, A., Vanclay, F. and Wilkinson, R. (2006) 'Understanding and promoting adoption of conservation practices by rural landholders', *Australian Journal of Experimental Agriculture*, 46: 1407-1424.
- Pant, L. P. and Odame, H. H. (2009) 'The promise of positive deviants: bridging divides between scientific research and local practices in smallholder agriculture', *Knowledge Management for Development Journal*, 5(2): 160-172.
- Patton, M. Q. (2002) *Qualitative research & evaluation methods*, Thousand Oaks, California: Sage Publications, Inc.
- Poole, N. D., Chitundu, M. and Msoni, R. (2013) 'Commercialisation: A meta-approach for agricultural development among smallholder farmers in Africa?', *Food Policy*, 41: 155-165.
- Pretty, J., Toulmin, C. and Williams, S. (2011) 'Sustainable intensification in African agriculture', *International Journal of Agricultural Sustainability*, 9(1): 5-24.
- Quaye, W. (2008) 'Food security situation in northern Ghana, coping strategies and related constraints', *African Journal of Agricultural Research*, 3(5): 334-342.
- Robinson, M. (2007) 'Does decentralisation improve equity and efficiency in public service delivery provision?', *IDS Bulletin*, 38(7-17).
- Rogers, E. M. (1995) *Diffusion of Innovations*, New York: The Free Press.
- Rogers, E. M. (2003) *Diffusion of innovations*, New York: The Free Press.
- Röling, N. (2009) 'Pathways for impact: Scientists' different perspectives on agricultural innovation', *International Journal of Agricultural Sustainability*, 7: 83-94.
- Rondinelli, D. A. (1981) 'Government decentralization in comparative perspective: Developing countries', *International Review of Administrative Science*, 47(2): 133-145.
- Ryan, G. W. and Bernard, H. R. (2003) 'Techniques to identify themes', *Field Methods*, 15(1): 85-109.
- Saco, R. M. (2005) *Good companies: Organizations discovering the good in themselves by using positive deviance as a change management strategy*, HEC Paris: Oxford Executive Education.
- Savadogo, K., Reardon, T. and Pietola, K. (1998) 'Adoption of improved land use technologies to increase food security in Burkina Faso: relating animal traction, productivity, and non-farm income', *Agricultural Systems*, 58(3): 441-464.

- Scott, W. R. (1995) *Institutions and organizations*, Thousand Oaks, CA: Sage.
- Sen, A. and Chander, M. (2003) 'Privatization of veterinary services in Developing Countries: A review', *Tropical Animal Health and Production*, 35(3): 223-236.
- Shane, S. (2000) 'Prior knowledge and the discovery of entrepreneurial opportunities', *Organization Science*, 11: 448-469.
- Silverman, D. (2000) *Doing qualitative research: A practical handbook*, Thousand Oaks, CA.: Sage.
- Smith, L. D. (2001) 'Reform and decentralization of agricultural services: A policy framework', *FAO Agricultural Policy and Economic Development Series 7*. Rome, FAO.
- Spielman, D. J., Ekboir, J. and Davis, K. (2009) 'The art and science of innovation systems inquiry: applications to Sub-Saharan African agriculture', *Technology in Society*, 31: 399-405.
- Statistical Service (2005) '2000 Population & Housing Census of Ghana. The Gazetteer Vol. II, III, IV'. Accra, Ghana.
- Sumberg, J. (2002) 'The logic of fodder legumes in Africa', *Food Policy*, 27(3): 285-300.
- Sumberg, J. and Lankoandé, G. D. (2013) 'Heifer-in-trust, social protection and graduation: Conceptual issues and empirical questions', *Development Policy Review*, 31(3): 255-271.
- Swanson, B. E. (2006) 'The changing role of agricultural extension in a global economy ', *Journal of International Agricultural and Extension Education*, 13(3): 5-18.
- Tarawali, S. A., Herrero, M., Descheemaeker, K., Grings, E. and Blümmel, M. (2011) 'Pathways for sustainable development of mixed crop livestock systems: Taking a livestock and pro-poor approach', *Livestock Science*, 139(1-2): 11-21.
- Tarawali, S. A., Thornton, P. and de Haan, N. (2005) 'Planted forage legumes in west Africa', *Tropical Grassland*, 4: 211-211.
- Toye, J. (1990) 'Ghana's economic reforms, 1983 – 7: Origins, achievements and limitations ', in Pickett, J. and Singer, H. (eds) *Towards Economic Recovery in Sub-Saharan Africa Essays in Honour of Robert Gardiner*. London, Routledge.
- Turkson, P. K. (2008) 'Client assessment of animal health care delivery in peri-urban Ghana', *Revue Scientifique et Technique. Office International des Epizooties*, 27 (3): 731-740.
- Turkson, P. K. and Brownie, C. F. (1999) 'Financing the delivery of animal health services in Developing Countries: A case study of Ghana', *Tropical Animal Health and Production*, 31(1): 33-44.
- Udo, H. M. J., Aklilu, H. A., Phong, L. T., Budisatria, I. G. S., Patil, B. R., Samdup, T. and Bebe, B. O. (2011) 'Impact of intensification of different types of livestock production in smallholder crop-livestock systems', *Livestock Science*, 139: 22-29.
- Umali, D. L., Feder, G. and de Haan, C. (1994) 'Animal health services: Finding the balance between public and private delivery', *The World Bank Research Observer*, 9(1): 71-96.

- UWADEP (2000) 'Upper west agricultural development project (UWADEP): Mid-term review report ', pp. 123. Wa, Ghana, Regional Directorate, Ministry of Food and Agriculture (MoFA)
- Van der Ploeg, J. D. (1990) *Labour, markets and agricultural production*, Boulder: Westview Press.
- Van der Ploeg, J. D. and Long, A. (1994) *Born from within: practice and perspectives of endogenous rural development* Assen, The Netherlands: Van Gorcum.
- Van Mierlo, B., Arkesteijn, M. and Leeuwis, C. (2010a) 'Enhancing the reflexivity of system innovation projects with system analyses', *American Journal of Evaluation* 31: 143-161.
- Van Mierlo, B., Leeuwis, C., Smits, R. and Klein Woolthuis, R. (2010b) 'Learning towards system innovation: Evaluating a systemic instrument', *Technological Forecasting and Social Change*, 77(2): 318-334.
- van Rooyen, A. and Homann-Kee Tui, S. (2009) 'Promoting goat markets and technology development in semi-arid Zimbabwe for food security and income growth ', *Tropical and Subtropical Agroecosystems* 11: 1-5.
- Vorley, B., del Pozo-Vergnes, E. and Barnett, A. (2012) 'Small producer agency in the globalised market: Making choices in a changing world'. IIED, London; HIVOS, The Hague, the Netherlands, pp. 75.
- VSD (2009-2011) 'Annual performance report for for 2009-2011'. Accra, Veterinary Services Directorate, Ministry of Food and Agriculture (MoFA).
- Wambugu, C., Place, F. and Franzel, S. (2011) 'Research, development and scaling-up the adoption of fodder shrub innovations in East Africa', *International Journal of Agricultural Sustainability*, 9(1): 100-109.
- Weimer, D. L. (2006) 'The puzzle of private rulemaking: Expertise, flexibility, and blame avoidance in U.S. regulation', *Public Administration Review*, 66(4): 569-582.
- Woodford, J. D. (2004) 'Synergies between veterinarians and para-professionals in the public and private sectors: Organisational and institutional relationships that facilitate the processes of privatising animal health services in developing countries', *Revue Scientifique et Technique. Office International des Epizooties*, 23(1): 115-135.
- World Bank (2003) 'Scaling-up the impact of good practices in rural development : a working paper to support implementation of the World Bank's rural development strategy'. Washington D.C. , The Worldbank.
- World Bank (2007) 'World Development Report 2008: Agriculture for development'. Washington, DC, World Bank.
- World Bank (2009a) 'Minding the stock: Bringing public policy to bear on livestock sector development'. Washington, D.C., The World Bank, Agriculture and Rural Development Department.
- World Bank (2009b) 'World Bank, 2009. Awakening Africa's sleeping giant: Prospects for commercial agriculture in the Guinea Savannah Zone and beyond.'. Washington, DC, World Bank.
- Worldatlas (2010) 'Countries of the world'.
<http://www.worldatlas.com/aatlas/populations/ctypopls.htm>.

- Wright, I. A., Tarawali, S., Blümmel, M., Gerard, B., Teufel, N. and Herrero, M.
(2012) 'Integrating crops and livestock in subtropical agricultural systems',
Journal of the Science of Food and Agriculture, 92(5): 1010-1015.
- Yin, R. K. (2003) *Case study research: Design and methods*, London: Sage
Publications.

SUMMARY

The conditions that highlight the significance of smallholder livestock production system in sub-Saharan Africa and other developing countries are well known. These conditions are that a large share of the rural poor keep livestock, livestock can contribute to improved soil fertility and sustainable crop production, and there is rapid growth in demand and market for livestock products. Notable desired outcomes of interventions in the livestock sector include sustainable livestock productivity, and enhanced incomes and food security of the majority of smallholder households who depend on livestock for their livelihood. How to address constraints and improve smallholder livestock production systems are fairly documented and debated in recent years. The key issues involved are: appropriate technologies that meet the needs of farmers, institutional innovation and policies that are pro-poor and supportive, improved access to markets and sustainable intensification of smallholder agriculture. The issue of contention revolves around the increased market production through intensification. One side argue that improving agricultural productivity requires improving market access and value chain development. The other side posits that smallholders who prioritize food security cannot be assumed to take advantage of increased market demand for livestock products. The debate has intensified following the food crisis since 2007/2008. This thesis aims to give an in-depth view on how these dynamics unfold in the small-ruminant production system in Northern Ghana.

Specific aspects of the issues of the foregoing broader view on smallholder livestock production systems are examined in the empirical chapters of this thesis. Chapter 1 introduces the thesis. Chapter 2 presents an empirical study that provides a broad understanding of the issues as experienced by smallholder farmers. These two chapters inform detailed empirical studies in Chapters 3 to 5. Chapter 6 synthesizes the empirical chapters.

In **Chapter 1**, I define the research problem and general objectives, and outline analytical concepts and methods. Chapter 1 indicates that almost 80% of smallholder farmers in Northern Ghana keep livestock, especially small ruminants (i.e. sheep and goats), as a major source of livelihood and food security. The high demand for livestock products at the national level remains unexploited by the farmers. A number of interventions have been implemented over the past 20 twenty years, but then, there has been minimal impact on productivity and market participation of smallholder small ruminant farmers. Recent studies within innovation systems frameworks indicate that innovation of the small ruminant production system have not come about due to

persistence of joint technical and institutional constraints (i.e. constraints that endure and operate at higher-than-farm levels). However, there is inadequate knowledge on the processes that account for the current low production and low market participation. The general objectives of this thesis, therefore, are: 1) to examine the salient technical and institutional constraints that hinder innovation with respect to improved production and market participation of smallholder farmers in Northern Ghana, and 2) to analyse how previous interventions and farmers themselves sought to address the constraints. Multiple methods of quantitative and qualitative survey were employed to provide the data for the studies reported in the empirical chapters (2-5). A quantitative survey of all livestock keeping households was conducted in four out of the six study communities for an overview of the farming system characteristics. The overview was complemented with qualitative methods including in-depth interviews, direct observation, and review of archival documents and other materials.

To provide a descriptive understanding (or diagnosis) of the reasons for low small ruminant production and marketing by smallholder farmers in Northern Ghana, **Chapter 2** examines the technical and institutional constraints hindering innovation of the systems in five communities in Lawra and Nadowli Districts. Three main constraints were prioritized by farmers i.e. water shortage during dry season, high mortality and theft of livestock. The corresponding institutional limitations include gaps in interaction between communities and district and national organizations for provision of water facilities, weak structure of veterinary services delivery, and weak traditional and formal justice delivery structures. In response to the joint technical and institutional constraints, most small farmers have adopted resilient strategies including diversified livelihood activities, low input and low volume production of small ruminants, and maintaining the herd as capital stock and insurance. Only few farmers - characterized as positive deviants- have increased their input use in small ruminant production and engage in market or demand-driven sales of small ruminants. It is concluded that market production or intensification requiring high use of external input is not a viable option for most farmers. This conclusion supports the literature that advocate for interventions aimed at improvement in livelihoods rather than increased market participation as seen in many value chain development projects. An important implication is that market-driven interventions are not the panacea for majority of smallholder small ruminant farmers and different pathways of innovation should be explored drawing lessons from positive deviants.

In furtherance of one of the important emergent issues in the foregoing chapter, I analyse the changes that have occurred in the institutional elements that govern

delivery and farmers' use of veterinary services since structural adjustment reforms in the 1990s and how various stakeholders have responded to the reforms. The results of **Chapter 3** show a substantial reduction in financial and human resources accompanied decentralisation and privatization reforms of veterinary services. The reforms and changes in the broader surrounding conditions triggered practices and new standards by both public and private actors that are not regulated. These practices include cessation of annual mass vaccination, service delivery in few communities or to rich farmers, moonlighting and consequent under-reporting by public (para)veterinarians, and inadequately informed self-medication by Fulani herdsman and cattle owning farmers. Only few communities self-organized to access effective veterinary services. It is concluded that institutional or policy changes are not a one-off activity. It is inter-linked with institutional changes in other domains or levels of social organization. This calls for policy makers and analysts to coordinate several fronts of change over time.

Another issue pursued from the diagnostic study relates to the extent to which interventionists and farmers co-learned and adapted during supplementation interventions (using *Cajanus cajan* and *Stylosanthes hamata* as fodder bank, and groundnut crop residue) as parts of small ruminant improvement projects executed from 1996 to 2009. In the two study communities described in **Chapter 4**, farmers stopped fodder bank cultivation after the projects, and 35% and 6% of farmers at N. Tankyara and Orbili respectively adopted groundnut haulm for supplementary feeding. Prevalence of livestock theft and desire to accumulate manure to improve soil fertility and crop yields prompted adoption of groundnut haulm. The farmer group formed at N. Tankyara was also disbanded because there was an existing active cooperative farmer group since the 1970s. At Orbili, low adoption was attributed to labour constraint. The farmers use their time in dry season market-driven production of vegetables. The livestock farmer group was maintained after the projects and the group members organized contribution to access tractor ploughing services. It is concluded that farmers select intervention outcomes that are useful to their objectives, resources and institutional conditions. This reflects on the literature that interrogates the competencies and cognitive framework of development agents to formulate interventions based on farmers' agenda. Moreover, it calls on interventionists to be responsive to feedback from farmers and better consider the broader social and institutional conditions.

Chapter 5 examines the issue emanating from the diagnostic study about how few farmers characterised as positive deviants succeeded to overcome the joint technical

and institutional constraints and participate in high-value markets. The results show that a total of nine out of 295 livestock keeping households were perceived by their community members as positive deviants. Five of the positive deviants had flock or herd sizes exceeding the population means plus two times standard deviations. The herd growth recorded by the positive deviants were induced by critical experience of theft of cattle, interaction with friends and development agents, and ability to support consumption needs from non-livestock enterprise such as crop farming or trading. The accumulated experiences led to moderate investment in livestock husbandry including organized herding, regular use of preventive and curative animal health care, and organized household or community to prevent livestock theft. Even though the positive deviants possessed larger herd sizes, they sold relative smaller proportion of their herd in high-value markets such as Christmas, Easter or Ramadan festivals than non-positive deviants. This implies that the positive deviants are not driven by the available market or demand, but, by the accumulation of livestock assets for wealth, food security, insurance and support .

In **Chapter 6** I explore the overall patterns in the foregoing empirical chapters and draw implications for policy and research. The main conclusion is that household food security is the principal driver of smallholder small ruminant production and that market demand is only a marginal driver. A majority of farmers keep livestock to support crop production and consequently invest minimally in animal husbandry. The positive deviants who changed from minimal to moderate investment as a result of accumulated experiences and recorded significant herd growth did not enlarge the volume of their market share . The continuous bulk importation of livestock products from Burkina Faso and other neighbouring countries reflects on the available market that could be captured by the local farmers. Yet the smallholders are not increasing their market participation. This indicates that product markets alone are inadequate to stimulate intensification driven by market demand.

Recent studies indicate that the framework for smallholder livestock development comprise appropriate technologies, improved access to markets, and supportive policies and institutions. The present study shows that over-emphasis on available market or development of product markets with little direct attention to issues farmers care about notably household food security will be counter-productive. Since food security remains the primary objective of smallholder farmers and drives their use of inputs, there should be simultaneous development of crop and livestock components of the farming system to explore the energy flows among them. Other non-market institutional constraints that require attention include provision of agro-pastoral dams,

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strengthening the regulatory role of veterinary services, and improving justice delivery structures of traditional and formal authorities.

Another crosscutting issue relates to the observation that self-organization of smallholder producers and the support systems in which they are embedded was quite effective in response to the different institutional constraints that these face, but that self-organisation has not been captured and built upon in interventions. So far, the livestock interventions did not explore the potential of building upon these existing groups. Future interventions could explore the potential of self-organized or existing groups to resolve institutional constraints from community through district to national levels. Furthermore, interventions should better consider farmers' capacity for learning as farmers select or generate intervention elements that were useful to resolving the constraints they cared about. The selection of intervention elements result from interaction of farmers' objectives, livelihood activities and surrounding institutional conditions. However, interventionists are often inflexible in the planning and implementation of projects and pay little attention to feedback and changes in the broader social and institutional surroundings. Hence, organizations whose activities are related to development of smallholder livestock require urgent capacity building in institutional and innovation system analysis and facilitation of dynamic multi-stakeholder processes.

SAMENVATTING

Dierlijke productie door kleine boeren in Afrika ten zuiden van de Sahara en andere ontwikkelingslanden is belangrijk. Redenen hiervoor zijn dat een groot deel van de arme bevolking op het platteland vee heeft, dat vee kan bijdragen aan de verbetering van de bodemvruchtbaarheid en duurzame gewasproductie en dat er een groeiende vraag en markt is voor dierlijke producten. Gewenste uitkomsten van interventies in de dierlijke productiesector zijn: een dierlijke productie die duurzaam is en een toename van de inkomens en voedselzekerheid voor de meerderheid van de huishoudens van kleine boeren die van vee afhankelijk zijn voor hun levensonderhoud. Hoe beperkingen aangepakt moeten worden en dierlijke productie door kleine boeren verbeterd kan worden is in behoorlijke mate gedocumenteerd en bediscussieerd in de afgelopen jaren. De belangrijkste kwesties zijn: toegepaste technologie die voldoet aan de behoeften van de boeren, institutionele innovaties en beleid die gericht zijn op armen en hen ondersteunen, verbeterde toegang tot markten en duurzame intensivering van de landbouw. De toename van marktgerichte productie door intensivering is een onderwerp dat regelmatig terugkeert in de discussies. Enerzijds wordt beargumenteerd dat het verbeteren van de productiviteit van de landbouw een betere toegang tot markten en een betere ontwikkeling van de waardeketens nodig heeft. Anderzijds wordt het standpunt ingenomen dat niet van kleine boeren (die voedselzekerheid de allerhoogste prioriteit geven) verwacht kan worden dat ze voordeel halen uit de toegenomen vraag naar dierlijke producten. Deze discussie is intensiever geworden na de voedselcrisis van 2007/2008. Dit proefschrift heeft als doel om een dieper inzicht te geven in de ontwikkeling van deze dynamiek in de productiesystemen met kleine herkauwers in Noordelijk Ghana.

Enkele specifieke aspecten van de hiervoor beschreven brede blik op de dierlijke productiesystemen van kleine boeren komen nader aan de orde in de empirische hoofdstukken van dit proefschrift. Hoofdstuk 1 geeft een introductie tot het proefschrift. Hoofdstuk 2 presenteert een empirische studie die een breed begrip geeft van de kwesties die spelen voor de kleine boeren. Deze twee hoofdstukken leveren belangrijke informatie aan voor de gedetailleerde empirische studies in de Hoofdstukken 3 tot en met 5. Hoofdstuk 6 tenslotte integreert de empirische hoofdstukken.

In **Hoofdstuk 1** definieer ik het onderzoeksprobleem en de algemene doelstellingen en geef ik de analytische concepten en de methoden weer. Hoofdstuk 1 geeft aan dat bijna 80% van de kleine boeren in Noordelijk Ghana vee houdt en vooral kleine herkauwers

(geiten en schapen) als een belangrijke bron van levensonderhoud en voedselzekerheid. De grote vraag naar dierlijke producten op nationaal niveau wordt niet door de boeren benut. In de loop van de afgelopen 20 jaar zijn er heel wat interventies geïmplementeerd, maar het effect op productie en marktparticipatie van kleine boeren met kleine herkauwers was minimaal. Recente studies gedaan binnen het raamwerk van systeeminnovatie geven aan dat innovaties van kleine herkauwerproductiesystemen niet hebben plaatsgevonden vanwege combinaties van technische en institutionele belemmeringen (om precies te zijn, belemmeringen die aanwezig zijn en hun werking hebben op aggregatieniveaus hoger dan het boerenbedrijf). Er is echter onvoldoende kennis over de processen die bijdragen aan de huidige lage productie en lage marktparticipatie.

De algemene doelstellingen van dit proefschrift zijn dan ook: 1) het vaststellen van de belangrijkste technische en institutionele belemmeringen voor innovaties die leiden tot verbeterde productie en marktparticipatie van kleine boeren in Noordelijk Ghana en 2) de analyse van de manieren waarop eerdere interventies en boeren zelf probeerden om te gaan met die belemmeringen. Verschillende vormen van kwalitatieve en kwantitatieve enquêtes werden gebruikt om data te verkrijgen voor de studies in de empirische hoofdstukken. Een kwantitatief onderzoek van alle huishoudens met vee werd uitgevoerd in 4 van de 6 dorpen om een overzicht te krijgen van de karakteristieken van de bedrijfssystemen. Dit overzicht werd compleet gemaakt met kwalitatieve methoden, waaronder diepte-interviews, directe observaties en het bestuderen van archiefmateriaal en andere documenten.

Om op beschrijvende wijze begrip te krijgen (of een diagnose te stellen) voor de redenen voor de lage productie van kleine herkauwers en de beperkte marktgerichtheid van kleine boeren in Noordelijk Ghana stelt **Hoofdstuk 2** de technische en institutionele belemmeringen voor systeeminnovatie vast in vijf dorpen in de districten Lawra en Nadowli. Drie belemmeringen werden door boeren als de belangrijkste genoemd: watertekort gedurende de droge tijd, het hoge sterftecijfer en veediefstal. De hiermee samenhangende institutionele belemmeringen zijn tekortkomingen in de interactie tussen de dorpsgemeenschappen en organisaties op district en nationaal niveau wat betreft de voorziening van waterfaciliteiten, de zwakke organisatie van de veterinaire dienstverlening en de slechtwerkende traditionele en formele wetshandhaving. Als reactie op de belemmeringen op technisch en institutioneel gebied hebben de meeste boeren verschillende strategieën ontwikkeld: diversificatie van activiteiten om in hun levensonderhoud te voorzien, productie van kleine herkauwers op basis van het principe “lage kosten-lage opbrengst” en de functie van de kudde als

spaarpot en verzekering. Slechts weinig boeren –hier positieve uitzonderingen genoemd- zijn meer inputs gaan gebruiken voor de productie van kleine herkauwers en produceren daadwerkelijk marktgericht of praktiseren vraag-gedreven verkoop van kleine herkauwers. De conclusie wordt getrokken dat marktgerichte productie en intensivering die een hoog gebruik van externe inputs vraagt geen levensvatbare opties zijn voor de meeste boeren. Deze conclusie onderschrijft de literatuur die oproept tot interventies gericht op verbetering van het levensonderhoud en niet tot die gericht op meer marktparticipatie zoals in veel projecten op het gebied van waardeketenontwikkeling. Een belangrijke implicatie is dat markt-gedreven interventies niet de panacee zijn voor de meerderheid van de kleine boeren en dat verschillende wegen die tot innovatie leiden onderzocht zouden moeten worden, waarbij lessen geleerd kunne worden van de positieve uitzonderingen.

Verdergaand met één van de belangrijke kwesties die naar voren kwamen in het voorgaande hoofdstuk analyseerde ik de veranderingen die plaatsvonden in de instituties die verantwoordelijk waren voor de veterinaire dienstverlening en het gebruik hiervan door boeren vanaf het moment dat er structurele reorganisaties plaatsvonden in de jaren 90 en hoe verschillende belanghebbenden reageerden op deze structurele reorganisaties. De resultaten van **Hoofdstuk 3** laten zien, dat de decentralisatie en privatisering van de veterinaire diensten een substantiële reductie teweegbrachten van financiële middelen en menskracht. De reorganisaties en veranderingen in de brede context deden allerlei praktijken en nieuwe uitgangssituaties ontstaan bij zowel publieke als private actoren, die vaak niet gereguleerd zijn. Deze praktijken omvatten het stoppen van jaarlijkse massavaccinaties, het verrichten van de dienstverlening in slechts een paar dorpen of alleen aan rijke boeren, het verrichten van veterinaire diensten die onder-gerapporteerd werden aan de bevoegde instanties en het uitvoeren van medische handelingen door Fulani herders en boeren met koeien. Slechts een paar dorpsgemeenschappen namen zelf de organisatie van de toegang tot veterinaire diensten in handen. De conclusie is dat institutionele of beleidsveranderingen niet op zichzelf staan. Ze zijn verweven met institutionele veranderingen in andere domeinen of in andere lagen van sociale organisatie. Dit vraagt van beleidsmakers en –analisten dat zij in de loop van de tijd verschillende veranderingsgolven moeten coördineren.

Een andere kwestie waarop ingegaan werd naar aanleiding van de diagnostische studie heeft te maken met de mate waarin interveniëerders en boeren samen leerden en zaken aanpasten gedurende interventies gericht op supplementatie (van *Cajanus cajan* en *Stylosanthes hamata* in een voederbank en van gewasresten van grondnoot) als

onderdelen van ontwikkelingsprojecten gericht op kleine herkauwers uitgevoerd tussen 1996 en 2009. In de twee dorpen van de studie die beschreven is in **Hoofdstuk 4** stopten de boeren met het gebruik van de voederbank nadat het project ophield en 35% en 6% van de boeren in respectievelijk N. Tankyara en Orbili hielden vast aan het gebruik van grondnotenstro als veevoersupplement. De veediefstallen en de wens om mest te verzamelen om de bodemvruchtbaarheid en de gewasopbrengsten te verbeteren stimuleerden het gebruik van grondnotenstro als supplement. De door het project georganiseerde groep van boeren in N. Tankyara werd na het project ontbonden omdat er al een coöperatie actief was sinds de jaren 70. De lage adoptie in Orbili wordt toegeschreven aan een beperkte beschikbaarheid van arbeid. Boeren hier besteden hun tijd in het droge seizoen aan de teelt van groentes voor de markt. Hier bleef de boerenorganisatie wel in stand na het project. Deze is belangrijk voor de coördinatie van ploegen met een trekker. De conclusie is dat boeren interventies selecteren met resultaten die belangrijk zijn voor hun doelstellingen, hulpmiddelen en institutionele omstandigheden. Dit sluit aan bij de literatuur die vraagtekens zet bij de kunde en het kader van de kennis van ontwikkelingswerkers om interventies te formuleren die passen bij wat boeren willen. Het roept interveniërs op om te reageren op informatie van boeren en om meer en beter de bredere sociale en institutionele omstandigheden mee te nemen.

Hoofdstuk 5 gaat dieper in op de kwestie uit de diagnostische studie namelijk hoe de weinige boeren die als positieve uitzondering te karakteriseren zijn er in slagen om de technische en institutionele belemmeringen weg te nemen en in staat zijn om in markten met een hoge waarde te participeren. De resultaten laten zien dat in totaal negen van de 295 huishoudens met vee door hun dorpsgenoten werden beoordeeld als positieve uitzonderingen. Vijf van deze positieve uitzonderingen hadden een kudde die groter was dan het gemiddelde plus tweemaal de standaard deviatie. De kuddegroei die vastgesteld werd bij deze positieve uitzonderingen kwam voort uit een ervaring met diefstal van koeien, interactie met vrienden en ontwikkelingswerkers en de mogelijkheid om voedselbehoefte te dekken met niet-vee activiteiten zoals gewasproductie of handel. Dergelijke ervaringen resulteerden in het doen van beperkte investeringen in dierhouderij zoals het organiseren van het hoeden, het regelmatige gebruik van preventieve en curatieve diergezondheidszorg en het organiseren op huishoudings- of dorpsniveau van preventie van veediefstal. Ondanks het feit dat de positieve uitzonderingen grotere kuddes hadden verkochten zij relatief minder op markten met hoge waarde zoals die ten tijde van Kerst, Pasen of Ramadan dan de niet-positieve uitzonderingen. Dit betekent dat de positieve uitzonderingen niet gedreven

werden door de beschikbare markten of vraag, maar eerder door de accumulatie van kapitaal in vee voor rijkdom, voedselzekerheid, verzekering en ondersteuning.

In **Hoofdstuk 6** kijk ik naar algemene patronen in de voorafgaande empirische hoofdstukken en beschouw ik de implicaties voor beleid en onderzoek. De belangrijkste conclusie is dat de voedselzekerheid van een huishouden de belangrijkste drijfveer is voor de productie van kleine herkauwers bij kleine boeren en dat de marktvraag slechts een marginale drijfveer is. De meerderheid van de boeren heeft vee om de gewasproductie te ondersteunen en investeert, als een gevolg daarvan, weinig in de dierlijke productie. De positieve uitzonderingen, die van minimale investering tot een redelijke investering gingen als gevolg van hun ervaringen en die een betekenisvolle groei van hun kuddes hadden, lieten toch geen groter vermarkting zien. De voortgaande importen van grote hoeveelheden dierlijke producten van Burkina Faso en andere buurlanden tonen het bestaan van beschikbare markten die veroverd zouden kunnen worden door lokale boeren. Toch verhogen de kleine boeren hun marktparticipatie niet. Dit toont aan dat productmarkten op zichzelf onvoldoende zijn om markt-gedreven intensivering te stimuleren.

Recente studies geven aan dat het raamwerk voor ontwikkeling van dierhouderij bij kleine boeren toegepaste technologie, verbeterde toegang tot markten en ondersteunend beleid en instituties omvat. De huidige studie laat zien dat het overmatig benadrukken van de beschikbaarheid van markten of de ontwikkeling van productmarkten met weinig directe aandacht voor kwesties van boeren, en met name de voedselzekerheid van de huishouding, contraproductief kan zijn. Omdat voedselzekerheid het primaire doel van kleine boeren blijft en de belangrijkste drijfveer voor hun gebruik van inputs, zou er gelijktijdige ontwikkeling van de gewas- en veecomponent van het bedrijfssysteem moeten zijn om de energiestromen tussen beide componenten te benutten. Andere, niet-markt-gerelateerde belemmeringen die aandacht behoeven zijn de voorziening van stuwdammen voor agro-pastorale watervoorziening, het versterken van de regulerende rol van veterinaire diensten en verbetering van de wetshandavingsstructuren van traditionele en formele autoriteiten. Een andere zeer belangrijke kwestie heeft te maken met de observatie dat de zelforganisatie van kleine boeren en de ondersteunende systemen waar ze onderdeel van uitmaken heel effectief was om om te gaan met de institutionele belemmeringen waar ze mee geconfronteerd werden, maar dat deze zelforganisatie nog niet opgenomen is en op voortgebouwd is in interventies. Tot op heden hebben de diergerichte interventies niet het potentieel van voortbouwen op reeds bestaande groepen boeren onderzocht. Toekomstige interventies zouden dit potentieel van zelfgeorganiseerde of reeds bestaande groepen moeten onderzoeken om institutionele

belemmeringen van dorps- via districts- tot nationaal niveau weg te nemen. Bovendien zouden interventies in meerdere mate het vermogen van boeren om te leren mee moeten nemen omdat boeren elementen uit interventies selecteren of zelfs scheppen als die nuttig zijn voor het wegnemen van belemmeringen die voor hen belangrijk zijn. De selectie van elementen van interventies is het resultaat van interacties tussen de doelstellingen van boeren, hun activiteiten gericht op levensonderhoud en de institutionele omgeving. Intervenieurs zijn echter vaak star bij de planning en implementatie van projecten en ze besteden weinig aandacht aan signalen en veranderingen in de brede sociale en institutionele context. Derhalve behoeven organisaties met activiteiten die gericht zijn op ontwikkeling van dierlijke productie bij kleine boeren ontwikkeling van hun capaciteiten om institutionele en innovatiesysteemanalyse uit te voeren en om dynamische processen met diverse belanghebbenden te kunnen faciliteren.

ABOUT THE AUTHOR

Kwadwo Amankwah was born in Kintampo in the Brong-Ahafo Region of Ghana. He attended Wenchi Secondary School and Kumasi Academy for Ordinary and Advanced Level General Certificate of Education (G.C.E.). Kwadwo obtained B.Sc. in Agriculture (Crops) at Kwame Nkrumah University of Science and Technology (KNUST) in 1994 and an M.Sc. in Management of Agricultural Knowledge Systems (MAKS - nowadays MSc. Development and Rural Innovation) at Wageningen University in 2000. Kwadwo completed one-year coursework as a PhD candidate in Development studies at University of Cape Coast during the 2007/2008 academic year. Then, he was awarded a PhD studentship from the CoS-SIS Programme (2009 – 2013) and worked on smallholder small ruminant production: driven by food security or markets? Kwadwo has worked with the Ministry of Food and Agriculture (MoFA) as Assistant Regional Training Officer and Regional Management Information Systems Officer. Since 2004, Kwadwo has been teaching Agricultural Extension and Development Communication Studies at Animal Health and Production College at Pong-Tamale in Northern Region. Kwadwo's research interests include institutional and innovation system analysis, writing and publishing scientific research, and formulation and evaluation of research and development interventions governed by usefulness of outcomes to local people's objectives, resources and institutional conditions.

Completed Training and Supervision Plan

Kwadwo Amankwah
Wageningen School of Social Sciences (WASS)



Wageningen School
of Social Sciences

Name of the course	Department/Institute	Year	ECTS (=28 hrs)
I. General			
CoS SIS course	CoS SIS programme	2009	9.5
Ceres Introduction course	Ceres Graduate School		P. M.
II. Research Methods and Techniques and Domain Specific Theories			
Qualitative Data Analysis: Procedures and Strategies (YRM 60806)	WUR	2009	6
Advanced Social Theory (RSO 32806)	WUR	2009	6
Innovation Management and Cross-Disciplinary Design (COM 21306)	WUR	2009	4
Institutional Economics and Economic Organization Theory (AEP 20806)	WUR	2009	6
Writing Research Proposal	WASS	2010	3
III. Academic Skills			
Competencies for integrated agricultural research	WGS	2009	1
Information Literacy for PhD including Introduction EndNote	WUR	2010	0.6
Tropical Farming Systems with Livestock	WIAS	2013	2
IV. Presentations of research results			
Presentation CoS-SIS workshops	CoS SIS programme	2010	5
'Diagnosing constraints to market participation of small ruminant producers in Northern Ghana'	EAAP	2013	1
V. Other			
Food and Nutritional Security in Developing Countries: Monitoring and Evaluation	WI	2009	4
Supervision of MPhil student	University of Ghana	2012	1
TOTAL			49.1

FUNDING

1. What is CoS-SIS?

1.1 Definition and Purpose

Convergence of Sciences-Strengthening Innovation Systems is an action research programme in Benin, Ghana and Mali. It carries out scoping and diagnostic studies, agrarian system analyses and participatory field experiments with innovation platforms at the local, district and national levels. Its purpose is to identify pathways for creating opportunity for smallholder farmers in West Africa. Focusing on the enabling conditions at levels higher than the field and farm, the Programme supports sustainable intensification of smallholder farming for food security.

1.2 Partners and Funding

CoS-SIS is a partnership among the *Université d'Abomey-Calavi* at Cotonou, Benin; the *University of Ghana* at Legon, Ghana, and the *Instut Polytechnique Rural de Formation et Recherche Appliquée*, at Katibougou, Mali; and *Wageningen University*, and the *Royal Tropical Institute* in the Netherlands. It is funded to a total of € 45 million for six years (end 2008-mid 2014) by Dutch International Cooperation.

1.3 History and future

CoS-SIS is the second phase of CoS. CoS1 (2001-2006) focused on participatory technology development (PTD) in Benin and Ghana. It showed that smallholders can capture only limited benefits from even the best-adapted and appropriate technologies because of their constrained opportunities. Hence CoS1 researchers started to experiment with institutional change (in addition to their agronomic work). Their early results inspired CoS-SIS in that they convincingly demonstrated that institutional change is both important and feasible. CoS-SIS is currently supporting CORAF in implementing its IAR4D strategy with its West African partners.

1.4 Personnel

CoS-SIS employs eight post-doc Research Associates (RAs), recruited part-time from national research organisations and universities, and nine African Ph.D. researchers. Some of the RAs are graduates of the COS1 programme. The RAs facilitate Concerted action and Innovation Groups (CIGs) (multi-stakeholder platforms composed of key actors in an agricultural domain) at the district and national levels to experiment with institutional change. The Ph.D. researchers work at community level with groups of local people to analyse constraints and experimentally develop livelihood opportunities. The doctoral research feeds into the deliberations of the CIGs. The work is overseen by National, Regional and International Programme Coordinators, who together form the Programme Management Committee (PMC). Responsibility for each country programme rests with a Programme Management Team (PMT) composed of senior representatives of universities, ministries, R&D organisations, the private sector, NGOs and FBOs. The PMTs and coordinators are proving to be high-level networkers and important advocates of the institutional change initiated by the CIGs and PhDs.

1.5 Domains reflect national priorities

- *Benin*: cotton, oil palm (inter-cropping oil palm and annual crops, and the oil palm seed system) and integrated water management (agro-pastoral dams in the North, and rice production in valley bottoms in the South);
- *Ghana*: palm oil and cocoa (work in the domain of small ruminants ended when the RA was promoted to another location by his home organisation);
- *Mali*: integrated water management, integration of crop and livestock production (both in the Office de Niger), and shea butter (*karité*).

1.6 Key activities

- Identifying key constraints that specific categories of smallholder farmers and processors experience when trying to improve their livelihoods and incomes through productive or value adding activities.
- Identifying and researching the institutional reasons for the constraints at the local and higher system levels.
- Identifying key actors, networks and mechanisms that maintain the constraints, as well as entry points for action to by-pass, or transform the institutional context to overcome them.
- Assembling multi-stakeholder platforms of key actors who can be expected to engage in institutional change in their respective domains.
- Enabling platform actors to experiment with institutional arrangements.
- Institutionalising achievements in university curricula, the programmes of research institutes, government policies, the structure of agricultural industries, and arrangements among enterprises and services and in value chains.
- Researching the processes of change and the work of the CIGs by means of real-time monitoring and a form of modified causal process tracing, based on two declared theories of change (intervention theory focused on internal and external activities and relationships of the CIGs; and power theory, focused on networks that have power to change or maintain institutional contexts linked to each domain).
- Ensuring that the outcomes of the action research are published and disseminated through international scientific media, and shared with local, national, and regional government agencies and political decision makers.