International conference on livestock value chain finance and access to credit

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Background

Improving the livelihoods of livestock smallholders and other value chain actors through livestock value addition and marketing is constrained by the lack of access to finance, working capital, affordable quality inputs and well-structured value chains. Unlike other agricultural subsectors such as crops, fruits and vegetables, the financing of livestock activities for smallholders, especially fattening and finishing activities, through financial institutions or value chain actors is very scarce. Livestock smallholders usually cannot provide collateral, such as land title deeds or physical assets, to obtain loans from financial institutions, and value chain finance in this sector is not well developed. However, there are a few examples from developing countries in Africa, Asia and Central and South America where financial products and mechanisms have been developed to help smallholder livestock producers to access working capital and to add value to their product.

This conference forms part of one of the outputs/deliverables of the "Innovative beef value chain development schemes in Southern Africa" project. The project is funded by the International Fund for Agricultural Development (IFAD) and implemented by the International Livestock Research Institute (ILRI) in collaboration with the Swaziland Water and Agriculture Development Enterprise (SWADE) with the support of Micro-Finance Unit (MFU) Swaziland. The conference is also part of the research on value chains under the CGIAR Research Program on Policies, Institutions and Markets (PIM). In addition to the mentioned project partners, Nedbank was the financial institution chosen to be part of the project and provide loans to the mini-feedlots farmers. For more information about the project, we suggest you visit the project website: https://swazibeefschemes.wordpress.com

Objectives of the conference

The main objectives of the conference were to:

• Demonstrate viable and financially sustainable business case models on low cost feeding regimes for fattening enterprises.

• Clarify segmentation of role of value chain actors and create smart linkages.

• Share experiences and research involving access to finance/credit for smallholder livestock producers and other value chain actors.

• Support a dialogue between livestock value chain actors, financial institutions, scholars, private sector companies (input and service providers) and governmental institutions.

• Discuss how to scale up and replicate success stories from the sector to other developing countries and regions.

The following topics were discussed during the conference:

- Institutional environment necessary to transform and support the commercialization of smallholder livestock farming;

- Smallholders' and livestock value chain actors' access to credit;

- The role of microcredit institutions in financing the livestock value chain; and

- Value chain finance mechanisms for the livestock sector in developing countries.

The abovementioned topics were discussed through the presentations and roundtables organized during the conference. In total, three keynote speakers' presentations, six contributed paper sessions (29 oral presentations) and three roundtables were held. Emphasis was placed on sessions mixing interdisciplinary perspectives and a showcase of innovative approaches from the field.

The three keynote speakers' presentations paved the road for the rest of the presentations and tackled general issues related to the constraints on smallholders and livestock value chain actors in accessing finance and credit from formal financial institutions, and how to improve the access to such types of funding. Karl Rich in his presentation describes how each organizational form of the value chain has its financing issues. He points out the two major gaps in value chain finance and access to credits: that rural producers/enterprises that have low access compared to urban ones; and that meso-finance (the so-called "missing gap") that corresponds to needed financial amounts is covered by neither microfinance institutions (MFIs) (above their capacities) nor equity banks. Kennedy Dzama in his presentation focuses on smallholders' market participation initiatives in sub-Saharan Africa (SSA), providing empirical evidence of potential success and failure. Calvin Miller also focuses on issues related to agriculture and, more precisely, livestock finance. He outlines the nature of the livestock production business, embedding risks (climatic, diseases, lack of collateral etc.) and transaction costs for financial institutions. From Miller's perspective, value chain finance, which could be either internal or external, is one of the important ways of accessing finance for smallholder producers and other value chain actors. He points out that lenders, such as banks or micro-financial institutions, reduce risk by financing the most creditworthy parties in a value chain, such as the input suppliers or agri-businesses, and let them provide financing to others from whom they buy and sell. In his presentation Miller also presents and discusses the appropriate financial instruments for livestock value chain finance.

As outlined in the conference program, the keynote presentations preceded or followed plenary session presentations and roundtables. The oral presentations of the participants were grouped into six sessions covering different topics directly or indirectly related to livestock production, marketing and access to finance. The first session, "Smallholders' access to credit", included five presentations related to the factors affecting smallholder livestock producers' access to credit. Case studies from Ethiopia, Swaziland, Indonesia, Nigeria and Senegal were presented and discussed. The second session focused on issues related to "value chains and market participation" and included case studies focusing on different livestock species: cows, cattle and small ruminants, and in different SSA countries: Kenya, Ghana, Zambia, Ethiopia and South Africa. "Governmental schemes and private funding models" issues were discussed in the third contributed papers session with case studies from Swaziland, Ethiopia and Zimbabwe, while a more in-depth focus on the "economic valuation of value chains" was discussed in the fourth session, with examples from Zambia, Swaziland, Tanzania and Nigeria. The fifth session provided a focus on "livestock production, efficiency and marketing" from case studies of beef fattening in Swaziland, small ruminant production in Ethiopia, cattle marketing in Botswana and fodder innovation in the dairy value chain in South Africa. The sixth and last session discussed issues related to "agricultural credit impact assessment and regional trade" and included case study presentations from the Southern African region, Namibia, Pakistan and Nigeria.

The roundtables allowed wider interactions and more open discussions between the conference participants. The first roundtable gave voice to the farmers and livestock producers who talked about their experience in livestock production (mainly cattle fattening) and the constraints faced in sourcing the feeders' stock and in accessing inputs and finance for working capital. In the second roundtable, representatives of banks and financial institutions highlighted

issues related to access to loans for smallholder livestock producers, mentioning that livestock could be used as collateral if it is ear tagged. Transaction costs were mentioned as an important factor hampering small farmers' access to funds from financial institutions and making the costs of lending money very high. The value chain should be made inclusive of all livestock value chain actors, and tailored financial products could be developed for smallholder farmers. The third roundtable included representatives from implementing agencies and donors. The participants discussed issues related to the role of donors (development partners) and implementing partners in project such as SWAZIBEEF. It was clearly articulated that their role is to facilitate the functioning of the value chains. The facilitation role includes bringing value chain actors, particularly producers and feedlot companies, to a stage where they view operations as a business rather than charity. Professionalization of farming and market orientation were emphasized during this roundtable.

The third day of the conference included a visit to two farmers' groups involved in the Innovative Beef Value Chain Development Schemes in Southern Africa project. The farmers' groups are involved in sugarcane production and cattle fattening. The visit helped the participants to learn more about the singularity of the fattening model based on low-cost feeding rations using sugarcane tops, molasses and grown fodder like yellow maize, beans, Napier grass etc. In one of the feedlots, the participants witnessed cattle sales on the basis of live weight.

Approach and process

In order to reach the outputs stated above an approach that combined "standard conference" and "interactive workshop" approaches was followed. Invited keynote presentations were made in plenary and contributed papers were made in parallel sessions in a conference style. Roundtable discussions were facilitated in a participatory interactive form.

Conference presentations and proceedings

For more information about the conference and the panel of keynote speakers and presenters we recommend you visit the conference website, which also includes the PowerPoint presentations of the accepted papers and the biodata of the presenters. The current proceedings book can also be downloaded from the conference website: https://virtual.ilri.org/conference/livestock-finance

Plenary sessions – keynote speakers

Perspectives on improving financial access for livestock value chain development: addressing the 'missing middle'

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Abstract

Access to credit often constrains the participation of smallholders in high-value agricultural and livestock value chains. While microfinance has been promoted as a way of alleviating the credit constraints faced by the poor, it is often unsuitable for the development of small-scale value chains, particularly for more medium-scale investments in storage, machinery, transport, and processing. This paper reviews the different financial mechanisms available to promote value chains, analysing whether such forms address the capital constraints faced by value chain actors. It also looks at the challenges faced by specific sectors, such as the livestock sector, in securing appropriate forms of capital.

Keywords: Value chain; microfinance; livestock; market access

Introduction

Access to credit is an important constraint on the participation of smallholders in high-value agricultural and livestock value chains. For example, a recent study by Swinnen and Maertens (2014) revealed that 81% of cotton farmers in Kazakhstan cited access to credit as a motivation to engage in contract farming arrangements, with 75% reporting this as their main reason. At the same time, significant gaps exist to finance agriculture in developing countries. Doran et al. (2009) report that less than 1% of all commercial lending in Africa goes to agriculture despite the importance of this sector as a share of GDP (30–50% in some countries; see Rich and Niemi, forthcoming). Rural areas are typically disadvantaged further in terms of commercial lending, with the International Labour Organization (2015) noting that access to finance is 12 percentage points lower in rural areas than in urban areas (46% vs. 58%).

The reasons for these gaps in agricultural lending are numerous. On the supply side, there is often a lack of interest by commercial lenders, given high transaction costs, particularly on the information side. In rural areas, farmers can be

widely dispersed over space, making the appropriate screening and monitoring of risk costly for lenders (Kloeppinger-Todd and Sharma 2010). Expanding infrastructure and developing specialized lending products for rural areas is costly, given much lower population densities in rural areas and greater per-loan costs (Pica-Ciamarra et al. 2010). There are perceptions that rural finance is not profitable or lacks appropriate scale to generate wider interest, generating lower returns relative to urban and more commercialized activities (Doran et al. 2009). Risks in agricultural areas themselves also prevent appropriate diversification for lenders. For instance, where climate risks are correlated geographically, lending in such regions is costly and prevents lenders from diversifying their risk exposure (Kloeppinger-Todd and Sharma 2010). Likewise, for more commercialized farmers or small and medium enterprises (SMEs), borrowers themselves are poorly diversified in terms of their own income sources (Schreiner and Colombet 2001). Finally, a host of regulatory, marketing and technological constraints can impede investment by the private sector (Doran et al. 2009). The net effect of these supply-side gaps is to reduce the availability of credit for smallholders, increasing its costs and making scaling-out or upgrading within value chains more difficult.

On the demand side, a major gap for customers of financial instruments is limited access to collateral for loans (Fleisig 1996; Fund for Agricultural Development (IFAD) 2015). This is compounded in areas where land tenure rights are also weak for livestock producers. Pica-Ciamarra et al. (2010) note that in many developing countries, it is nearly impossible for farmers to use their stocks as collateral for loans, while this is commonplace for developed countries (e.g. the United States, New Zealand). Doran et al. (2009) note that a lack of farm recordkeeping makes it difficult for smallholders to provide the requisite documentation to secure loans. Poor organization at the individual farm level, as well as of farmers collectively, impedes the ability of smallholders to effectively negotiate for already scarce rural capital.

Microfinance has been promulgated as a possible solution to remedy some of the gaps that the poor face in accessing formal credit (Buckley 1997). Microfinance typically takes the form of small loans for poor consumers, often lent to groups or rural savings associations to ensure collective responsibility for repayment. As Karnani (2007) notes, microfinance organizations often provide more than credit to clients, including a host of services to improve livelihoods and borrower capacity to use finance. However, microfinance has historically remained a relatively targeted and primarily an urban phenomenon (Schreiner and Colombet 2001; Milder 2008). The lack of microfinance in rural areas can be attributed to many of the supply and demand constraints noted above. Even where microfinance has targeted poor stakeholders, its record has been relatively mixed in terms of SME development (Buckley 1997), its ability to generate needed employment opportunities (Karnani 2007) or in its profitability and sustainability in the absence of government or donor support (Morduch 2000).

An even more salient question is whether microfinance itself is suitable for value chain development activities. Most microcredit loans tend to be small (in the hundreds of dollars) for the purchase of consumption goods or small-scale equipment. However, the development of burgeoning small-scale enterprises requires capital well in excess of what microfinance can provide – investments in storage, machinery, transport etc. all require much larger outlays of money. At the same time, the absence of formal bank lending for "meso" amounts of lending (for reasons stated earlier) creates a gap that Milder (2008) dubs "the missing middle". Figure 1 illustrates this gap, distinguishing between the financial gap between microfinance and commercial finance and the gap that exists between urban and rural areas.

Figure 1. An illustration of the "missing middle" in finance
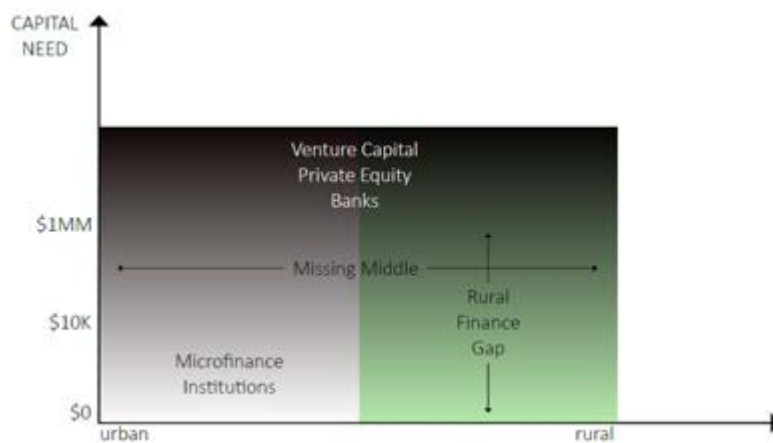
Source: Milder (2008)

In recent years, various value chain financial instruments have been developed to overcome the financial constraints associated with smallholder and SME access to markets. While different in their scope, as will be detailed in this paper, these financial instruments all aim to improve linkages between smallholders and other value chain actors. However, a couple of research questions remain. First, given the proliferation of value chain finance and forms, does this in effect solve the "missing middle" problem or do various gaps still remain? Second, do certain types of rural farming have attributes that make value chain finance more or less suitable or, conversely, are there certain types of value chain finance that are more appropriate for certain sectors? In particular, do the characteristics of the livestock sector present any unique challenges for the use of value chain finance?

Value chain finance—forms and modalities

Value chain finance can be defined as the provision of finance that takes into account the broader financial needs of the value chain (Miller and Jones 2010). Coon et al. (2010) distinguish between value chain finance that comes from within the value chain itself (direct value chain finance) and that which is sourced from outside the value chain (indirect value chain finance). An important attribute of value chain finance is in its ability to mitigate risk through improving information flows and marketing linkages amongst value chain actors. In turn, this lowers the cost of credit provision both within the chain and from outside financial sources (Miller and Jones 2010).

How value chain finance is provided depends greatly on the means by which the value chain is organized. Miller and Jones (2010) distinguish between four different modes of organizing value chains, which are summarized in Table 1. Three of the four forms (buyer-driven, facilitator-driven and integrated) are "top-down" approaches in which a chain "champion" (either from within the value chain or external to it) organizes and facilitates market linkages, including the provision of credit. The motivations for these champions can vary. For buyer-driven and integrated chains, an important consideration is to guarantee quality, quantity or other forms of assurance for customers (Lee et al. 2012). The use of contracts is one-way, to coordinate production between farmers and buyers, with the provision of credit and/or inputs made in exchange for the sale of standardized outputs from farmers to buyers. The level of quality assurance needed and transaction costs associated with coordination determine whether contracts or more hierarchical forms of integration are needed. While greater coordination provides smallholders with needed access to markets, it also makes them over-dependent on one or a small subset of buyers. In rapidly evolving value chains, where changing consumer demands place increasing pressure on upstream actors for innovation and compliance with increasing standards, this exposes some participants to exclusion from the value chain if they cannot keep up with these changes (Dolan and Humphrey 2000).

Facilitated and producer-driven chains rely on the development of horizontal linkages amongst smallholders or other value chain nodes to achieve scale and greater organization. Both are similar in scope and aim – namely, to improve the leverage that farmers have with markets through increased scale and bargaining power. The former is achieved through external means, i.e. via the facilitation of non-governmental organizations (NGOs), government or donors, while the latter depends on the internal motivations of the group itself. While facilitated value chains tend to have stronger linkages to other sources of value chain finance due to deeper networks with public and private sector financial actors, an important concern of such organizations revolves around their broader sustainability once projects or donor funds have been exhausted.

Table 1. Value chain organizational forms and financing issues

Model	Organization mode	Rationale	Challenges for financing
Producer-driven	Associations, cooperatives	Scale to improve negotiating power, market access, better prices	Knowledge of market needs Finance access depends on partners downstream, reputation
Buyer-driven	Contract farming	Improved quality and assurance of supply, meet consumer demands	Transactions costs in contract enforcement Reliance on one buyer Power asymmetries
Facilitator-driven	Associations or cooperatives driven by donor/NGO support	Equity considerations, improve smallholder market access	Dependence on facilitator during/ post-project Sustainability over time – who champions after?
Integrated	Lead firms, supermarkets, Falso organizing chain via direct ownership/contracts; integrated service models	Ensure quality and scale for high-value or high-volume markets	Complexity Power asymmetries, exclusion

Source: Adapted from Miller and Jones (2010)

A range of value chain financial instruments exists to link smallholder farmers to markets. Based on the analysis in Miller and Jones (2010) and Navás-Aleman et al. (2012), Figure 2 summarizes a range of these, organized graphically based on the degree of value chain coordination required and complexity of the instrument themselves. Product financing, through the provision of credit by traders or other value chain intermediaries, is one of the most common forms of value chain finance and is often facilitated through contracts. These contracts reduce the cash flow constraints at the production end, while providing buyers with assurance as to product supply and attributes. As noted in Figure 2, these forms of product financing (trade credit, input supplier credit, lead firm financing) typically require greater amounts of coordination in the value chain and cannot rely wholly on purely market governed transactions (Navás-Aleman et al. 2012).

By contrast, other forms of value chain finance can be made use of without the need for formal coordination with value chain actors; nonetheless, they still require the provision of good market information and enforceable contracts to ensure success (Navás-Aleman et al. 2012). The use of warehouse receipts, for instance, whereby product stored in inventory serves as collateral and guarantee for a loan, does not necessarily require formal value chain coordination as such but does require the presence of service providers and downstream actors with whom to engage. Similarly, factoring, whereby partial payment is advanced on the basis of sales contracts, allows arms-length links between farmers and buyers to be made in conditions where traditional forms of formal finance are not available (Miller and Jones 2010). Root Capital, a social investment fund, is an example of factoring, advancing farmers up to 60% of the value of the sales contract. Payment from the contract is made to Root Capital directly by the buyer; Root Capital then transfers final payment (less fees) to the seller (farmer) (Milder 2008). Leasing is another financial instrument whereby financial institutions lend physical assets to borrowers, reducing risks where finance for production infrastructure is required (Miller and Jones 2010; Navás-Aleman et al. 2012).

Other, more complex, forms of value chain finance, including futures markets, securitization and repurchase agreements, exist within the landscape of financial instruments although their wide use in developing country contexts is fairly limited (Miller and Jones 2010). Loan guarantees, where a private or public entity guarantees a loan, have a mixed history, with public sector loan guarantees often fraught with politicization (Doran et al. 2009). At the same time, there are examples of public-private partnerships (e.g. Regional Agriculture Union of Producers of Yellow Corn and Other Grains and Seeds in Mexico, Bank for Agriculture and Agricultural Cooperatives in Thailand) that provide multiple layers of loan guarantees to reduce transaction risks (Miller and Jones 2010).

Figure 2. Value chain financial forms and their relation to value chain organization and complexity of use

Source: Adapted from information in Miller and Jones (2010) and Navás-Aleman et al. (2012)

Value chain finance and livestock markets

In this section, we address the second of the two research questions posed earlier, namely, to what extent value chain finance instruments are suitable in the livestock sector. An important distinction between livestock and crops concerns the ability of livestock farmers to use the various types of financial innovations and hedging tools available to crop farmers, particularly in the developing world. At present, there appears to be little empirical evidence of more complex forms of financing, such as the use of futures markets or securitization. Warehouse receipts or inventory storage mechanisms, increasingly used for crops, are likewise limited in their scope; Bote et al. (2014) provide an example from Zimbabwe, while IFAD (2015) discusses a case study of grain banks as a means of smoothing out consumption shocks that cause farmers to liquidate their stocks of livestock. Pica-Ciamarra et al. (2010) note that the requisite physical and regulatory infrastructure is missing to support warehouse receipts, including the need for strong information systems, inspection services, contract enforcement and processing, where end products are used as collateral.

A second distinction between livestock and crops is the multifaceted use of livestock in farm livelihoods, where animals represent a source of animal protein (meat and milk), draught labour, a store of wealth and a source of social status. Where financial markets themselves are underdeveloped, livestock serves as an important source of easily convertible assets to money that can be used to meet various livelihood needs. Indeed, where financial markets are lacking or rudimentary, the fact that livestock serves such multifaceted roles makes it difficult to commercialize traditional production systems (Naziri et al. 2015). Moreover, given the risks faced by livestock producers (drought, disease etc.) this suggests not only a need for greater financial service development, but the use of financial instruments other than credit, such as savings or insurance (Doran et al. 2009). Index-based insurance holds promise in pastoral settings (Chantarat et al. 2013), with empirical evidence showing important behavioural changes towards risks among those that have adopted such services (Carter and Janzen 2012). Fakudze and Machethe (2015) further

highlight the role of public-private partnerships between government and smallholder-focused trade associations in the provision of credit for livestock in South Africa.

Has the 'missing middle' been found?

A more difficult question is whether the financial innovations and market linkages developed over the past couple of decades have solved the rural and meso-finance gap discussed earlier. Linking farmers to markets through value chains solves many of the problems that smallholders face in obtaining sufficient capital for operations and expansion. Moreover, it is certainly the case that technological and institutional innovations have played a major role in broadening and cheapening access to finance for more stakeholders. However, three important points still need to be considered.

First, an important gap in the literature concerns issues of access to Financial services. While much attention has been given to the process of linking farmers to markets through finance, its impacts and determinants of success, less attention has been paid to the dynamics of access, in terms of how these links have changed or been sustained over time. Abate et al. (2016) find, for example, that levels of technological adoption engendered by access to finance can vary depending on the source of that capital, suggesting that how finance is provided can yield insights into some of these governance and upgrading issues.

Second, and related to this, there are concerns around issues of governance and power dynamics within the value chain. As noted earlier, much of the provision of value chain finance comes from top-down linkages from buyers and lead firms with significant power over transactional attributes of exchange. Changes in value chain coordination change governance patterns in value chains, which can have both positive and negative impacts. While this can afford smallholder farmers better, more reliable incomes, it can also lead to exclusion (Laven 2009). An important area for inquiry concerns whether there has been exclusion or not, and what the attributes of this might be.

Finally, much of the focus on value chain development has been led by lead firms or NGOs organizing supply bases rather than facilitating the entrepreneurial capacity of stakeholders themselves. Indeed, as IFAD (2015) notes, there is significant potential in the livestock sector for value-adding opportunities in processing and other downstream activities. These could potentially serve new market niches that leverage consumer attributes for traditional products but which are outside the remit of modern value chains and those with wider networks of capital and finance. In such cases, the question remains as to what sources of funds exist for such opportunities. Doran et al. (2009) cite the growth of social investment funds and equity capital in the developing world (e.g. GroFin in South Africa) but agriculture has been noticeably absent from such portfolios. Are there ways the financial and capacity-strengthening needs for these new markets can be addressed? And what role can NGOs and other facilitators play to help smallholders navigate the social investment landscape? (Achleitner et al. 2011).

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Smallholder livestock production and market participation in Southern Africa: Lessons learnt

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Abstract

Smallholder farmers' active market participation is considered a gateway to poverty alleviation. This review gathers empirical evidence of the potential success and failure of smallholder market participation initiatives in sub-Saharan Africa (SSA) with special focus on livestock marketing. The intention is to identify constraints and opportunities in existing marketing structures in the region. Finally, more appropriate interventions drawn from lessons learnt from other countries in the region are suggested. Interventions aimed at facilitating the organization of smallholder farmers into marketing groups reduce intermarket costs, improve the bargaining power of farmers and raise awareness of technologies which may be adopted for more efficient production.

Keywords: market participation; smallholder livestock production, sub-Saharan Africa, transaction costs

Introduction

To a very large extent, most smallholder farmers depend directly or indirectly on livestock for their livelihoods (Food and Agriculture Organization of the United Nations (FAO) 2009). It is anticipated that the livestock sector will play an even more significant role in value addition and land use in future (Van der Zijpp et al. 2010). It has been demonstrated that improved market access is an effective catalyst for poverty alleviation among resource-poor smallholder farmers. Active participation in livestock markets is considered a potent strategy to achieve food self-sufficiency and income from locally available natural resources. Most smallholder livestock producers are, however, located in very remote marginalized areas with poor road and transport networks (Ainslie et al. 2002). Furthermore, the areas are associated with poor market infrastructure and poor access to support services. The system is characterized by high marketing costs, and farmers resort to local livestock trading which is largely informal (Coetzee et al. 2005).

Researchers and developmental scientists suggest that livestock marketing is not the primary production goal of most smallholder livestock producers (Montshwe 2006; Lubungu et al. 2012). Instead, farmers equally place value on other livestock roles such as the provision of draught power, signs of household wealth, inheritance assets and many other socio-cultural roles (Ouma et al. 2003). This partly contributes to the non-participation of a large number of smallholder livestock producers in formal markets (Randolph et al. 2007). It is important, indeed essential, to identify

and implement strategies aimed at creating opportunities for enhanced smallholder livestock producers' access to formal markets as this is considered a gateway to poverty alleviation (Coetzee et al. 2005). The determinants and livestock marketing behaviour of smallholder farmers are critical in designing alternative strategies and policies that are relevant to elevating the returns realized by smallholder farmers from livestock.

In spite of the great financial potential inherent in smallholder livestock, improving farmers' access to markets should not be considered in isolation, as markets need to be supported by a vibrant and consistent production base (Coetzee et al. 2005). Increased livestock productivity improves cattle market off-take rates and ultimately leads to enhanced food security and farmer livelihoods (Altman et al. 2009; Fidzani 2009). A reinforcing loop exists whereby access to stable and reliable livestock markets provides the investment capacity and other incentives to drive even greater livestock production. Success in implementing alternative strategies and realizing the true economic value of smallholder livestock requires dedicated institutional support (Bailey et al. 1999).

Reasons for poor market participation by smallholder farmers

Market participation by smallholder livestock farmers is largely influenced by their marginalized and remote locations with respect to the main urban market centres, poor market information, and poor road and other relevant infrastructure which results in high transport costs.

Small herd sizes and poor body conditions

Individual smallholder livestock farmers keep small livestock numbers; potentially, therefore, they can sell only a few animals. Besides extreme climatic conditions, poor nutrition and diseases and parasites are among the greatest limitations to increasing livestock numbers and productivity by smallholder farmers (Mapiye et al. 2009). A combination of poor nutrition, parasites and diseases leads to low live weight and poor livestock body conditions. Consequently, smallholder livestock fetches low farm gate prices and is either poorly graded or completely rejected in formal markets (Monsthwe et al. 2005). A study carried out by the National Emergent Red Meat Producers' Organization (NERPO) and Industrial Development Trust (2005) reported that most smallholder livestock producers in South Africa sell livestock that is too old and lean yet demand high prices for it.

Low market off-take rates

The livestock market off-take rate for a specific species is calculated as the number of animals sold as a proportion of the total animals of that species per a given period of time. The livestock market off-take rate for smallholder livestock producers in southern Africa is estimated to be less than 5%, except for Namibia and Botswana where off-take rates of up to 20% were recorded by smallholder beef cattle producers (Ainslie et al. 2002; Musemwa et al. 2010). Comparatively, offtake rates of commercial livestock producers are reported to be up to 40% in the same region.

The low livestock market off-take rates in the smallholder sector are, partly attributed to multiple uses of livestock, with little emphasis placed on marketing. Smallholder farmers keep livestock for a variety of reasons, such as for draught power, as a sign of wealth and a form of savings, among other roles. The other reason for low livestock market off-take rates is the complex livestock ownership patterns whereby one animal in a herd or flock of animals is owned by more than one family member of an individual smallholder household. Sometimes livestock owners may be living in urban areas and engaged in other forms of employment. The fact that they are not involved in day-to-day farm activities makes decision-making, including marketing of livestock, complicated as family members on the farm may not decide on their behalf.

Inappropriate carcass classification systems in the formal market

Smallholder livestock farmers in southern Africa are discouraged from formal markets by the unfair classification systems used to value meat carcasses, which favour young, well-muscled animals. This disadvantages most smallholder livestock producers as they keep their livestock on farm for longer to benefit from the multifunctional roles of most livestock. For this reason, livestock marketing is only considered towards the end of the animal's life when its ability to perform other roles becomes diminished. Marandure et al. (2016) revealed the existence of consumers who prefer beef to mature natural pasture-fed cattle. It would be prudent to establish the location of such markets and develop strategies that cater for these consumer preferences.

Few and unreliable marketing channels

Most smallholder livestock producers prefer to use informal marketing channels for their livestock (Montshwe et al. 2005; NERPO 2005). The markets usually depend on availability, prevailing market prices, distance to the market and the extent of relationships developed in previous transactions, among other factors.

The informal or private market is characterized by more localised sales between the farmers themselves or sales to other non-farming individuals from the same or neighbouring communities. It may also refer to sales made to local institutions such as clinics, hospitals, schools and churches. Informal marketing is highly seasonal with no fixed market prices, prices being a result of deliberations and negotiations between the buyer and the seller (Coetzee et al. 2005). For this reason, the prices hardly reflect prevailing formal beef market prices (Rendani 2003). The informal markets thrive prior to the Christmas and Easter holidays to coincide with the celebration time as urban-based family members return home and these are the seasons when most traditional activities are conducted.

Speculators take advantage of their prior knowledge that most smallholder farmers sell their livestock for emergencies, for example to pay school fees, medical bills or for a funeral (Ainslie et al. 2002). They then exploit the poor bargaining power of the farmers and pay very low prices for livestock which they then resell to formal markets. Most speculators operate in very remote and the least accessible areas where marketing infrastructure and marketing institutions are either rudimentary or non-existent (Musemwa et al. 2007). Musemwa et al. (2010) described this practice as open exploitation of smallholder farmers as necessitated by poor or lack of appropriate marketing infrastructure in smallholder areas.

An alternative marketing channel available for smallholder cattle producers is the auction system, which operates on a bid and offer basis (Coetzee et al. 2005). Under the auction system, live animals are sold to the highest bidder. Livestock is sold on a weight basis but the majority of smallholder cattle producers do not fully understand the mode of operation of this auction system. In the end, smallholder cattle producers often choose to ignore the price per kilogram system, preferring their expected prices, as in informal sales (Montshwe 2006). The low numbers of livestock for sale has led to the failure of this marketing channel in many smallholder areas (NERPO 2005).

Inadequate marketing infrastructure

A reasonable marketing organization with appropriate marketing physical infrastructure including accessible road networks, transport, holding and loading facilities enables a smooth flow of livestock (Bailey et al. 1999). Apart from providing for a smooth physical flow of cattle at trade, physical and institutional marketing infrastructure also acts as an incentive for smallholder farmers to participate in formal livestock markets (Musemwa et al. 2008). In communities, however, the market infrastructure is either in deplorable conditions due to poor maintenance (Montshwe et al. 2005) or completely non-functional (Musemwa et al. 2010). In extreme cases, some smallholder areas are located in very remote areas far from major markets where marketing infrastructure does not exist at all (Rendani 2003). For example, a poor road network is associated with high transport costs and discourages buyers (NERPO 2005). Marketing infrastructure is also regarded as a positive community development asset.

Insufficient marketing information

Most smallholder livestock producers in the region still lack sufficient and timely marketing information due to a combination of low literacy levels and inefficient communication systems. More recently, however, improved communication systems have been facilitated by the provision of cellular services across the marginal areas in the region. Information such as market opportunities and consumer demands is essential for farmers to organize their production techniques towards a targeted product quality (Bailey et al. 1999). Coetzee et al. (2005) added that access to sufficient relevant marketing information prevents exploitation of livestock producers by speculators or middlemen. There is also evidence to suggest that provision of sufficient marketing information to smallholder cattle producers helps to create an atmosphere of inclusiveness that increases transparency and improves market participation (Musemwa et al. 2008).

Livestock market access programs in Southern Africa

The government of South Africa, through the National Agricultural Marketing Council (NAMC), has introduced programs aimed at improving the condition of cattle through improved feeding prior to marketing. Under these programs, farmers send cattle they intend to sell to a communal custom feeding program for a subsidized commercial diet for a period of up to four months or until they are ready for slaughter. Although the NAMC does not connect the farmers to a particular market, the idea behind the model is that the cattle's good condition will be able to attract formal cattle buyers, to the benefit of the farmers. Support from the government comes in the form of subsidized commercial feed, construction of custom feeding structures and payment of workers employed to ensure the smooth operation of the feeding program. According to Marandure et al. (2016), custom feeding centres are doubling up as auction pens where buyers, including local ones, come to buy cattle at competitive prices.

Although these projects are still ongoing they are likely to face viability challenges once the government withdraws the subsidies. Currently, operational challenges raised include farmers bringing older emaciated cattle that are not suitable for feedlot finishing. The smallholder farmers prefer to keep cattle on-farm until a more advanced age for social and cultural reasons rather than sell weaners into the feedlots. Unfortunately, the beef classification system in South Africa discriminates against older animals and smallholder farmers thus consistently receive lower prices. Since these older animals are sold primarily into low-value local markets, there is little incentive for producers or value chain partners to invest in a high-quality pasture-fed beef value chain.

NERPO is another organization founded to represent black farmers with the objective of improving their contribution to formal beef marketing. NERPO's terms of reference include identifying new markets for smallholder farmers and setting up cattle buyers' days. The organization resuscitated auction pens throughout the smallholder areas in the Eastern Cape Province. Buyers come to auction pens where they buy cattle on a highest bidder basis. The benefits of auctions include introducing farmers to an entry point into the formal markets, serving as market signals on cattle types, quality and prices, and eliminating the middleman. The auction system previously failed due to poor road networks, the poor condition and old age of cattle and lag in payment, among other reasons. Moreover, the fact that formal buyers still insist on buying cattle per kilogram of live weight discriminates against some areas where the infrastructure does not allow for weighing cattle.

Goat marketing in Zimbabwe was organized into pen sales by the Rural District Council, with goat sales conducted in parallel to cattle sales. Alternatively, collection points are organized by community leaders such as local councillors at the request of buyers or sellers (Homanne et al. 2007). A similar marketing arrangement was reported for goats and sheep in Ethiopia (Kocho et al. 2011). The authors mentioned lack of holding and measuring facilities but services still have to be paid for by community leaders, who act as intermediaries between the buyer and seller to prevent exploitation of farmers. Even with these options available, most smallholder livestock producers prefer private farm gate sales.

Efforts were also made towards securing pre-slaughter contracts with abattoirs and leading meat retailers. The pre-slaughter contracts ensure guaranteed markets for smallholder livestock producers. Barriers to this form of marketing arise from the inability of farmers to meet set targets of production with regards to the quality and quantity of beef required at specific times. Moreover, Marandure et al. (2016) reported that some farmers are not comfortable with forward contracts as they feel indebted. The same authors investigated the perceptions of all the beef value chain partners on developing a natural pasture beef brand by smallholder farmers to improve their access to formal markets. The potential of a beef brand development was compromised by low cattle productivity levels despite the other value chain partners indicating their willingness to support the brand.

Conclusion

There is great economic potential inherent in smallholder livestock production but farmers do not realize as many financial benefits from their livestock as they should. Key public investments are necessary to increase access by smallholder farmers to livestock markets. The investments could be in the form of building institutional and infrastructural capacities that improve the competitiveness of the smallholder livestock production system. The provision of an enabling environment through public sector investment to improve the efficiency of livestock production must be considered in parallel with the market participation campaign.

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Models of inclusive value chain financing and investment for livestock

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Abstract

Livestock value chain financing presents huge opportunities for reaching small farmers but has often been missing in the dialogue on agricultural value chain finance. By using a value chain approach, lenders can reduce costs and risks of both short and long-term financing of livestock, especially for smallholder households, including a special impact on women. Various business models and financial instruments for financing of livestock are presented and illustrated. These build on the strength of the markets and market linkages rather than being focused on conventional collateral.

Keywords: Agriculture, livestock, value chain finance, investment models

Agri-food systems as drivers of production, marketing and financing

Agri-food systems worldwide are being transformed in unprecedented ways. Farm production and distribution are rapidly evolving from the simple relationships and points of interaction of the past to the highly integrated linkages and closer alignments among business partners we witness today. Value chains are being promoted as the business development frameworks of choice in the agri-food sector. Much more attention is being paid to inter- and intra-organizational efficiency in production, processing and logistics. There is increased focus on marketing, product differentiation and product niche development. Furthermore, the competition is now global: prices are less affected by local conditions, seasonality and markets. All these developments make a solid financing structure even more important than it has always been. Market competitiveness and market risks are becoming the drivers of financing decisions in the new agri-food systems.

Integrated food chains are heavily prevalent in some of the meat industry sectors. The poultry, turkey and pork sectors, for example, have witnessed massive transformation in the past two decades. The beef industry is following close behind. What does this mean for smallholder livestock farmers, household chicken-raising smallholder farmers, local dairies and the like? What does this mean for financing?

Livestock as a culture, an investment and a business

The term 'piggy bank' is well-known as describing a way to save for the future. Raising livestock can also be a cultural way of life, such as with the Masai and many other cultures. To finance livestock it is first important to understand its role and context for those involved rather than to think about it as a simple commodity with an economic value. The intrinsic value is very important to understand.

The role of livestock for finance and investment is:

• A store of value – savings bank

• A source of cash flow levelling

• An intrinsic social status representation of wealth

• A household insurance and risk mitigator

• A business investment and income generator

• A source of value addition and complement to crop farming

• A source of food and an important source of income generation for women

Risks of financing agriculture and livestock

The nature of agriculture means financing it and those involved with it is risky and costly. It is costly because of its rural nature, whereby the servicing of loans is more difficult and administratively expensive. Moreover, in many countries, the producers are, in the main, smallholders. This increases transaction costs for lenders. Risks, too, impact lenders. Many perils, such as climatic risk and diseases, are unpredictable, uncontrollable and systemic in nature, affecting many at the same time. The use of insurance products and good production practices, such as diversification and investment in irrigation or drainage, can mitigate but not fully control such risks.

Livestock financing holds less risk than many types of production agriculture but has significant risks and additional constraints, such as the slower returns to capital. Price downturns can also be longer-term. Health and safety risks are important and meeting standards can be costly and difficult for many smaller livestock producers and local butcheries. Moreover, animals can die. Finally, often there are no land titles for livestock grazing areas, some of which are often communal or with rights that cannot be used as mortgage security for loans. Grazing and water rights can also be in dispute.

Value chain financing for livestock

Whereas conventional financing is not available for many in the livestock industry, financing that makes use of the value chain does fit well.

A value chain is the path that a product follows from raw material to consumer, from the field and pasture to the buyer, transporter, processor and the various actors (private, public and including support service providers) that take ownership of the product before it arrives at its final condition and location. The relationships between the parties are very important. The path may be very short from farmer to the local market household or follow a complex path of value addition and geographical movement from farmer to aggregator or cooperative, to raw materials processor to marketing (wholesaler, exporter etc.) to retailer (Miller and Jones 2010). In the expanded definition of the term, a value chain and its analysis also embody the following: service providers, socio-cultural constraints, enabling environment and relationships amongst stakeholders.

Figure 1. Agricultural value chain processes and environment
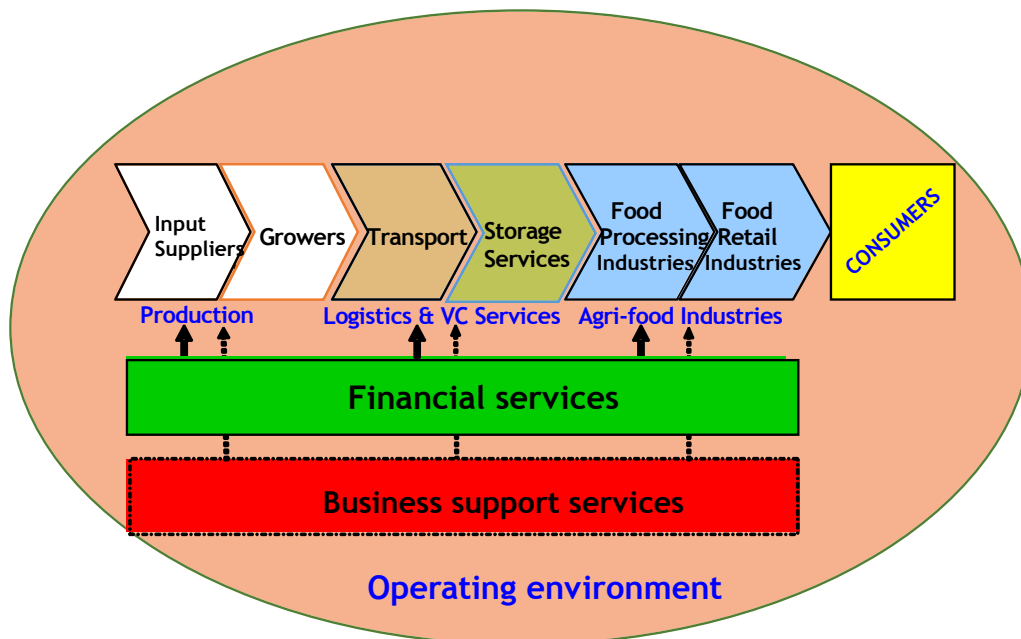
Competitive agriculture is connected agriculture—linking those in a sector or within a value chain in which everyone involved has a vested interest (Miller 2011). Moving from conventional production and marketing (defined as ad hoc buying and selling transactions of producers, traders and agribusinesses) towards focused value chains reduces the inherent uncertainty of traditional production and value addition of agricultural commodities. The market is more secure, the price or method for price determination for the seller and buyer is agreed ahead and the type of produce and its quality and quantity can be similarly agreed. These factors make it easier to plan, and increase the efficiency by which traders or agri-businesses can organize collection, storage and processing, and for agro-industries to organize sales to supermarkets or exports. All can benefit with increased access to financing, both from financial institutions and from those from whom they have contracted purchases. In fact, financing is generally an integral ingredient of value chain agreements and can help 'glue' or bond value chain parties in a formal or, sometimes, informal relationship.

Value chain finance refers to the flows of funds to and through, or among, the various actors in a value chain. It is an approach to financing that uses an understanding of the production, value addition and marketing processes to best determine financial needs and provide financing to those involved (Miller and Jones 2010). The strength of value chain finance lies in helping to appreciate the risks of the business through understanding the risks and competitiveness in the value chain. This information can then be used both for investment decisions and to help develop financial products for the current and potential clients within the value chain.

Value chain finance can be either internal or external to a value chain. For example, when a dealer supplies inputs on credit to a producer, or a wholesaler makes an advance payment to a trader for the purchase of raw materials, these represent internal value chain finance. Internal financing between value chain actors is often 'embedded' with other services. Common forms of embedded finance are trader credit, input supplier credit, marketing company credit and lead firm financing. On the other hand, the flow of funds from an outside provider to a business or category of businesses (e.g. producers, traders, input suppliers) in the value chain is defined as external value chain finance. For example, when a bank lends money to a buyer so it can finance product purchases, or when a microfinance institution (MFI) provides credit to a farmer using a warehouse receipt as collateral, these are examples of external value chain finance.

Why is livestock value chain finance important?

Lenders, such as bankers and MFIs, are concerned with cost, risk and uncertainty. It is also less costly to finance those in a value chain than to independently assess and lend to each party individually. Furthermore, they can finance the most creditworthy parties in a value chain, such as the input suppliers or agri-businesses, and let them provide financing to others from whom they buy and sell. They can also increase efficiency and secure repayments by arranging for loan payments to be directly discounted at the time of sale. In addition, they can even lend to otherwise non-bankable clients without conventional collateral by using their forward-sale contracts or inventory receipts as collateral.

Lenders are often non-financial actors, such as buyers who use finance as a procurement instrument, and cattle raisers or poultry producers who use their suppliers and buyers as a source of financing for buying on credit or receiving advance payments.

Value chain finance is knowledge-based financing. Lenders require high levels of certainty of industry and market risks in the short and long terms, and of knowledge of production and price risks and client risks, yet the cost of acquiring such information is high. The leaders in a value chain, who are most often the processors and buyers, can provide this information. They know the industry and those involved in it. Lenders can use this to understand the business, nature of relationships and ability of the clients to repay a loan. Furthermore, this understanding is needed to ensure that the financial service conditions consider the cash flows and other interests of the additional actors within the value chain or chains of the borrower (Miller and da Silva 2007).

Value chain business models

The nature of the product, cash flow dynamics, type of relationships and risks associated with a value chain are influenced by various business models defined by who is the 'driver' of the value chain. There are several types:

- Producer-driven models
- Buyer-driven models
- Facilitated models
- Integrated models

Producer-driven models are ones in which the driver and principal decision-maker is the producer organization. Producers and even governments often envision this model as the most desired as it gives producers the greatest power. However, this model generally comes with higher risks for financing since many small producer organizations do not have the capacity and market knowledge for sustainable success and growth.

> **Box 1: Smallholder producer-driven business model**
>
> **UNAPEGA smallholder cattle association**
>
> In Bolivia, Heifer International, with its lend-a-heifer revolving in-kind credit program for undernourished rural families, facilitated the development of many village-level dairy cattle groups through training, pasture improvement and para-vet services. These were then organized in districts and an independent national organization, UNAPEGA, was created. It became an important leader in the dairy industry in the country with the creation of one dairy, shareholding or participating in others, and forming some cheese production setups. While UNAPEGA is not a financier, its members can more easily obtain financing either from banks or from the dairies and repayment obligations can be directly deducted from their sales.

Buyer-driven models, such as contract farming or out-grower schemes, have become much more common for value chains. The buyers contract producers to supply the product and offer them direct or indirect credit as one important tool. This assists producers to meet the delivery requirements of the buyer, and helps the latter to secure the product needed for factory throughput and/or marketing requirements. Financing conditions are set to fit the producer's cashflow schedule. For dairy, with regular payments, it is ideal; for beef cattle, it is more difficult and risky to finance. For competitiveness, smallholders producing on contract, especially for small animals, is becoming a norm, which opens avenues for financing as well as more market security and stability.

For value chains to include and benefit the poor, facilitated value chain models can be used. In this case development agencies facilitate or broker relationships for markets or financial institutions. In doing so they help build capacity, thereby reducing the costs and risks for those involved. For example, UNAPEGA was developed with the support and mentoring of Heifer International.

Finally, integrated models are ones in which the lead agri-business has full control and therefore power of coordination. This is common with larger conglomerate agri-business firms and can allow them to substantially reduce financing and business risks. The trend is for more industry consolidation of the meat industry by large integrated business models with built-in value chain financing. However, as shown below, even smallholders can be aggregated and benefit.

Figure 2. YES Bank, India smallholder dairy aggregation, services and financing model
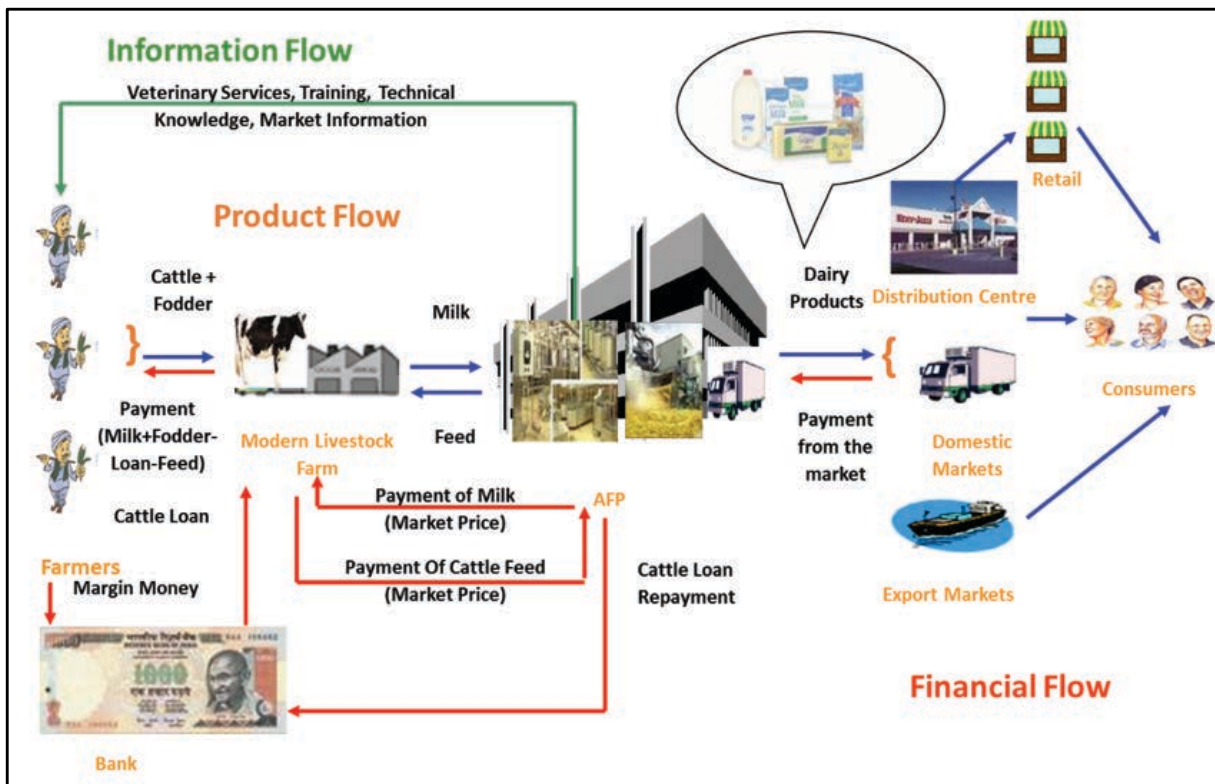
Source: Miller and Jones 2010

What financial instruments are appropriate for livestock value chain finance?

Many financial instruments or tools can be used in agricultural value chain finance. These instruments, summarized below, are not exclusive to value chain finance.

Product-linked financing involves the advance of funds or inputs to producers, intermediaries or processors to be repaid at time of delivery. This form of value chain finance is commonly practised in agrarian societies and allows traders, for example, to procure products, and provides farmers with needed cash or inputs, as well as a secured sale and price. As requirements for quality, safety and/or timeliness of products increase, there is more use of contract farming by a lead firm or company that often provides technical guidance as well as facilitating financing. The finance may be given directly to the producer, trader, etc., or the contracts and value chain partner relationship may be used by them to secure financing from financial institutions.

Receivables financing involves the selling of accounts receivable at a discount for receiving advance funding before collection. A bank or other financier advances working capital to agri-business (supplier, processor, trader and exporter) companies against accounts receivable or confirmed orders to producers. It takes into account the strength of the buyer's purchase and repayment history rather than relying on the company's collateral, thus extending access to credit. Factoring is a specialized receivable financial transaction whereby a business sells its accounts receivables (i.e. invoices) at a discount to a specialized agency, called a factor, who pays the business minus a factor discount and collects the receivables when due. Factoring speeds working capital turnover, credit risk protection, accounts receivable bookkeeping and bill collection services. The use of factoring in agriculture is quite new but it is becoming increasingly valued for small and medium agri-businesses.

Physical assets may also be used as collateral for financing in value chains. Crops, inputs or processed goods can serve as collateral as long as they are secure. Warehouse receipts guaranteeing the quantity and quality of the goods can be pledged as collateral for banks. In some countries, such as Brazil, crops can even be formally pledged early in the season. With financial leasing, the asset being purchased serves as the collateral since ownership stays with the financier.

Indigenous Agricultural Development Foundation

In the harsh climate of the Chaco of Paraguay, the multi-ethnic smallholder association Indigenous Agricultural Development Foundation provides its farmers with inputs, animal traction equipment and machinery pools, veterinary service, storage and financing. Cattle are the principal income, along with family food and limited commercial crop production. Cattle financing is carried out using solidarity groups of five families with the cattle serving as the guarantee and the solidarity group as a secondary guarantee. The cattle and offspring under loan are branded to ensure repayment. After more than 10 years of functioning, there have been no loan defaults (Source: Klassen 2017).

Finally, risk reduction instruments which reduce risk for the borrower and/or lender are important in value chain finance. Insurance reduces production and operational risks while futures and forward contracts do the same for price risk and market risks. Repurchase agreements, or 'repos', are also used for livestock fattening and are very common in Islamic finance. Other instruments, such as loan guarantees, enhance financing by reducing the lender's risks.

Value chain finance is not simply a collection of financial instruments, nor is it the use of one or more of the financial instruments noted above. Neither does the mere provision of Financial services to a borrower within a value chain capture the essence of value chain finance. Rather, the most important aspect of a value chain finance approach is to understand the value chain and its participants and processes in order to structure financing accordingly, using whatever instrument or instruments are most appropriate. Table 1 groups five categories of value chain finance instruments to illustrate their use.

Value chain financing offers a promising approach for financing livestock at any level, from producer to agro-industrialist. It does not replace the need for other banking services, nor does it substitute for sound financial assessment and practices. Rather, it is an avenue to improve efficiency and access to finance as it refocuses emphasis:

a.   From collateral to transactions of product and cash flows.

b.   From client activity financing to chain-focused financing.

c.   From conventional supply-driven financial products to efficiency and risk reduction, i.e. tailored financing.

d.   From collateral to transactions of product and cash flows.

e.   From client activity financing to chain-focused financing.

f.   From conventional supply-driven financial products to efficiency and risk reduction, i.e. tailored financing.

Opportunities and challenges

Value chain finance has been shown to provide many opportunities. However, in order for the financial industry to be able to take full advantage of its opportunities, there are many challenges to be addressed, especially in serving smallholders in less developed parts of the world. As shown in the following table, most of the challenges are due to a lack of capacity, both human and physical. For example, for small producers to be able to integrate into value chains, they require organization to have the economies of scale required. They require technical and management training and they must have roads and communications systems that are adequate to compete in the marketplace. Similarly, banks and MFIs need increased understanding of market assessment and need to gain experience in working with the various traders and agri-businesses in the value chains in order to structure their products and services to their precise needs in a way that can maximize the benefits of value chain finance.

Table 1. Considerations of value chain financing for livestock

Opportunities	Challenges
Value chain financing linkages offer increased financial access: - Lower transaction costs to banks and producers - Reduced financial risks to lenders - Tailored to fit specific chain needs	Required bundle of services for investment in value chains is lacking: - Small, unorganized productive capacity of many producers - Missing physical and financial infrastructure
Value chain financing concept provides increased understanding of agricultural and agri-business finance: - Better understanding, coordination and control of the marketplace - Improved long-term horizon for financial entities - Adaptation to future market trends	Capacity, understanding and hence commitment are missing: - Small farmers lack capacity and often production competitiveness - Agri-business and finance institutions lack experience and tools - Governments lack understanding and supporting policies
Increased opportunities for equity finance and capital market interventions: - Increased chain competitiveness - Improved understanding and risk mitigation for investors - Structured finance opportunities and new products	Required investment and support services are not available: - Risk-reducing services not universally available - Enabling policies and conditions are not in place in many countries - Fear of long-term investment with alternative collateral such as value chain financing offers is still common
Value chain financing is not socially exclusive (in principle, small farmers can benefit): - Leading non-governmental organizations (NGOs) in sector can facilitate small farmer inclusion - New technologies open new frontiers	Livelihoods are at risk for those excluded: - Exclusion of small producers is accentuated by the increasingly strict meat standards - Value chain financing benefits for actors integrated into chains, but many are not in chains

The future of value chain financing for the livestock industry

Two principal points can be concluded for agricultural value chain finance for livestock. First, the growth of Financial services embedded into or linked with the value chain can be expected to continue to grow as production and marketing system integration intensifies. Second, and perhaps most important, the concept and use of value chain systems is, and should become even more, important in informing financial service providers in their lending decisions and product development for agriculture. Using the knowledge of a value chain, assessing its strengths, risks and trends and assessing a loan client's position and competency within that chain, will inform the lending decision-making at both the client level and that of the providers' overall portfolio.

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Contributed papers session 1: Smallholders' access to credit

Factors affecting household decision to allocate credit for livestock production: Evidence from Ethiopia

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Abstract

Limited access to and use of agricultural credit has been identified as one of the constraints that hamper agricultural productivity by discouraging technology adoption and agricultural intensification by smallholders. Consequently, access to credit is often viewed as key to transforming semi-subsistence smallholders into market-oriented producers. However, few studies have examined factors that affect farmers' decision to allocate credit to farm activities in general and livestock production in particular in a systematic way that controls for selection biases. In this paper, we used a three-stage probit model with double selection bias corrections to analyse the determinants of credit use in livestock production. The first-stage probit model estimates determinants of household use of agricultural credit among credit-constrained farmers; the second-stage probit estimates credit users' decision to allocate the credit to agricultural activities, while the third-stage probit estimates determinants of the decisions by agricultural credit users to allocate the credit to livestock production. Using appropriate exclusion restriction variables, such an analytical framework, enables us to more accurately identify the variables that determine the decision to use credit for livestock production. The results are based on data collected from 5,000 smallholder farmers and 497 rural communities in Ethiopia. After controlling for two sample selection biases, we find that female-headed households, households with literate heads, wealthy farmers and farmers that have access to livestock-focused extension services are more likely to utilize credit for livestock production. Larger size of land detracts from credit allocation to livestock. The study highlights the fact that lending to female household heads may lead to increased access to animal-sourced foods for rural households. Furthermore, the study shows that improving farmers' access to credit should be accompanied with livestock-focused extension services that also consider the special needs of female farmers. The study's findings should be viewed with caution as only households with excess demand for credit were the subject of the analyses.

Keywords: livestock production, credit access, credit allocation, household decision, double sample selection

Introduction

Limited access to agricultural credit has been identified as an important constraint for smallholder agricultural development in many developing countries (Carter and Olinto 2003; Dercon and Christiaensen 2011; Guirkinger and Boucher 2008; Karlan et al. 2014; Tiffen et al. 1994; Winter-Nelson and Temu 2005). Consequently, access to and use of agricultural credit has been considered an important instrument to increase agricultural production and improve rural livelihoods (Abdallah 2016a; Gatti and Love 2006; Shimamura and Lastarria-Cornhiel 2010). Dong et al. (2012) reported that removing credit constraints in China would increase agricultural productivity by 75%. For sub-Saharan African (SSA) countries, increased access to credit is linked with increased adoption of agricultural technologies (Abdallah 2016b). At a macro level, limited access to credit has been identified as a major constraint that prevents people from escaping poverty (Kumar et al. 2013).

As in other developing countries, despite the pivotal role that agriculture plays in the livelihoods of Ethiopians and its contribution to the national economy, limited access to credit has been identified as one of the constraints that hamper agricultural productivity by discouraging technology adoption and agricultural intensification by smallholders (McIntosh et al. 2013). Access to and use of credit are particularly important for Ethiopian smallholders since smallholder farmers often operate with minimum capital and are trapped in a vicious circle of low investment leading to low productivity, which in turn leads to low income, and low levels of savings and investment.

The usefulness of any agricultural credit program, apart from its availability, accessibility and affordability, also depends on its proper and efficient allocation and utilization for the intended purpose by farmers. However, there have been limited studies that identify factors that affect allocation of credit to agricultural activities in Ethiopia. Studies on the determinants of farmers' decisions to use credit for livestock production are also scarce. This paper attempts to contribute to the understanding of smallholders' use of agricultural credit.

The contribution of this paper is twofold. First, it is one of few empirical studies that try to identify factors that affect households' credit allocation to livestock in systematic way that controls for confounding effects using three-stage probit models. Given the emphasis on financial constraints in livestock development, new empirical insights on household credit allocation are essential to design more effective development interventions. Second, the analysis relies on a comprehensive dataset that represents the major agricultural systems of the country.

This rest of the paper is organized as follows. Section two presents our conceptual framework. Section three describes estimation technique and the data used for the analysis, and presents descriptive statistics of the variables used in the model. Section four presents and discusses the descriptive and econometric results. Section five concludes the paper and draws implications.

Conceptual framework

Households obtain credit with specific purposes in mind. Credit can be used for agricultural or non-agricultural purposes. Credit used for agricultural purposes can be used for crop production or livestock production. Hence, we identify three decisions in the process of obtaining and using credit for livestock production (obtaining credit or not; using the credit for agricultural or non-agricultural activities; and using the agricultural credit for livestock or crop production).

Access to and use of credit are influenced by the transaction costs of obtaining the loan, the household's ability to repay the loan, and the expected return from the activities for which the loan is used. Hence, the three decisions are modelled as functions of household characteristics, farm characteristics, access to financial institutions and agricultural services, opportunity cost of factors of production and community-level factors that may have a bearing on returns to farm or non-farm activities.

The three regression models are modelled as follows:

$credit_i$ = F (hshd, farm, access, oppcost, commun)
$cruse\_a_i$ = F(hshd, farm, access, oppcost, commun)   EQ(1)
$cruse\_l_i$ = F(hshd, farm, access, oppcost, commun)

Where: $credit_i$ refers to whether the household obtained credit or not; $cruse\_a_i$ refers to whether the household used the credit for agricultural or non-agricultural activities; $cruse\_l_i$ refers to whether the household used agricultural credit for livestock or crop production; hshd refers to household characteristics (sex, age and education of household head, labour supply and total dependency ratio); farm refers to farm characteristic (size of cultivated land); access refers to household access to microfinance, markets and services (distance to microfinance institutions (MFIs) and to markets, and access to extension services); oppcost refers to the opportunity cost of the key factor of production (wage for off-farm employment); and commun refers to the community-level factor (communal grazing land per tropical livestock unit (TLU). Since we used identification variables in the second- and third-stage decisions, and not every variable is appropriate for each decision problem, the specifications of each of these regression models are not identical.

Econometric estimation, data and description of variables

Econometric estimation

Our aim is to identify factors that affect a household's decision to allocate credit to livestock production. We used a three-stage probit model with double sample selection. The first-stage probit model estimates determinants of household use of agricultural credit among credit-constrained farmers; the second-stage probit estimates credit users' decision to allocate the credit to agricultural activities, and the third-stage probit estimates determinants of the decisions of agricultural credit users to allocate the credit to livestock production. Using appropriate exclusion restriction variables, such an analytical framework enables us to more accurately identify the variables that determine the decision to use credit for livestock production.

To construct the log likelihood function, we need the probabilities for the four possible outcomes: a household not taking credit at all during the production year; a household taking credit, deciding to allocate it to farm activities and actually using it for livestock; a household taking credit, deciding to allocate to farm activities and actually using it for non-livestock production; and a household taking credit but using it for non-farm activities. Combining the above possible outcomes with their probabilities gives the log likelihood function of our model. The resulting likelihood function is maximized using the method of simulated maximum likelihood as described by Roodman (2011).

Data and description of variables

Data used in this analysis are drawn from a survey of 5,000 households and 497 communities conducted in 2014 in the four highland regions of Ethiopia (Amhara, Oromia, Tigray and the Southern region). The data refer to the 2012/2013 production season. Ten zones were selected for the study, from which 62 districts[1] were identified. The study area accounts for about 13.6% of the national area[2]. For sampling purposes, the study districts were stratified into 10 agro-ecological zones, and farm households were selected randomly based on the proportional to size sampling technique. Data were collected on household and farm characteristics, crop and livestock production, access to institutional services and infrastructure, community characteristics and income and expenditure.

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1   Among the surveyed districts, 31 are intervention districts of the Livestock and irrigated value chains for ethiopian smallholders (LIVES) project implemented by the International Livestock Research Institute (ILRI) in partnership with other national and international organizations to demonstrate market-oriented transformation of smallholder agriculture in Ethiopia. The remaining 31 districts are control districts for impact evaluation. For more information, please visit www.lives-ethiopia.org.
2   The national figures used to compute these percentages exclude the lowland non-sedentary zones of the Afar and Somali regions.

Descriptive statistics (percentiles, means and standard deviation) of the continuous variables used in our model are presented in Table 1. Looking at the socio-economic characteristics of the household, the results show that the average age of the household is 44 years, and one quarter of the household heads are less than or equal to 36 years old. On average, a household has about 3.2 members of working age (aged 15–64) with an average total dependency ratio of 1.1. A typical household in the sample owns about 1.3 ha of land while half the sample households own less than or equal to 1 ha. On average, a household has access to 0.1 ha of communal grazing land. The average value of household physical assets, both livestock and non-livestock, is estimated at ETB 33,000[3](Ethiopian birr). Microfinance offices, the nearest market town and livestock watering points are located on average within a 5.1, 10.2 and 0.4 km radius of the households' homestead, respectively. We use wage rate for off-farm employment as a proxy for opportunity cost of labour. Participation in off-farm wage employment is possible for women in rural Ethiopia but, not unlike other African countries (Swaminathan et al. 2010), it is not as frequent as for men. Hence, the daily wage rate for males is used in the analysis. The average daily wage rate for off-farm employment is about ETB 90.

Table 1. Distribution of continuous explanatory variables

Explanatory variable	Percentile					Mean	Std. Dev
	10	25	50	75	90		
Age of household head	30	36	43	50	60	44.3	11.1
Total dependency ratio	0.3	0.5	1.0	1.5	2.0	1.1	0.8
Number of household members aged between 15 and 64	2	2	3	4	5	3.2	1.5
Total cultivated land owned by the household (in ha)	0.3	0.5	1.0	1.8	2.8	1.3	1.3
Household asset value (livestock and non-livestock) in 10,000 (2013 ETB)	0.3	0.9	1.9	3.4	6.3	3.3	5.9
Communal grazing land (in ha per TLU)	0.0	0.0	0.0	0.1	0.2	0.1	0.1
Distance to livestock watering point (in kilometres)	0.1	0.1	0.2	0.5	0.8	0.4	0.5
Distance to market town (in km)	2.0	5.0	8.0	15.0	20.0	10.2	8.5
Daily wage rate for off-farm employment	72.9	81.2	90.1	99.6	108.2	90.2	14.0
Distance to rural saving and credit institutions (in km)	0.3	1.0	3.0	6.0	12.0	5.1	6.4

Means of the binary variables are presented in Table 2. About 81% of the sampled households are male-headed. Almost 83% reported receiving general extension services and only 67% received livestock-focused extension services during the production period under study. The literacy level of the household head is an important indicator of farmers' ability to process information. In this regard, the result reveals that 56% of household heads are able to read and write.

Table 2. Distribution of binary explanatory variables

Explanatory variable	Share of households
Male-headed household	0.81
Household receiving general extension services	0.83
Household receiving livestock-focused extension services	0.67
Household head who can read and write	0.56

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3   The official exchange rate of USD1 is equal to ETB 20.4322 as of 23 February 2015

Results and discussion

Descriptive results

Of those households which reported needing credit (1,400), only 66% managed to get it, 63% of which allocated it to agricultural activities such as purchasing inputs for crop or livestock production. A further disaggregation of credit use shows that of those who allocated the credit money to agricultural activities, about 66% utilized it for crop production while 34% used it for livestock production. On the other hand, 20% utilized the credit to cover household expenditures and 9.5% made use of it to start a small trading business. The remaining 67 households, which account for about 7.3%, spent the credit on activities other than those mentioned above.

The average loan obtained was about ETB 3,886 per borrower, ranging from ETB 100 to 70,000. The credit amount disaggregated by sex of household head reveals that on average the amount of credit received by male-headed households is higher than that received by their female counterparts (ETB 4,075 compared to ETB 3,156) and the difference is found to be statistically significant ($t = 3.230$, $p = .000$).

Households on average had 13.6 months to repay their debt. The terms of credit seem to differ for male- and female-headed households (13.4 months for male and 14.3 for female). However, test results show that the difference is not statistically significant ($t=-1.315$, $p=.189$). The result further reveals that 109 households, which account for about 12%, had to pay back their debt within six months. In most cases, smallholders had to wait for more than six months before getting any return on their investment in agricultural activities. Thus, farmers who are required to pay their loans within six months have limited options as to how to use the credit.

The average interest rate was found to be 13.6% and ranged from 0% to 50%. A zero interest rate is not uncommon in a rural setting where farmers resort to family or friends for credit with no interest rate. On the other hand, higher interest rates, such as the 50% rate, are charged by informal sources. Higher interest rates induce short-term credit. As a result, borrowers who face higher interest rates have an incentive to use the credit on activities that guarantee quick returns, such as petty trade, rather than longer-term investments.

Comparing the purpose of the credit with that for which it was actually used reveals that about 228 (168 male- and 60 female-headed) households did not use the credit money for the intended purpose. This accounts for 24.7% of households (23% male- and 31.6% female-headed) that took credit during the production season. A test for the relationship between credit diversion and sex of household head was found to be statistically significant, $x^2 (1) = 6.033$, $p = 0.014$. This indicates that female household heads are more likely to engage in credit diversion behaviour. In the literature credit diversion is associated with lack of sustainable income (Behrouz et al. 2012) and in rural settings female household heads have less access to income-generating activities than their male counterparts (De Janvry and Sadoulet 2001).

Model results

Farmers' decisions as to whether to allocate the credit to livestock production are modelled as a three-stage decision problem. Two probit models, namely the decision to take credit and the decision to use the credit money for agricultural activities, precede the probit equation of the decision to allocate credit to livestock production. Appropriate exclusion restriction variables are used to identify the second and third probit models.

To identify the second-stage equation, we used distance to credit sources as an exclusion restriction variable which has a statistically significant effect on the probability of getting credit (p=000) but became irrelevant both conceptually and empirically for the subsequent decision (p=0.172).

To identify the third probit equation, of the allocation of credit to livestock or crop production, we used wage rate for off-farm employment as an exclusion restriction variable. Wage rate for off-farm employment is a relevant variable in deciding to invest in farm or non-farm activities but once the decision is made to invest in farm activities, it becomes conceptually irrelevant for the decision to invest in crop or livestock activities. This assumption is supported by our test statistics, which show that wage rate for off-farm employment is statistically significant in stage 2 (p = 0.000) but turns out to be insignificant in stage 3 (p = 0.774).

The model assumes a non-zero correlation among the three error terms corresponding to the three equations in EQ (1). To test this assumption a restricted model is estimated by setting the correlation among the error term zero and a LR test is conducted. With x^2 (3) = 7.53, p = 0.057, the null hypothesis of zero correlation among the error terms is rejected. The above tests suggest that failing to account for the two-sample selection biases would result in biased inferences.

Credit market participation

Table 3 presents the results of the model estimations. Male-headed households are less likely to receive credit than their female counterparts. This could be because Ethiopian microcredit programs, which are the major source of credit for rural people, are deliberately targeting female-headed households. The literacy status of the household head has a statistically significant effect on the likelihood of securing a loan. Household heads who can read and write are more likely to get loans than those with no education by 7 percentage points. This is probably because households with more education are more likely to have employment opportunities, which makes them better bets for lenders.

Table 3. Model estimate of factors that affect a household's credit allocation decision

Explanatory variable	Stage 1 (Y_{1i}=1 if the household took credit, =0 otherwise)	Stage 2 (Y_{2i}=1 if the household allocated credit for farm activities, 0 otherwise)	Stage 3 (Y_{3i}=1 if the household allocated credit for livestock production, =0 otherwise)
Household characteristics			
Household head sex (1=male)	0.242**	0.190*	-0.344*
	(0.022)	(0.076)	(0.054)
Household head age	0.060***	0.014	0.009
	(0.006)	(0.597)	(0.830)
Household head age square/100	0.0537**	-0.011	-0.004
	(0.016)	(0.666)	(0.928)
Literacy status of household head (1=Literate)	0.199**	0.106	0.302*
	(0.012)	(0.256)	(0.052)
Total dependency ratio	0.023	0.030	0.074
	(0.689)	(0.637)	(0.438)
Labour supply	-0.011	-0.029	0.032
	(0.753)	(0.443)	(0.597)
Total land owned by the household (in ha)	0.084*	0.219***	0.559***
	(0.099)	(0.000)	(0.000)
Total land owned by the household squared	0.005	0.012**	0.031***
	(0.352)	(0.027)	(0.000)
Household asset value ETB (2013 prices)	0.017**	0.007	0.022**
	(0.021)	(0.277)	(0.044)

Explanatory variable	Stage 1 (Y_{1i}=1 if the household took credit, =0 otherwise)	Stage 2 (Y_{2i}=1 if the household allocated credit for farm activities, 0 otherwise)	Stage 3 (Y_{3i}=1 if the household allocated credit for livestock production, =0 otherwise)
Access to extension services and rural institutions			
Distance to livestock watering point (in km)	–	–	0.035
			(0.770)
Distance to market town (in km)	0.002	-0.003	0.000
	(0.681)	(0.532)	(0.971)
Access to general extension services (1=Yes)	0.275***	0.386***	0.369
	(0.005)	(0.009)	(0.284)
Access to livestock-focused extension services (1=Yes)	–	–	0.503***
			(0.005)
Peasant association (PA) characteristicsa			
Communal grazing land (in ha per TLU)	-0.335	0.218	-0.562
	(0.215)	(0.488)	(0.371)
Distance to rural saving and credit institutions (in km)	0.026***	–	–
	(0.000)		
Wage rate for off-farm employment for males	0.012***	0.011***	–
	(0.000)	(0.000)	
Constant	2.067***	0.613	-0.354
	(0.000)	(0.391)	(0.798)
Ancillary parameters			
ρ12	-0.078		
	(0.894)		
ρ13	0.011		
	(0.735)		
ρ23	0.842		
	(0.156)		
Log likelihood	1678.14		
LR ratio	227.55***		
Number of observations	1338		

Note: *, ** and *** denote significance at 10%, 5% and 1% level respectively, p-value in parentheses.

The likelihood ratio is asymptotically distributed as c^2 with 41 degrees of freedom.

a Peasant association is the lowest administrative unit in Ethiopia

Older households are more likely to get credit than younger ones, perhaps because older household heads are more likely to be rated as creditworthy. The negative coefficient for age square, however, indicates that beyond 55.4 years of age farmers are less likely to get credit.

Household wealth has a positive and statistically significant effect, indicating that lenders prefer wealthy farmers. Wealthy farmers are an attractive choice for credit institutions as they can easily provide collateral or are more likely to pay back the loan. This finding is in line with a recent study by Yuan and Xu (2015) in China, who found that poorer households have limited access to the informal credit market.

As expected, receiving an extension service is positively and significantly associated with the probability of securing a loan. All else being equal, access to extension services increases the likelihood of getting credit by 9.4 percentage points. Distance to MFIs, which is considered as a fixed cost of accessing credit, have a negative and statistically significant effect on a farmer's access to credit.

Agricultural and non-agricultural use of credit

Although male-headed households in our sample are less likely to receive credit, they are more likely to use the credit money on agricultural activities than their female counterparts. Conditional on being a credit receiver, an average male-headed household is 7% more likely to direct credit money towards farm works than is an otherwise comparable female-headed household. This is consistent with Swaminathan et al. (2010), who found that in Malawi, as compared to women, the majority of men use loans from formal credit sources to purchase agricultural inputs. This is probably because female household heads have limited access to agricultural resources such as land.

Access to general extension services is positively and significantly associated with farmers using credit money for agricultural production. All else being equal, receiving information and knowledge support from the extension services increases the conditional and unconditional likelihood of using the credit on agricultural activities by 21.3 and 11.8 percentage points, respectively. One reason is that households that have access to agricultural extension services are more likely to be exposed to a range of new agricultural technologies and are motivated to apply these new technologies (Emmanuel et al. 2016; Maffioli et al. 2013).

Use of credit for livestock production

The ultimate objective of this paper is to identify factors that affect households' decision to allocate credit to livestock production. Male-headedness decreases the probability of using the credit money on livestock production by 0.11 percentage points. Engagement in livestock production, particularly in small ruminant and poultry, is attractive for female farmers since their access to productive resources such as oxen and cropland that are needed for crop production may be limited. Even if they own land, female-headed households in Ethiopia are more likely to rent out much of it (Ghebru and Holden 2008). It is worth noting that livestock is the primary source of micronutrients for rural households. Combined with our results, the implication is that lending to females would improve households' nutrition status. In fact, Jin and Iannotti (2014), using data from a large-scale impact evaluation conducted in Kenya, found that targeting females in livestock production leads to improvements in child nutrition.

As expected, access to livestock-focused extension services has a positive and statistically significant effect on the probability of allocating credit for livestock production. Conditional on deciding to use the credit on agricultural activities, households whose head had received information and knowledge about improved livestock production were likelier to utilize the loan to invest in livestock production than those who had not by 15 percentage points, all else being equal. This is probably because access to livestock-focused extension services enhances farmers' knowledge and skills in relation to improved livestock production, which encourages them to engage in livestock production.

5. Conclusions and implications

This paper uses a three-stage probit modelling approach to identify the factors that affect a household's decision to obtain credit, allocate the credit to agriculture and, finally, to livestock activities. Different specification tests of the model show that accounting for the selection bias is a significant improvement on the one that excludes the stepwise selection process. By so doing, this study tries to contribute to the understanding of households' credit allocation decisions in Ethiopia. Results are expected to enhance the understanding of smallholders' behaviours and inform project implementers and lending institutions who work with farmers.

Results show that socio-economic and institutional factors have a statistically significant effect on small-scale farmers' decisions of whether to allocate credit to livestock production. This has implications for programs and projects that aim to improve small-scale livestock production. The fact that female household heads are more likely to allocate credit to livestock production indicates that extending credit to females may lead to improved household access to animal source foods and income. Thus, efforts to develop the livestock sector should adopt a gender-sensitive approach that addresses the specific needs of female farmers.

The results also show that access to livestock-focused extension services has statistically positive effect on farmers' decision to allocate credit to livestock. In addition, literate household heads are likelier to allocate credit to livestock production, implying that improving rural education and literacy can enhance livestock development. As a final note, the study's findings should be viewed with perspective and caution, as only households who had excess credit demand were the subject of the research.

Acknowledgement

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The role of contracts in improving access to credit in the smallholder livestock sector of Swaziland

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Abstract

The study investigates the role of contract farming in improving access to credit for smallholder cattle farmers in Swaziland. The objectives of the study are to determine the credit access status of smallholder cattle farmers, and whether participating in contracts leads to improved access to credit; and to identify the factors that determine smallholder farmers' access to credit from formal financial institutions and those that may lead farmers to become involved in contracts with other actors in the value chain.

Two sets of structured questionnaires were designed to capture the required data from farmers. Two logistic regression models were applied to the survey of 111 respondents who were selected using random sampling. The descriptive results indicated that 36% of cattle producers, 36% of cattle finishers and 50% of cattle traders have access to credit from financial institutions. The results from the logit model for participation in contracts indicated that off-farm income, access to extension services, being a member of a farmers' association and having access to market and marketing information were positively associated with farmers' involvement in contract agreements. The logit model on formal credit access indicated that off-farm income, age, herd size and training had significant effects on a farmer's probability of having access to formal credit. It is concluded that participating in contracts does not lead to improved access to credit, and that access to credit relatively decreases participation in contracts. Farmers' involvement in formal contract agreements should be increased, particularly by enhancing access to market, improvements in capacity building and encouragement of collective action by farmers.

Keywords: commercialization, access to credit, contract farming

Introduction

Access to credit is essential for the development of the agricultural sector. The agricultural sector in Swaziland accounts for about 25% of the total volume of credit from formal financial institutions, with commercial sugarcane farmers being the biggest recipients (Central Bank of Swaziland (CBS) 2012). However, the commercial banks are unwilling to participate in the provision of credit to smallholder farmers on Swazi Nation Land (SNL), due to their lack of collateral and the high cost involved in its administration (as smallholders usually borrow small amounts and are dispersed). Currently, there are no non-governmental organizations (NGOs) involved in providing credit to smallholder farmers in Swaziland (Msibi 2009).

In developing countries, including Swaziland, a major constraint on increasing the productivity of smallholder farmers is their inability to access credit from formal financial institutions. Despite many interventions involving supplier-led approaches to credit, limited success has been achieved in improving access to credit for smallholder farmers in Swaziland. Hence, the country is still searching for better ways to improve access to credit for smallholder farmers. Research has shown that improving access to formal credit will require a paradigm shift to a demand-driven approach (Zeller and Sharma 1998; Meyer 2002).

Contract farming has played a major role in improving access to credit for smallholder farmers, as empirical evidence from previous research has shown. As stated by Slangen et al. (2008), contracts have enabled farmers to gain access to a wide range of services that were otherwise unattainable, such as access to credit, markets, new technologies and risk reduction. Although contracts have the potential to improve access to credit, little research has been conducted in Swaziland to determine the role of contracts in enhancing access to credit. Results of a study by Da Silva (2005) on the growing role of contract farming in agri-food systems development indicated that credit is enhanced and typically supplied through input provision and as investment credit for the acquisition of machinery and buildings by the contracting firms or the banking system.

Masuku (2011) conducted a study on the role of contracts in sugarcane farming in Swaziland but did not address how participation in the contracts enhances access to credit from formal financial institutions for smallholder farmers. Studies on the role of contracts are few in the smallholder livestock sector and focus mostly on production and marketing of smallholder farmers' products, rather than on livestock farmers' access to services. They also focus on the impact of contract farming on the household income of smallholder farmers (Catelo and Costales 2009; Musara et al. 2011; Wainaina et al. 2012) rather than enhancing access to credit from formal financial institutions. There is also scant information on the determinants of participation in these contracts in the case of smallholder cattle farmers. Assessing the impact of contracts on smallholders' access to formal credit is important for the design and implementation of policies and strategies that aim to create sustainable markets for smallholder cattle farmers.

The main objective of the study is to investigate the role of contracts in promoting access to credit for smallholder cattle farmers, cattle fatteners and traders in Swaziland. The specific objectives of the study are to determine the credit access status of smallholder cattle farmers, finishers and traders; identify factors that determine smallholder cattle farmers', fatteners' and traders' access to credit from formal financial institutions; determine whether participating in contracts leads to improved access to credit; and determine factors that may lead cattle farmers to become involved in contract agreements with other actors in the value chain. The hypothesis to be tested in this study is that participation in contract farming will improve access to credit for smallholder cattle farmers, cattle finishers and cattle traders in Swaziland.

The rest of the paper is structured as follows: the research methodology is presented, followed by a presentation and discussion of the results/findings of the study. Finally, the conclusions and recommendations are presented.

Methodology

The study involved descriptive research using quantitative approaches. The credit access status of smallholder cattle farmers was analysed using descriptive statistics (means, standard deviation, minimum and maximum values). Logistic regression was used to analyse the factors influencing credit access and involvement in contract agreements. Data collected were analysed using SPSS version 20.0 software.

Logistic regression analysis was used to analyse the influence of independent variables on a binary/dichotomous dependent variable (access to credit, and contract agreement). Access to credit/contract agreement takes up a dichotomous criterion variable, that is, 1 =Yes, 0 = No. The logistic model takes the following functional form (Greene 2012):

$$Prob(Y = 1|x) = \frac{e^{x'\beta}}{1 + e^{x'\beta}}$$
$$= \ddot{E}(x'\beta)$$

(1)

Where: Y is the dependent variable taking the values of 0 or 1; x is the vector of dependent variables; β is the vector of coefficients to be estimated; and $\ddot{E}$ is the logistic cumulative distribution function.

Relating the usual regression equation (a + bX …. etc.), which is a linear formula, to the logistic regression equation, the equation is formed as:

$$\text{Logit}[y\ (x)] = \log\left[\frac{y(x)}{(1 - y(x))}\right]$$
$$= a + b1x1 + b2x2 + b3x3$$

(2)

Equation 2 has been linearized in order for the data to be easily fitted, hence the following two logistic regression specifications for contract agreement and access to credit:

$$\begin{aligned}&\text{Logit (contract agreement)}\\ &= \alpha + \beta1\text{Gender} + \beta2\text{Training} + \beta3\text{Extension} + \beta4\text{AM}\\ &+ \beta5\text{AMI} + \beta6\text{FA} + \beta7\text{Cr} + \beta8\text{BA} + \beta9\text{LF} + \beta10\text{Age}\\ &+ \varepsilon\end{aligned}$$

(3)

$$\begin{aligned}&\text{Logit (access to credit)}\\ &= \alpha + \beta1\text{Age} + \beta2\text{Herdsize} + \beta3\text{Farmsize} + \beta4\text{OI}\\ &+ \beta5\text{AMI} + \beta6\text{Training} + \beta7\text{CA} + \beta8\text{CF}\\ &+ \varepsilon\end{aligned}$$

(4)

The variables used in equations 3 and 4 are described in Table 1 under the results and discussion section.

Results and discussion

Description of major variables used in the study

As shown in Table 1, the average income level per month of cattle farmers from other businesses was between 1001 lilangeni (SZL) and SZL 2,000. The income is derived from sugarcane farming dividends, and vegetable, cotton and maize farming. Most smallholder cattle farmers in Swaziland are found on SNL, that is, communal land tenure. The average land or farm size allocated per farmer was two ha (ranging from 0 ha to 15 ha). A minority (13.2%) of the cattle farmers interviewed share land with other family members or members of their association, and this land is used for farming. Almost all farmers interviewed were members of farmers' associations.

The herd size of cattle ranged from 1 to 74 animals per farmer with an average of 18 cattle. The standard deviation of the average herd size is 16. Of the cattle farmers interviewed, a minority (16%) were involved in cattle fattening (this was done by cattle finishers). Almost half the population interviewed had verbal contract agreements of sale with other stakeholders in the beef value chain. Formal contracts were not used by smallholder farmers and for the beef value chain to improve, this mechanism is encouraged. The average number of cattle sold in the market was five animals with a standard deviation of 16 animals. From Table 1, it can be observed that a minimum of cattle sold was 0 with a maximum of 150, showing that some cattle producers did not sell their cattle in the previous year (2013) and the maximum of 150 animals sold was mostly by cattle finishers who were involved in cattle fattening.

Table 1. Description of variables used in the study

Variable	Mean	Std. Dev.	Min	Max
Farmer's age (years)	48.610	13.472	21	82
Education level[a]	2.650	1.235	1	5
Income in other business (OI) per month[b]	2.090	1.395	1	4
Association member[c] (FA)	0.700	0.462	0	1
Farm size (Fsize) (ha/farmer)	2.140	2.998	0	15
Herd size (Hsize) (number)	17.910	16.505	1	74
Cattle sold (number)	4.990	16.895	0	150
Cattle fattening[c] (CF)	0.160	0.366	0	1
Contract arrangement[c] (CA)	0.440	0.499	0	1
Market information[c] (AMI)	0.690	0.520	0	1
Access to training services[c]	0.480	0.503	0	1
Market access[c] (AM)	0.620	0.489	0	1
Access to extension services[c]	0.360	0.483	0	1
Bank account[c] (BA)	0.790	0.412	0	1
Loan facility[c] (LF)	0.600	0.494	0	1
Access to credit[c] (Cr)	0.440	0.499	0	1

[a]Illiterate=1; Literate=2; Primary=3; Secondary=4; Tertiary=5
[b]>E1000=1; E1001-E2000=2; E2001-E5000=3; <E5001=4
[c]Yes=1; No=0

More than half the cattle farmers had access to markets as well as market information. Training and extension services were provided to cattle farmers but less than half the population of farmers interviewed had access to such services.

Although more than half the cattle farmers had private bank accounts and had acquired informal loans for farming and livestock production, access to credit from formal financial institutions was a challenge for cattle farmers as these institutions require collateral which many smallholders do not possess. Less than half the respondents had access to credit from banks or microfinance institutions (MFIs) but money was easily available from friends and relatives.

Access to credit

Access to credit is one of the necessary factors for successful livestock production and productivity, as farmers need credit to improve their investment in new and improved technologies and to purchase cattle. Inability to access credit inhibits production and hence there is a need for the improvement of credit availability. According to the survey results, 36% of cattle producers, 36% of cattle finishers and 50% of cattle traders had access to credit.

The main sources of credit were friends or relatives, banks, MFIs, the Swaziland Meat Industry (SMI) and cooperatives or associations. From the survey table, it appears that cattle traders had more access to credit than cattle producers and fatteners. The main source of finance was Fincorp, the Swaziland Industrial Development Company (SIDC) and Swazibank, and other sources used by farmers were the Inhlanyelo Fund, Standard Bank and First National Bank. From

the surveyed sample, 70% of cattle producers, 92% of cattle finishers and 91% of cattle traders had access to banking services, such as bank accounts. These accounts were savings, investments and transmission accounts.

Factors influencing farmers' involvement in contract arrangements

Results in Table 2 summarize the logistic regression model to identify the factors that influence cattle farmers' involvement in contract agreements with other value chain actors. The model correctly explains 51% of the variation in the dependent variable (contract agreement) as reported by the Nagelkerke R square. Overall, a majority of respondents (58%) were not engaged in contract agreements. Logistic regression analysis was employed to predict the probability that a respondent would agree to be involved in contract agreement with other value chain actors. A test of the full model versus a model with intercept only was statistically significant at 1%, with 10 degrees of freedom and $x^2 = 39.9$. This means that the model with the variables is better than the one with the constant only. The model is able to correctly classify 66% of those who were involved in contract agreements with other stakeholders in the value chain and 75% of those who were not, for an overall correct predicted estimated model rate of 71% sample cases.

The results of the logistic model, although some coefficients are not significant, indicate that participation in contract agreement by a farmer is positively influenced by gender, off-farm income, access to market and marketing information, extension services, loan facility and being a member of a farmers' association. It is negatively influenced by access to credit, age and having a bank account. With the exception of having a bank account, the coefficients all have the expected signs.

A majority of the variables were significantly associated with farmers' involvement in contract agreements with other actors in the value chain. Three variables—bank account, loan facility for agricultural production and gender of the farmer-were not statistically significant. Age and off-farm income are significant at the 10% level, and access to credit, marketing information, extension services and being a member of a farmers' association are significant at the 5% level, while access to market is significant at the 1% level. This shows that access to market provides a greater opportunity for farmers to be involved in contract agreements, mostly with buyers, as this will guarantee a market for their product.

Table 2. Factors influencing farmers' involvement in contract agreements

Variable	B	Wald x2	p	Odds Ratio
Age	-0.039*	2.734	0.098	0.962
Gender	0.933	1.551	0.213	2.543
Off-farm income (OI)	0.483*	3.698	0.054	1.620
Access to credit (Cr)	-2.947**	4.478	0.034	0.052
Access to market (AM)	2.770***	11.783	0.001	15.955
Access to marketing information (AMI)	0.503**	4.975	0.026	1.654
Extension	1.482**	4.058	0.044	4.404
Bank account (BA)	-1.835	2.599	0.107	0.160
Loan facility (LF)	2.007	1.942	0.163	7.441
Association membership (FA)	2.576**	5.658	0.017	13.142
Constant	-3.914**	5.418	0.020	0.021

*,**,***Statistically significant at 10%, 5% and 1% respectively. R2 = 51% and correct prediction = 71%

A farmer who has access to formal credit is 0.05 times less likely to enter into a contract agreement with either input suppliers and/or output buyers, when all other variables are constant. The result is similar to studies by Costales et al. (2008), Sharma (2008) and Tongchure and Hoang (2013), in whose studies the logic was that producers with relatively more constrained access to credit were more likely to participate in informal or formal agreements with intermediaries in order to benefit from the contracting firm.

Further, an older farmer is 1.0 times less likely to participate in contract farming. The finding is in line with studies by Sharma (2008) and Musara et al. (2011), who stated that the negative sign for the age variable could be due to the negative correlation between age and adoption decision for most technologies in dynamic economic environments. This result is contrary to findings by Costales et al. (2008), who found that older farmers are more likely to participate in contract farming.

Access to market was identified as having a positive and significant effect on farmers' involvement in contract agreements. A farmer with market access is 16 times more likely to be involved in contract agreements than one who has no market access.

A farmer who is a member of a farmers' association is 13 times more likely to participate in contract farming than one who is not a member of an association. This variable has the second largest marginal effect on contract participation. This finding is in line with the results of Sharma (2008) and Tongchure and Hoang (2013), that farmers in farmers' or agricultural associations will participate in contract farming.

The odds ratio for off-farm income indicates that when all other variables are constant, a farmer with off-farm income is 1.6 times more likely to be involved in contract agreement with buyers of cattle and input providers. The findings vindicate studies by Sharma (2008), Wainaina et al. (2012) and Swain (2012), who found that having other sources of income will increase chances of farmers' participation in contract farming. On the contrary, Catelo and Costales (2009) and Musara et al. (2011) stated that when smallholder farmers have higher levels of off-farm and non-farm income, they are less likely to participate in contract farming because they have enough to finance their farming activities and still have enough for contingencies. Similarly, the odds ratio for marketing information indicates that a farmer is 1.65 times more likely to have access to marketing information for their product when they participate in contract farming.

Furthermore, a farmer who receives extension services from the government and NGOs is 4.4 times more likely to be involved in a contract agreement than a farmer with no access to extension services at all. The results are in line with a study by Wainaina et al. (2012) in terms of significance but contrary in the sense that their extension variable was negative, implying that farmers who obtain technical advice from government extension agents or NGOs are likely to be more aware and informed of alternative marketing channels and production methods, and thus less likely to participate in contract farming.

Factors influencing value chain actors' access to formal credit

Table 3 presents the results of the logistic regression model on factors affecting access to credit by farmers. The explained variation in the models in the dependent variable (access to credit) is 26.2%, as reported by the Nagelkerke R square. This indicates that the model represents a fair goodness of fit between access to credit by farmers and the explanatory variables. Overall, a majority of respondents (56%) had no access to credit. Logistic regression analysis was employed to predict the probability that a respondent would have access to credit.

The predictor variables are as described in Table 3. A test of the full model versus a model with intercept only was statistically significant at 1%, $x^2 = 19.35$ and 8 degrees of freedom, meaning the model with the variables is better than the model with intercept only. The model was able to classify correctly 59% of those who had access to credit and 82% of those who did not, for an overall correctly predicted estimated model rate of 72% of sample observations.

Employing a 0.05 criterion of statistical significance, the herd size, age and training variables had significant partial effects. Further, employing the 0.1 criterion of statistical significance, only income had significant partial effects while the other variables (farm size, contract agreement, cattle fattening and market information) were not significant even at this criterion.

This result corresponds with the a priori expectation except the negative effect of herd size on access to credit. Access to market information and being involved in cattle fattening also show a negative sign and were not significant. For herd size, which was significant at the 5% level, a farmer with a larger herd size is 0.95 times less likely to access credit from a financial institution than a farmer with a smaller herd size. The prediction was that the larger the herd size, the less willing a farmer will be to ask for credit from a formal credit institution. Yehuala (2008) stated that, as the total number of animals in the household increases, the household would be less likely to opt for credit as the animals can be easily converted into cash when demand arises.

Age was significant at the 5% level and yielded positive results. The odds ratio for age indicates that, all other variables being constant, an older farmer is 1.05 times more likely to gain access to credit from a financial institution than is a younger farmer. The result in relation to age is similar to a finding by Mohamed (2003) which reveals age as one of the five socio-economic factors found to influence smallholders' access to credit from formal and quasi-formal credit institutions.

Table 3. Factors influencing farmers' access to formal credit

Variable	B	Wald x2	p	Odds Ratio
Herd size (Hsize)	-0.048**	5.904	0.015	0.954
Age	0.045**	5.019	0.025	1.046
Training	1.144**	4.725	0.030	3.140
Farm size (Fsize)	0.070	0.613	0.434	1.073
Income	0.335*	3.208	0.073	1.397
Contractual agreement (CA)	0.634	1.373	0.241	1.885
Marketing information (AMI)	-0.122	0.520	0.241	0.885
Cattle fattening (CF)	-0.634	0.716	0.397	0.530
Constant	-2.931**	6.479	0.011	0.053

*, **,***statistically significant at 10%, 5% and 1% respectively. R2=26% and correct prediction=72%

Similarly, training has a positive effect on access to credit because this shows that the farmer has knowledge of the business and there is less chance of failure. At the 5% level of significance, the results show that trained farmers have higher probabilities of accessing credit. This finding vindicates studies conducted elsewhere, such as by Mohamed (2003) and Etonihu et al. (2013).

Further, income yielded a positive result but was significant at the 10% level. A farmer who receives income per month from other businesses is 1.4 times more likely to receive credit from a financial institution than a farmer with no income at all. This finding vindicates a study by Muhongayire et al. (2013) in rural Rwanda, which found that off-farm income has a significant influence on farmers' participation in credit market.

Conclusions and recommendations

The study has shown that fewer than half of smallholder cattle farmers, finishers and traders had access to credit and, on average, fewer than half of cattle farmers were engaged in verbal contracts with other stakeholders in the value chain, while none were engaged in formal contracts. Participation in contract farming by smallholder farmers was affected by off-farm income, access to assured markets, marketing information, extension services, age of the farmer, being a member of a farmers' association and access to credit. There is at present limited potential for implementing successful contracts because of the lack of appropriate institutional arrangements and incentives to support such innovations.

Access to credit from formal financial institutions was affected by herd size, age of farmer, training of farmers and income derived from other business activities. There is at present a limitation on accessing credit, attributable to the strict requirements for accessing loans and the limited regulation of formal financial institutions' interest rates by

the CBS. The physical absence of regulatory enforcement in the financial market seriously militates against farmers' chances of accessing credit from formal institutions.

Participation by smallholder cattle farmers in formal contracts should be enhanced through the promotion of access to markets and marketing information, promoting farmers' involvement in farmers' associations, enhancing access to extension services and promoting access to credit through contract farming.

Access to credit for smallholder cattle farmers should be enhanced through institutional supports, improvement in government policies and socio-economic initiatives. Farmers' involvement in formal contract agreements should be increased, particularly by enhancing access to market, improvements in capacity building and encouragement of collective action by farmers. There is a need to target the implementation and the monitoring of credit interventions for smallholder cattle farmers in order to improve their access to credit and participation in contract farming.

Acknowledgement

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Factors influencing farmers' uptake of credit for cattle fattening in two districts in East Java, Indonesia

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Abstract

The government of Indonesia has established several credit programs to support the development of cattle fattening, particularly for smallholder farmers. However, only a limited number of households involved in cattle fattening have been able to access that credit. A survey was conducted in 2015 to identify factors influencing access to credit by cattle fatteners in two districts (Tuban and Lamongan) in East Java Province, Indonesia. A total of 102 farmers, with and without access to credit, were interviewed using a structured questionnaire, and a logistic regression model was used in the analysis. The results showed that a significant factor influencing the ability of smallholders to access finance was the area of land owned by farmers ($P<0.01$) as land is an important form of collateral in taking out bank loans. Moreover, the probability of being a borrower was significantly better ($P<0.05$) for those farmers with more cattle and for those farmers whose primary occupation was off-farm or in non-farm industries, who generate higher and more regular income. In addition, the participation of farmers in groups was a significant factor affecting farmers' access to credit ($P<0.05$), in which case group membership appears to help them get assistance from livestock institutions or related institutions. However, income from cattle had a lesser, though still significant, effect ($P<0.1$), while education level and the type of pens used to fatten cattle were not significant factors affecting farmers' access to credit even though values for those factors were different between farmers with and without access to credit.

Keywords: beef cattle fattening, agricultural credit accessibility, logistic model

Introduction

Cattle play several roles in the life of Indonesian society. As a source of income, cattle are necessary to meet farmers' needs, particularly in the eastern islands of Indonesia (Ifar 1996; Talib et al. 2003). Some researchers have found that farmers in Indonesia generally keep cattle to cover primary expenses (farm input such as seed and fertilizer) and for secondary items such as motorcycles, houses and/or land or to pay for a wedding or religious ceremony (Padjung and Natsir 2005; Mahendri et al. 2010; Kalangi et al. 2014). Moreover, in rural communities cattle play a significant part in supporting farming systems such as cultivating the land (as draught animals) and producing manure (fertilizer sources). Cattle production also has an important sociocultural role in some parts of Indonesia, such as East Nusa Tenggara.

Cattle fattening is one type of cattle production which is an important part of the commercialization of the Indonesian cattle sector for a number of reasons. Firstly, this business keeps cattle for a short period. It also reduces the turnoff age and increases the rate of return on capital faster than a cow-calf operation. Moreover, farmers will obtain high profits if they are able to use efficient feed to gain a particular bodyweight for their cattle. This operation entails commercial activities and brings rural development opportunities for rural and land-poor households (Waldron et al. 2013). The next reason is that the fattening operation can play an important role in triggering the development of cow-calf operations due to the demand for feeder cattle by fattening operations. Finally, this business can stimulate the connection of farmers to the cattle or beef industry.

However, the establishment of cattle fattening operations requires high investment, especially in the initial period. This includes expensive feeder cattle, higher-priced feed, veterinary costs, high technical/infrastructure costs and higher demand for skilled labour. In fact, only a limited proportion of overall farmers have the skills, resources, incentives or willingness to enter fattening operations. In addition, there are series of high start-up costs such as pens, feed storage and a weighing system and farmers have limited access to capital to fund those costs. Most farmers in eastern and central Indonesia, as well as fatteners in Bangladesh, were unable to reach their capacity in cattle fattening due to limited money to invest in input production (Ahmed et al. 2010; Sujan et al. 2011; Adinata et al. 2012; Priyanti et al. 2012; de Rosari et al. 2014).

To deal with the finance problem, the government of Indonesia has established several credit programs to support cattle fattening, one of which is the Food Security and Energy Credit (Kredit Ketahanan Pangan dan Energi (KKPE)) provided by banks since 2007. Funding is sourced from both state-owned banks (such as Bank Rakyat Indonesia (BRI), Mandiri, BNI (Bank Negara Indonesia), Bukopin, CIMB (Commerce International Merchant Bankers) Niaga, BCA (Bank Central Asia) and BII (Bank Internasional Indonesia)) and regional development banks (Bank Pembangunan Daerah (BPD)) in some provinces. The interest rate subsidized by government reaches 7.5% and farmers pay around 6.5%. From 2010 to 2014, total credit for livestock decreased by about 45%. In 2014, banks provided IDR 2.4 trillion in credit for livestock, but only 27% of that credit was distributed to farmers (Direktorat Pembiayaan Pertanian).

The low investment in cattle fattening and limited number of households entering this business pose the question of what constraints and factors determine a farmer's decision to access credit. Therefore, this paper aims to identify factors influencing access to credit by fatteners in two districts (Tuban and Lamongan) in East Java Province, Indonesia.

Methods

Study area and data sources

Multisampling techniques were used in this research study, which were classified into three steps. The first step was purposively choosing the research areas, which were the Lamongan and Tuban districts in East Java province, Indonesia. East Java province has 28% of Indonesia's total cattle population and these two districts were selected because beef production is important and local government develops cattle fattening there. The second step was a selection of a group of farmers who obtained credit or had not borrowed money by means of stratified sampling. The cattle fatteners with and without loans were chosen randomly, based on information from banks, Dinas Peternakan dan Kesehatan Hewan Kabupaten and the leaders of farmers' groups in those areas. Finally, simple random sampling was used to select 102 respondents, who were 54 cattle fatteners who had experience of obtaining credit for their cattle fattening operations and 48 fatteners who had not borrowed money. A structured questionnaire was used to interview the farmers in regard to their cattle fattening practices and also to identify the constraints on obtaining credit.

Data analysis

Data from the survey were analysed using the binary logistic regression modelling technique through SAS software. In this study, since only two options were available, namely 'access to credit' or 'no access to credit', a binary model

was set up to define Y=1 for the situation in which the fatteners obtained access to credit; and Y=0 for situations in which the fatteners did not access credit from either formal or informal credit sources. Assuming that X is a vector of explanatory variables and p is the probability that Y=1, two probabilistic relationships, as asserted by Wooldridge (2009), can be considered, as follows:

$$p(Y = 1) = \frac{e^{\beta x}}{1 + e^{\beta x}}$$ (1)

$$p(Y = 0) = 1 - \frac{e^{\beta x}}{1 + e^{\beta x}} = \frac{1}{1 + e^{\beta x}}$$ (2)

Wooldridge (2009) concluded that since equation (2) is the lower response level, which is the probability that farmers did not access credit from formal and informal credit sources, this will be the probability to be modelled by the logistic procedure by convention. Both equations present the outcome of the logit transformation of the odds ratios, which can alternatively be represented as:

$$\log it[\theta(x)] = \log[\frac{\theta(x)}{1 - \theta(x)}] = \alpha + \beta 1 x 1 + \beta 2 x 2 + \cdots \beta k x k$$ (3)

and thus allow its estimation as a linear model for which the following definitions apply:

θ = logit transformation of the odds ratio; α= the intercept term of the model; β= the regression coefficient or slope of the individual explanatory variables modelled; and Xi = the explanatory or predictor variables. The logistic regression in this study can be specified as

$$Yi = \alpha + \beta 1 x 1 + \beta 2 x 2 + \beta 3 x 3 + \beta 4 x 4 + \beta 5 x 5 + \beta 7 x 7 \ldots + \mu k$$ (4)

Where: Yi = the dependent variable defined as access to credit by smallholder farmers = 1 and 0 otherwise; α = constant and intercept of the equation; X_1 = farmers' education; X_2 = having off-farm and non-farm occupations as a primary occupation, 1 = had off-non-farm occupation and 0 = otherwise; X_3 = total land owned; X_4 = participation in group, 1= yes and 0 = otherwise; X_5 = total of all cattle owned; X_6 = type of trough, 1 = trough made from concrete and 0 = otherwise; and X_7 = income from cattle per period.

Results

The characteristics of farmers

Generally, farmers in the Tuban and Lamongan districts were 47–48 years old, had gone to school for about eight years at the time of survey and had four family members. Most respondents (59%) in those areas were farmers, although about 31% had their main occupation in the off-farm and non-farm sectors. Other farmers' main occupation was as fatteners (only 4%) and traders (cattle and other commodities, about 6%).

The characteristics of the farming system

Farmers who had 26 years' experience of the farming system at the time of survey planted mostly paddy-rice two or three times a year, combined with peanuts, or left the area empty (fallow). On average, farmers had about 1.2 ha of rice field with the range of 0.05 to 6 ha of rice field, higher than the study by Priyanti et al. (2012a; 2012b) in the Malang, Pasuruan and Probolinggo districts of East Java Province, which averaged 0.4 ha and 0.7 ha of rice field.

The characteristics of cattle production

Most farmers (61%) specialized in cattle fattening, while 39% mixed their cattle fattening with CCO. Fatteners in research sites had an average of 14 years' experience of fattening.

Cattle fattening in East Java is also categorized into small-scale farmers, dominated by farmers (more than 79%) who fatten around two head of cattle. This figure is lower than the average number of cattle owned by smallholder farmers in Pasuruan, Probolinggo, Malang and Bandung, which reached three to four head of cattle (Perdana 2003; Priyanti et al. 2012b). While 14% of farmers owned about nine head of adult male cattle, 9% of farmers kept on average 11 head of young male cattle and 7% of farmers grew around seven head of calves. However, fewer than 9% of fatteners are large-scale, with an average of 27 young male cattle and 60 adult male cattle.

In general, farmers feed their cattle ad libitum with approximately 13 kg of native grass, and 8 kg of rice straw. Farmers substitute more rice straw for native grass and sometimes also use peanut, maize or soybean straw, which are only fed in the dry season and depending on availability. In addition, farmers commonly add 4 kg of a mixed ration consisting of rice bran and a small amount of salt and molasses to the large bucket of water (known as Ngombor). This is usually done two or three times a day and the amount of rice bran varies depending on availability. Forty-two per cent of farmers also feed their cattle with elephant grass, even if not every day.

About 89% of households use family labour for fattening on a part-time basis. However, 11% of farmers use non-family labour, both full-time (7%) and part-time (3%). Medium to large fatteners usually hire one to two non-family labourers to work on cattle production. The average labour cost is IDR 50,000[1] (Indonesia rupiahs) per day and IDR 30,000 per half day.

Cattle fatteners use either individual pens or group pens. Most farmers (91%) use individual pens for their cattle. However, a few farmers (11%) keep cattle in group pens, which can be managed collectively or individually. Most pens are standardized with stalls for one animal, a concrete floor and a concrete trough for feed and water. Only 30% of farmers have 'traditional' pens made from wood, where feed is placed on the ground. Farmers who get credit from banks usually build standard pens as one of the requirement for applying for credit.

Determinant factors for accessing credit

Certain factors determine access to credit, as shown in Table 1.

Table 1. The output of logit analysis for factors determining access to credit

Parameter	Estimate	Chi-square	Pr > Chi-square
Intercept	-3.3891	13.4912	0.0002
Farmers' education	-0.0690	0.4955	0.4815
Having off-farm and non-farm occupation as primary occupation	1.4013	4.3112	0.0379**
Total land owned	0.000106	0.0107	0.0107***
Participation in group	1.4796	4.5687	0.0326**
Total cattle owned	0.2161	4.6069	0.0318**
Type of trough	0.2602	0.1478	0.7007
Income from cattle per period	4.04E-8	2.8421	0.0918*
Odds ratio estimates	**Point estimate**		
Farmers' education	0.933		
Having off farm and non-farm occupation as primary occupation	4.061		
Total land owned	1.000		
Participation in group	4.391		
Total cattle owned	1.241		
Type of trough	1.297		
Income from cattle per period	1.000		

*less significant with confidence level 90% (P<0.1); **significant with confidence level 95% (P<0.05); and *** very significant with confidence level 99% (P<0.01)

The logit model for credit access shows the likelihood ratio chi-square of 57.13 with p-value of 0.0001. This number indicates that independent variables included in this model as a whole model fit significantly to explain factors considered in the decision of farmers to access credit, even though there are still some parameters outside this model which influence farmers' decisions.

Land assets

The size of the land owned by farmers correlated with access to credit. The obvious explanation is that farmers with higher land assets are more able to access credit because land is an important form of collateral in taking out bank loans. Survey results (Mahendri et al. 2016) showed that the number of respondents who obtained credit have more total land (1.54 ha of rice field) than those who did not borrow credit (0.62 ha of rice field). However, this result contradicts the study by Motsoari et al. (2015), who found a negative relationship between land ownership and the ability of farmers to obtain loans due to borrowers being involved in the government's credit program, which did not require land as collateral.

Off- and non-farm occupation

Farmers with a primary occupation outside cattle farming increase their probability of accessing credit by 1.4 times. This implies that those farmers who generate higher and regular income from off-farm sources are seen as a lower risk and more attractive. This is also related to one aspect of the bank evaluation process whereby only farmers who have capital can access loans. However, agricultural farmers in Lesotho, Africa who have an increased amount of total non-farm income, reduces demand for loans (Motsoari et al. 2015). They may use their non-farm income to purchase inputs for their agricultural activity. In turn, fatteners in two research sites in East Java, Indonesia who have an increased amount of non-farm income, have high demand for loans. This is probably because those fatteners usually use their non-farm money to support the farming system first and then for other commodities, such as for cattle fattening. Consequently, they need additional capital through loan or credit for cattle fattening activity. Based on survey data (Mahendri et al. 2016), 44% of respondents with credit had a primary occupation outside farming, compared to only 14% of farmers without credit.

Group participation

The participation of farmers in farmers' groups has a positive correlation and is a significant factor (P<0.05) influencing access to credit: if farmers are involved in groups, the probability of access to credit increases by 1.5 times. Mahendri et al. (2016) reported that three quarters of farmers who were successful in accessing credit participated in farmers' groups, while farmers without credit could not obtain credit because almost 50% of them did not participate in farmers' group. Group participation is not a mandatory requirement to access credit, as individuals also successfully access bank credit if they meet other criteria. However, if farmers form a group, accessing credit can be easier than it is for individual farmers in areas such as proposal preparation, budget planning and assistance from livestock or related institutions (training, permit letters or recommendations). The cooperative groups are also considered as security that makes banks confident in providing money and as concerns the easy administration of credit (Oluwasola and Alimi 2008).

Total cattle owned

Total cattle (male and female) owned by farmers has the expected positive sign and influences significantly (P<0.05) access to credit. One criterion of credit assessment from banks is capacity, referring to the existing capital base of the borrower's business that determines the additional capital required. The existing capital could be in the form of the number of cattle owned by farmers when applying for credit, such farmers being much more likely to receive loans than those who do not already have cattle. Cattle credit from banks may aim to help farmers to expand or

develop their existing cattle fattening business but not to build a new fattening operation, so farmers need to have cattle already. The result shows that a unit increase in the number of total cattle owned by farmers is more likely to increase farmers' chance of obtaining credit by 0.2 times (Table 1). In addition, the survey reported by Mahendri et al. (2016) showed that farmers with credit (more than 10%) were categorized as medium- to large-scale, with more than five head of cattle, while fewer than 5% of farmers without credit were placed in the same category.

Income from cattle

Total income from cattle also has a positive correlation to access to credit, confirming that increasing this factor raises the probability of a farmer accessing credit. Other criteria considered by a bank are 'conditions' which refer to the prospects, productivity and competitiveness of the cattle business. Farmers and banks are more confident in applying for and providing a loan if there is a certain increasing income generated by cattle. However, the result is less significant or significant at the 10% level. This is not surprising, because even if farmers generate less income from cattle, as long as they have additional income from outside cattle production, they still have greater capacity to pay back loans and pose a lower risk.

Education and type of pens

Education levels do not significantly increase or reduce the probability of farmers accessing credit. Indeed, the education of farmers who accessed credit was significantly higher than those who did not access credit (Mahendri et al. 2016). This is partly because farmers who obtained credit, particularly in groups, are helped by group leaders or Dinas Peternakan dan Kesehatan Hewan Kabupaten to process their loan application. In addition, having a cattle pen with a concrete trough was not a significant factor in accessing credit. This is because the types of credit in the two study districts (Lamongan and Tuban) consist not only of funding which requires standard pens but other types of cattle credit programs which do not include cattle pens in their criteria.

Conclusion

The size of the land owned by farmers is one significant factor that increases their access to credit. Farmers with higher land assets are more able to access credit because land is an important form of collateral in taking out credit. Moreover, farmers who have both more cattle and a primary occupation in off-farm or non-farm industries and thus generate higher and more regular income have a higher probability of accessing credit. In addition, the participation of farmers in groups was a significant factor affecting farmers' access to credit, as group membership seems to help them get assistance from livestock institutions or related agencies. However, income from cattle had a lesser, though still significant, effect ($P<0.1$), while education level and the type of pens used to fatten cattle were not significant factors affecting farmers' access to credit even though values for those factors were different between farmers with and without access to credit.

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Microcredit financing in rural economy or formal banking institutions—which has better positioned the smallholder livestock farmers for credit access in southwest Nigeria?

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Abstract

Livestock farming has remained of utmost importance not only as a means to meeting sustenance, protein and micronutrients requirement in food security but also as a source of livelihood of smallholder farmers most especially women in the rural Nigeria. To garner financial resources women livestock farmers have more often resolved to cooperative groups where they access microcredits while some have sought credit from more formal lending institutions. This study was therefore carried out, as a comparative study, to examine the acceptability and determinants of credit accessibility through the formal and informal finance sources in southwestern Nigeria. The survey instrument was a semi-structured questionnaire administered to 120 respondents randomly selected in a three-stage sampling procedure. Analytical tools employed in the study include descriptive statistics and binary logistic regression technique. The study revealed that 82.5% of the respondents currently access microcredits while 71.67% of the respondents will opt for formal institutions where available considering the longer repayment periods and moratorium. However, 92% still prefer cooperatives microcredit for the convenience, timeliness and ease of access. At 5%level, factors that significantly determine access to credit from formal banking institutions include livestock farm size, availability of guarantor, ownership of acceptable and perfected collateral, transaction volume in bank account and the duration for which banking relationship have existed while at 5%level, marital status, household size, stake amount in the cooperative pool account, and availability of guarantor determine access to informal funding source. This study recommends exploring microcredit funding option as they are more able to cater for the financial need of women farmers and hence down-tune the existing financial vulnerability.

Keywords: Binary logistic regression, financing, gender, livestock production, microcredit

Introduction

Agriculture is the oldest industry known to humankind and the source of food and raw materials for many industries. In fact, it can be justifiably referred to as the primary industry (Martin and Aja 1998). The case of Nigeria, like many

other developing countries, is peculiar in that its agriculture is largely characterized by the dominance of small farm holders, otherwise known as peasant farmers, and its large production in rural areas. Activities of individuals that fall within this category are characterized by small land space, high cost of production and vulnerability to pests and the outbreak of disease. More often than not, these farmers do not religiously embrace insurance and hence suffer severe loss when an unexpected, unpleasant situation arises. The rural sector harbours the majority of Nigerians and a successful attempt to improve the living standard of Nigerians in rural areas will definitely have an impact on the standard of living in Nigeria as a country.

Livestock production constitutes an important component of the agricultural economy in developing countries and is an instrument of socio-economic change, improved income and quality of rural life in Nigeria (Okumadewa 1999). Livestock plays multiple roles in the livelihoods of people in developing communities, especially the poor. It provides food and nutrition, work and economic and social status, and ensures environmental sustainability (Moyo and Swanepoel 2010). Reports by the World Bank (2008) and the Food and Agriculture Organization of the United Nations (FAO) (2009) indicate that the majority of the world's estimated 1.3 billion poor people live in developing countries where they depend directly or indirectly on livestock for their livelihoods. From the global perspective, livestock contributes about 40% to the agricultural gross domestic product (GDP) and constitutes about 30% of the agricultural GDP in the developing world (World Bank 2009).

Livestock products account for about 30% of human protein consumption (Steinfield et al. 2006). Waters-Bayer and Letty (2010) opined that beyond the important role that livestock plays in the provision of food and nutrition in people's diets, it also has important social functions given that it raises the social status of owners and contributes to gender balance as women and children have the opportunity to own livestock, especially small stock. Further to this function, livestock serves as a risk buffer in marginal areas with harsh environments, providing a means of risk diversification for resource-poor small-scale farmers and their communities, especially in the event of crop failure (Freeman et al. 2007; Thornton et al. 2009; Vandamme et al. 2010).

Several studies have suggested an alarming rate of rural-urban migration, resulting in the neglect of agriculture by strong young people, especially males, and leaving the older generation and women in charge of agriculture with the mandate of feeding an increasing population. Lawanson (2010) reported that women are the major actors in all aspects of life while Ogunlela and Mukhtar (2009) stated that the role played by women and their position in meeting the challenges of agricultural production and development are quite dominant and prominent. Their relevance and significance, therefore, cannot be overemphasized (Nnadozie and Ibe 1996; Rahman 2008).

In spite of the contribution of both sexes to food production, women's role in promoting economic growth and social stability, unlike that of men, continues to be inadequately recognized and under-valued. The factors responsible for this may be due to the male-dominated culture in Nigeria which gives women an inferior position in society; customs that forbid women from owning land; taboos and the sexual division of labour which keeps women subordinated to men; and the problem of unpaid productive activities performed by women in the domestic arena (Mohammed and Abdulquadri 2012).

The majority of rural farmers and non-farmer producers are poor, marginalized and credit-starved. This is attributable to the fact that, in most cases, they lack the much-needed collateral which is a prerequisite for accessing loans from the competitive money market. According to Mohammed and Abdulquadri (2012), women are more constrained than their male counterparts in terms of access to information technology, inputs and credit, among other things.

One of the reasons for the decline in the contribution of agriculture to the Nigerian economy is the lack of a stable national credit policy and a paucity of credit institutions which can assist farmers (Odoemenem and Obinne 2010). The current economic recession in Nigeria has brought a clarion call to diversify the economy from its current state of over-dependence on petroleum to agriculture, given the viability and prominent role the sector can play in the economy. A popular adage in Nigeria is that 'when hunger is solved as a component of poverty, then the poverty level is improved'. This may be likened to improving the food security status of the populace. The minimum daily protein requirement of 65 g is a prerequisite, alongside the daily energy requirement per capita, for an individual to be

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classified as being food secure. Livestock contributes an enormous percentage to the animal-source protein available for human consumption. The contribution of women and children in the supply of livestock cannot be overemphasized given that this set of people is most involved in livestock rearing, especially in rural economies. However, their activities are not without challenges, especially in terms of financing, which often inhibit them from achieving higher levels of production. Over the years, women have resorted to various approaches to fund their livestock farming activities, given the potential of their ventures in livelihood sustenance and contribution to household upkeep. Some of the funding avenues have been informal, in the form of various microcredit financing schemes, and others formal, through commercial banks.

Microcredit is an important instrument for improving the welfare of the poor directly through consumption smoothening that reduces vulnerability to short-term income variation (Afolabi 2008). Microcredit is considered able to energize or motivate other production factors. It can make the latent potentials or underused capacities functional in such situation credit acts as a catalyst, which activates the engine of growth in agriculture. Small-scale enterprises, including rural farmers in Nigeria, are confronted with inadequate capital despite the fact that they produce the bulk of food consumed locally and some export crops, generating foreign exchange to the country (Ugbajah and Ugwumba 2013). Not addressing the issue of financing in rural economies will, over time, lead to a state of perpetual poverty. It is therefore important to note that the neglect of rural farm and non-farm households as concerns credit is a setback for the Nigerian economy.

Commercial banks also have opportunities for funding targeted at rural farmer and non-farmer producers. However, as they are in the business of taking deposits from those with excess money and lending to those in deficit, the goal of commercial banks is clearly profit making, and their business is deliberately skewed towards non-agricultural businesses which offer more certainty.

Over the years, farmers and non-farmer producers in rural areas have been able to come together to form cooperative societies, pooling funds from which they lend microcredit to members to carry out their farming or business activities. The fields of micro and rural financing are interwoven. There is no clear cut distinction between them, especially in developing countries where most households are poor, simultaneously cultivating a small acreage of land and engaged in micro-economic activities.

Olaitan (2001) defined microfinance as the provision of credit, savings repositories and financial services to low-income earners or poor households to create or expand their economic activities and improve their standard of living. Toluyemi (1999) stated that microcredit is a small credit volume which is offered to small-scale enterprises to alleviate poverty by increasing the productivity of the poor (Toluyemi 1999). Microcredit is defined as small loans to very poor people for self-employment projects that generate income, allowing them to care for themselves and their families (Swider 2004). Microcredit has been variously defined; however, these definitions point to the fact that it is low-volume and targeted at the poor, aiming to bring them out of poverty by improving their productive powers. Hence, only enterprising individuals who are considered 'unbankable' by formal credit institutions are considered as prospects.

Microcredit has been viewed as a revolution in social and economic development that will pull people out of the depths of poverty (FAO 2004). The microcredit system was developed in response to the needs of small-scale farmers and rural entrepreneurs who did not have access to finance (New Agriculturist 2004). Women are well known for their prowess and demonstration of excellence in forming groups targeted at improving their communal welfare. This is evident in the number of groups, units, associations, clubs and the like founded and run by women.

In view of the foregoing, this research was designed as a comparative study of microcredit and formal banking institutions as a means of livestock financing in a rural economy. Specifically, the study assessed the acceptability and determinants of credit accessibility through the sources of finance.

Materials and methods

The study was carried out in southwestern Nigeria, which consists of the states of Lagos, Ogun, Oyo, Osun, Ondo and Ekiti. Figure 1 is a map of Nigeria, showing the southwestern region.
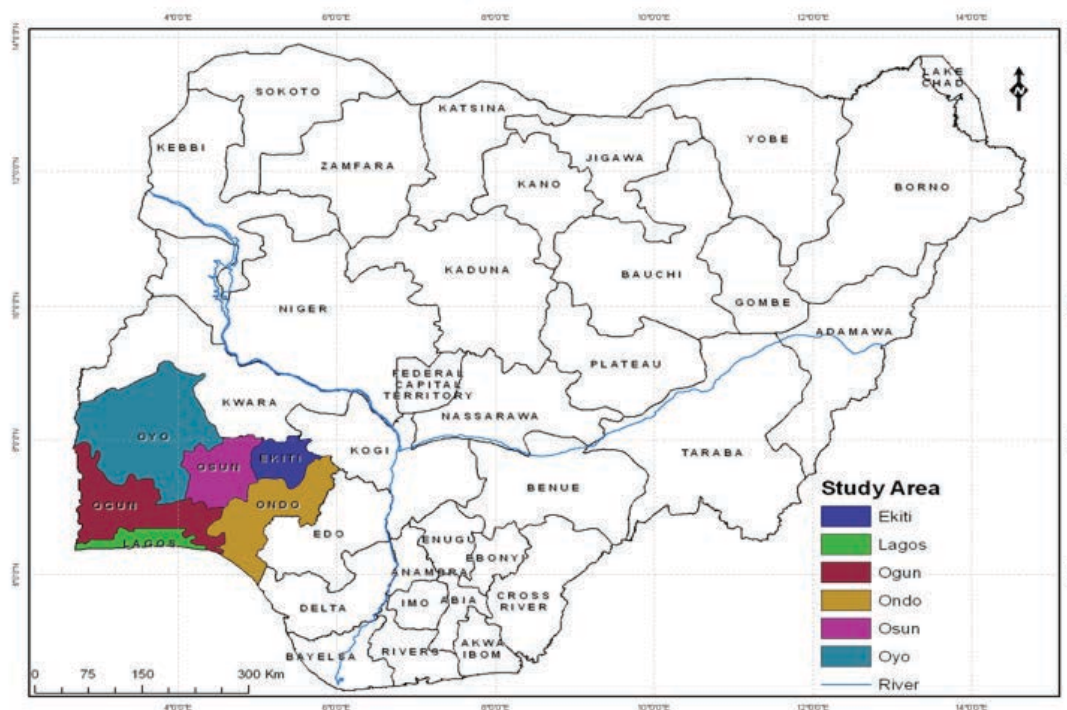
The zone lies between longitude 2°311 and 6°001 E and latitude 6°211 and 8° 371 N. Southwestern Nigeria has a total land area of about 77,818 square km and an estimated population of about 32.5 million. The area is bounded in the east by the Edo and Delta states, in the north by the Kwara and Kogi states, in the west by the Republic of Benin and in the south by the Gulf of Guinea. The climate of southwestern Nigeria is tropical in nature and characterized by wet and dry seasons. The temperature ranges between 21 and 34°C while the annual rainfall ranges between 150 and 3000 mm. The wet season is associated with the southwest monsoon wind from the Atlantic Ocean while the dry season is associated with the northeast trade wind from the Sahara desert. The climate is well adapted to agricultural activities, hence the high level of involvement in agriculture, mostly by the rural population. There is a pronounced level of livestock production activities among the rural population of the region, most especially by the women and children. All households can be said to be livestock-rearing households, as this has been taken up as a means of livelihood by individuals within households. The activity is dominated by women and children and it is even commonplace for a groom's family to pay livestock as part of the dowry, making it possible for each wife to own livestock when she gets married. Over time children gain access to such livestock, especially those that show a keen interest in looking after the animals. Sharing formulae exist which allow individuals to tend livestock on another's behalf and then share the animals' offspring.

The data used for the study were primarily sourced with the use of a semi-structured questionnaire. The questionnaire was designed to elicit the determinants of formal and informal credit access by women livestock farmers in the study area. A three-stage sampling technique was used in the selection of the sample size for this study. The first stage involved the purposive selection of one local government area (LGA) from each of the six states. The selected LGAs were Ikorodu (Lagos state), Irewole (Ogun state), Oriade (Osun state), Iseyin (Oyo state), Okeigbo (Ondo state) and Gbonyin (Ekiti state). The selection criterion was that the selected LGAs were located in rural areas of the states. The second stage involved the random selection of two villages from each LGA using the State agricultural development project (ADP) village listing. The randomly selected villages were Imagbon, Abule Igbira, Aba Lawani, Iwaraja, Fidiwo, Molarere, Aba Sule, Apenpe, Agunla, Lipepeye, Iro and Odilowo. The third stage involved the selection of ten female livestock farmers using the snowballing technique. This gave a total number of 120 respondents interviewed in this study.

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With the use of descriptive statistics and the binary logistic regression model, the study carried out a comparative analysis, assessing acceptability and determinants of formal or informal credit accessibility by women farmers in southwestern Nigeria. The explicit function for binary logistic regression is expressed as:

$Y = \beta X_i + e$

The implicit function is stated thus: $Y = \beta X1 + \beta X2 + \ldots + \beta X7 + e$

For women farmers who accessed formal credit sources, the variables modelled are as indicated,

where: Y is a dichotomous response variable (1 for formal credit source and 0 otherwise); X_1 = average monthly income; X_2 = awareness of funding terms and conditions; X_3 = livestock farmsize; X_4 = availability of guarantor; X_5 = ownership of acceptable and perfected collateral; X_6 = transaction volume in bank account; X_7 = duration of banking relationship; X_8 = marital status; and X_9 = household size.

For women farmers who accessed informal credit sources, the variables modelled are as indicated:

Y is a dichotomous response variable (1 for informal credit source and 0 otherwise); X_1 = average monthly income; X_2 = awareness of funding terms and conditions; X_3 = livestock farm size; X_4 = availability of guarantor; X_5 = ownership of acceptable and perfected collateral; X_8 = marital status; X_9 = household size; X_{10} = stake amount in the cooperative pool account; and X_7 = duration of cooperative membership.

Results and discussion

Table 1 presents the distribution of the respondents based on their socio-economic characteristics. Results from the table revealed that the majority of the respondents were of active age given that 80% were aged between 21 and 50. About 72.5% of the respondents were married, which might be an indication that they had access to family labour to assist with tending the livestock. Up to 25% of the respondents had no form of formal education. This may to an extent prevent them from being financially included, especially as relates to formal banking. Evidently, the majority of the women had incomes of less than NGN 10,000 (Nigerian naira), which is an indication that they were low-income individuals. This is an indication the women were financially marginalized, which may be a major constraint to expansion plans in their livestock farming. Seventy-three per cent of the respondents had a household size of six and below. This implies that the respondents had access to family labour which they may engage in livestock rearing.

Table 1. Socio-economic characteristics of sampled women livestock farmers

	Category	Frequency	Percentages
Age (in years)	11–20	10	8.3
	21–30	33	27.5
	31–40	27	22.5
	41–50	36	30.0
	>50	14	11.7
	Total	120	100
Marital status	Single	25	20.8
	Married	87	72.5
	Divorced	-	-
	Widow	8	6.7
	Total	120	100
Educ. status	Primary education	49	40.8
	Secondary education	21	17.5
	Tertiary education	2	1.7
	Adult education	18	15.0
	Koranic education	-	-
	No formal education	30	25.0
	Total	120	100
Monthly income	≤ NGN 10,000	77	64.2
	NGN 10,001–20,000	23	19.2
	NGN 20,001–30,000	16	13.3
	NGN 30,001–40,000	3	2.5
	NGN 40,001–50,000	1	0.8
	Total	120	100
Household size	1–3	18	15
	4–6	70	58
	7–9	24	20
	10–12	8	7
	Total	120	100
Source of financing	Cooperatives	99	82.5
	Commercial banks	21	17.5
Preference of funding alternative	Cooperatives	110	91.7
	Commercial banks	10	8.33

Source: Field survey, 2016

It was affirmed by 82.5% that they accessed funding through the various cooperatives of which they were members. A preference was indicated for cooperatives as a means of financing their livestock production by 91.7% of the respondents. They attributed this to the fact that accessing funding through their cooperative societies was less challenging than approaching formal banking institutions as they were unable to meet certain conditions required to access credit. However, 71.7% of the respondents asserted that they would patronize formal financial institutions if the stringent rules were relaxed since they were sure they would have longer repayment periods than those obtainable from their cooperative societies.

To identify the determinants of formal credit access by women livestock farmers in the study area, the binary logistic regression model was used. Table 2 shows the result of the analysis.

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Table 2. Parameter estimate for the logistic regression model for formal finance source Variables in the equation

	Variables	B	S.E.	Wald	Df	Sig.
Step 1[a]	X_1—monthly income	.002	.011	.016	1	.894
	X_2—awareness of funding terms and conditions	3.671	1.026	10.788	1	.651
	X_3—livestock farm size	.015**	.121	.013	1	.046
	X_4—availability of guarantor	0.49**	.261	.024	1	.036
	X_5—ownership of acceptable and perfected collateral	2.14***	.819	.056	1	.007
	X_6—transaction volume in bank account	2.64**	3.368	.641	1	.039
	X_7—duration of banking relationship	5.06**	0.049	.037	1	.043
	X_8—marital status	0.271	1.026	2.788	1	.071
	X_9—household size	1.38	.261	.024	1	.036
	Constant	-.758	1.543	.028	1	.864

Variable(s) entered on step 1: X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9
[a]Overall case correctly predicted 72.1%
[b]Model Chi-square 48.27

Table 2 reveals that the logistic model explains 72.1% of the factors determining access to formal credit sources by the women livestock farmers in the study area. From the table, it can be seen that ownership of acceptable and perfected collateral was significant at 1% while transaction volume with the bank, duration of banking relationship, availability of a guarantor and livestock farm size were significant at 5%. One question that may be interesting is: 'what form of collateral would a commercial bank classify as acceptable?' To a certain extent, this may be seen as subjective as the form of security will be determined by the bank; hence, what the respondents regard as being acceptable may be turned down as unacceptable by the bank. The number of years of banking with a commercial bank is also positively significant, implying that new women livestock farmers approaching a bank will be required to wait for years before they can start enjoying funding benefits, which is unlike the situation in cooperative societies. Transaction volume with the bank being positively significant will perpetually put low-income women livestock farmers at a disadvantage when it comes to being able to satisfy loan conditions imposed by a commercial bank.

Table 3. Parameter estimate for the logistic regression model for informal finance source .Variables in the equation

	Variables	B	S.E.	Wald	Df	Sig.
Step 1[a]	X_1—monthly income	.024	.014	.012	1	.606
	X_2—awareness of funding terms and conditions	3.671	1.026	10.788	1	.651
	X_3—livestock farm size	.065	.119	2.15	1	.0698
	X_4—availability of a guarantor	0.49**	.261	.024	1	0.043
	X_5—ownership of acceptable and perfected collateral	2.14	.819	.056	1	.007
	X_8—marital status	2.64***	3.368	.641	1	.009
	X_9—household size	5.06**	0.049	.037	1	.043
	X_{10} = stake amount in the cooperative pool account	0.271**	1.026	2.788	1	.041
	X_{11}—duration of cooperative membership	1.38	.261	.024	1	.036
	Constant	-.25.36	3.6783	6.018	1	.434

Variable(s) entered on step 1: X_1, X_2, X_3, X_4, X_5, X_8, X_9, X_{10}, X_{11}
[a]Overall cases correctly predicted 80.05%
[b]Model Chi-square 51.98

Table 3 reveals that the logistic model explains 80.05% of the factors determining access to credit from cooperative societies among the female livestock farmers in southwestern Nigeria. From the table, it can be seen that the availability of a guarantor, household size and the amount of the stake an individual has in the cooperative society were all significant at 5% while marital status was significant at 1%. One may deduce from this finding that it was easier for small-scale livestock women farmers to access credit through informal sources than through commercial banks. Microfinance funding appeared to be more integrity-based than the lending of commercial banks. In other words, the women farmers could more readily access financing from cooperatives based on their personal guarantee. This is a

promising observation given that most individuals in rural areas are usually very protective of the family name, causing a low default level among rural women despite the fact that no tangible property had been pledged.

Conclusion and recommendations

Having established the major roles that cooperatives play in the granting of microcredits in livestock financing in southwestern Nigeria, the study recommends exploring the microcredit funding option as more able to cater for the financial needs of women farmers and therefore reduce this group's existing vulnerability. There is a need to put a better structure in place in terms of cooperative management in order to be able to harness the numerous benefits of cooperatives. Long-standing cooperatives should be assisted by government through the advancement of loans to the societies for onward lending to individuals, as one may generally say that the chances of prompt repayment are very high. There is also a need to put in place periodic training of cooperative management staff so that their skills are sharpened to enable a better cooperative market.

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Risk assessment and management to enable access to credit for livestock actors

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Abstract

Credit rationing remains a major concern for livestock value chain stakeholders, in particular for smallholders for whom poor access to credit is one of the principal constraints on their activities. To date, the mismatch between credit supply and demand is usually tackled in sub-Saharan Africa (SSA) through the intrinsic attributes of credit applicants and very seldom, or never, through the prism of unavoidable multifaceted livestock risk management with a view to moving forward to an enabling environment. This is the approach adopted in this paper, which focuses on livestock risk assessment and management in Senegal, as well as on a thorough literature review, secondary data analysis, and interviews with public and private corporations and national and international research institutions working in the livestock sector. After the identification, quantification, impact assessment and prioritization of multifaceted livestock risks, we demonstrate how risk management contributes to the emergence of an enabling environment and stimulates access to credit.

Keywords: credit rationing, risk assessment, risk management, credit access, Senegal

Introduction

Between 2000 and 2012, Senegal's livestock sector contributed an average of 30% of agricultural gross domestic product (GDP) and 4.2% of total GDP, with average annual growth of 6.1% (Niang and Mbaye 2013). Livestock production activity supports nearly 350,000 families, equivalent to three million individuals (Niang and Mbaye 2013), just over a quarter of the total population.

Given the large proportion of rural households keeping small and large ruminant livestock, the role of ruminant livestock in improving farmers' cash income and livelihoods is limited by the weak access to technologies and innovations which are themselves largely dependent on the availability of timely and adequate credit. Many small farmers are credit-rationed (Reyes and Lensink 2011).

As elsewhere in SSA, access to credit for many smallholders in the livestock sector in Senegal is limited, constraining the growth of the sector. Beyond household attributes that could seem to be determinant for credit access, the risky

livestock environment limits access to finance and ultimately constrains its productivity, which requires investments from value chain and financial actors. The mismatch between the supply of credit and real investment needs, which is often attributed to logistical challenges, is also partly rooted in the high level of multifaceted risks. Most of the empirical literature focuses only on household attributes to explain credit rationing. However, it would also be useful to produce an evidence-based risk analysis of the Sahelian livestock sector to provide useful information for an enabling environment.

The purpose of our contribution is to demonstrate how livestock risk management should contribute to enable a livestock environment and facilitate access to credit. Section 1 introduces a theoretical framework to credit rationing. Section 2 provides a livestock risk assessment in Senegal and describes initiatives developed for risk management. Section 3 describes how to move forward for an enabling environment in order to increase the supply of credit.

Conceptual framework for measuring credit rationing

The supply and demand of credit are sometimes misaligned, and even thought to be irreconcilable. According to the seminal work of Stiglitz and Weiss (1981), then the important contribution of Jaffee and Stiglitz (1990), credit rationing occurs in situations with asymmetric information, in which lenders are not able to discriminate between high-quality and low-quality borrower attributes, thus leading to a non-Walrassian equilibrium that implies an excess demand for loanable funds. The term 'credit rationing' is mainly used in two circumstances: first, when some of a homogeneous group of applicants receive a loan and others do not, regardless of the level of interest rates they consent to pay; and second, when there are identifiable social groups in the population unable to obtain loans at any interest rates and whatever the volume of available credit (Stiglitz and Weiss, 1981). In other words, a potential borrower is credit rationed if their private demand for credit persistently exceeds the loan amount offered by the lender (Petrick 2005). However, linking credit rationing exclusively to asymmetric information has been strongly disputed as, empirically, this situation could inversely lead to a situation of overlending (De Meza and Webb 1987, 2000; Bonnet et al. 2016).

In addition, the literature widely addresses the causes of credit rationing. Beyond asymmetry of information, credit rationing may arise from the difficulties in overcoming excessive transaction costs, situations of poverty, costs associated with screening, monitoring and enforcement, collateralization issues and a risky environment in rural areas, mainly in developing countries (Binswanger and Rosenzweig 1986; Hoff and Stiglitz 1993; Ghatak and Guinnane 1999; Petrick 2005).

Adequate access to credit should contribute towards improving livestock productivity and sustain intensification activities by facilitating access to technology and innovation (Simtowe, Zeller and Diagne 2008, 2009). Adequate access to credit would contribute to farmers' livelihoods and their ability to purchase inputs and enhance investments (Reyes and Lensink 2011). Inversely, credit-rationed agents have more incentives to invest in less risky and less productive technologies (Dercon 1996). Furthermore, credit rationing could affect rural development by preventing households from diversifying these activities and moving out of poverty (Reardon 1997; Ellis 2000).

In SSA, most of the empirical literature focuses on the determinants of households' participation or non-participation in credit programs. This was the case in Ghana, where non-participation was strongly explained by fear of loan default and lack of savings, while the factors that significantly influence farm households' participation are the gender status of the household head, their formal education level, farm size and membership of associations (Asante-Addo 2016). Few contributions, however, found an analysis in the linking of credit rationing to global uncertainties that characterize the rural environment in the Sahel.

Livestock risk assessment analysis in Senegal

The livestock risk assessment provides a comprehensive and quantification of livestock risks in Senegal through a holistic approach (D'Alessandro et al. 2015; Wane and Mballo 2016).

General context

The Senegal livestock sector consists of three subsystems of livestock production: a pastoral subsystem based on mobility and extensive exploitation of natural resources and providing 549,737 Tropical Livestock Units (TLUs), or 19% of ruminants (cattle, sheep, goats) in the Ferlo region that covers more than one third of the national territory; an agro-pastoral subsystem in the southeast region concentrating up to 67% of cattle and 62% of small ruminants from the year 2000 (Niang and Mbaye 2013), which are gradually developing to the detriment of transhumant pastoral subsystems; and an intensive and semi-intensive subsystem in the Niayes region mainly producing poultry, eggs, pigs and, to a lesser extent, ruminants, particularly for dairy production.

This animal production activity in Senegal is evolving in a global context of severe socio-ecosystem shocks, as well as a deficit in infrastructure, basic social and economic services and a suboptimal and unfavourable environment (only 4% of investments in the agricultural sector and difficulties enforcing legal provisions adapted to livestock dynamics). In addition to these constraints, the livestock subsector in Senegal is facing climate-related shocks that are both a direct source of loss and an aggravating factor of economic, health and political and social threats.

Methodological approach

Our study mostly tackles risk assessment rather than constraint analysis even though there are obvious links between constraints and risks. Assessing risks in the livestock sector involves risk profiling, identification and inventory of current risk management initiatives, risk quantification, multiscale impacts and prioritization in order to facilitate risk management decision-making.

We carried out a very thorough analysis of the literature related to livestock dynamics in the Sahel in general and Senegal in particular. We compiled secondary data collected by public technical services, national and international research institutions and private companies, then processed these data for statistical purposes by using various techniques (Monte Carlo simulations, extreme value theory, descriptive statistics, mapping). We interviewed each segment of the livestock value chain stakeholders to better identify their perception of livestock sector strengths, weaknesses, opportunities and threats (SWOT analysis). A prioritization approach allowed us to classify the identified risks according to their severity, frequency and potential impacts. Finally, we went back to the main livestock stakeholders through a final workshop held in Dakar in June 2016 with the objective of assessing reasons for potential discrepancy analysis.

Table 1. Characteristics of data used and analytical methods

Types of data	Length of the series	Sources	Methods
Temperature	Monthly data, 1960–2014	National Civil Aviation and Meteorology Agency of Senegal (ANACIM)	Monte Carlo simulation and extreme value theory, time series analysis
Bushfires	Annual data, 2003–2013	Ecological Monitoring Centre (CSE)	Descriptive statistics, Extreme Values Theory
Animal diseases	2014–2015	Directorate of Veterinary Services (DSV)	Descriptive statistics, mapping
Markets	Monthly data, 2012–2016	Commissariat for Food Security (CSA)	Descriptive statistics, time series analysis
Conflicts	Annual data, 1960 to 2015	FAOSTAT (indirect measures based on the cattle decrease on some periods)	Descriptive statistics, Secondary data analysis
Cattle thefts		Directorate of Livestock—Livestock Theft Unit	Secondary data analysis

Risk assessment

The livestock situation in Senegal is mixed. It remains sensitive to multifaceted risks that could lead to physical and financial damage. Quantifying the financial costs of losses is truly challenging as they are subject to significant data,

statistical and model uncertainty. Using our own calculations and estimates from public and research institutions, we were able to determine the overall financial costs of the identified risks related to the Senegalese livestock sector. Under strong assumptions, the minimum average annual cost is estimated at XOF **601.05 billion (West African CFA francs), almost USD 1 billion in current values.**

Risk prioritization[1]

On the basis of criteria of severity, frequency and impacts, the scores obtained made it possible to prioritize risks related to the livestock sector: the dominant risk with a score of 5 is bushfires, followed by risks related to animal health (4.6), rainfall (3.84), markets (2.52), conflicts (1.81) and locust invasion (1.31).

Risks	Worst-case scenario severity	Average frequency	Average severity	Score
Bushfires	Very high	Very high	Very high	5.00
Animal diseases	Very high	Very high	Very high	4.60
Climate	Very high	Medium	Very high	3.84
Markets	Very low	Very high	Very low	2.62
Conflicts	Medium	Very low	Very low	1.81
Locust invasion	Very low	Very low	Very low	1.31

Depending on the agro-ecological regions specifically monitored as the main livestock areas, the hierarchy is changing due to the socio-ecosystemic realities: bushfires are a repetitive and very high risk in all livestock areas. Risks related to input deficits are high in the Niayes and Ferlo regions. Regarding rainfall variations, only the southeast region seems to be more or less protected from this phenomenon. Conflicts have recently had a greater effect on the very sensitive region of the Ferlo, closer to northern Mali and Mauritania. It is also important to consider the persistent internal conflicts in Casamance, the southern region of the country.

Risks	Ferlo region	Niayes' region	South-East region
Bushfires	Very high	Very high	Very high
Animal diseases	Medium	Very high	Very high
Climate	Medium	Medium	Very low
Markets	Medium	Medium	Medium
Conflicts	Very high	Very low	Very low
Locust invasion	Very low	Very low	Very low

Risk management to make progress towards creating an enabling environment

In the risky livestock environment, the government of Senegal (GoS) has historically and successively taken global and specific approaches to livestock sector development to help rural populations in general, and people living with livestock in particular, to cope with persistent risks.

In terms of general measures, public authorities launched two umbrella documents to support livestock sector development for 2011–2015: the Accelerated growth strategy document and the Economic and social policy paper. These documents develop options and strategies aimed at securing pastoral and agro-pastoral farming systems and fostering farms capable of meeting the challenges of internal demand for animal products with the main objectives of increasing livestock productivity, productions and incomes in Senegal. This was operationalized through the National Plan for the Development of Livestock (PNDE), validated in June 2013, as a provision of the Agro-Sylvo-Pastoral Act (LOASP) promulgated on 4 June 2004.

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1   Risk scoring is used, following the risk assessment methodology developed by the International Fund for Agricultural Development-the Platform for Agricultural Risk Management. The frequency, average severity and worst-case scenario were scored and weighted based on the following formula to reflect the greater importance of average losses as a better indicator for the long-term cost of risk: Risk score = 0.75 * (average severity * frequency)^0.5 + 0.25 * worst case

Other multi-sectoral initiatives were launched in 1998 with the establishment of the National Food Security Council (CNSA) attached to the prime minister's office and responsible for regular assessing of the food and nutritional situation of the Senegalese population.

In addition, through the National adaptation programmes of action (NAPAs) adopted in 2006, the GoS is pursuing the objective of reducing the vulnerability of production systems and better anticipating risks that could arise from climatic disturbances.

In order to facilitate access to credit for livestock professionals, the GoS set up a Stabilization Support Fund on 6 November 2007 but this did not start operations until June 2009. Measures have taken the form of various instruments: a guarantee fund to provide the banks and financial institutions with coverage for counterparty risks of up to 50% of loss-related loans; the interest rate subsidy fund to enable livestock professionals to benefit from the lowest rates in the agricultural sector; a Credit Fund to refinance the financing institutions approved by the fund; and a line of credit based on Islamic finance.

However, this coherent institutional network has not always succeeded in totally protecting the country from a number of threats in the livestock subsector. Some of these threats have been specifically addressed.

Risks	Risk management procedures and instruments
Bushfires	Every year, much of Senegal is affected by bushfires, which have a considerable impact on the development of the vegetation. The CSE, a national entity whose core activities include environmental monitoring, natural resources management and conducting environmental impact assessments, was charged to monitor fires by remote sensing since 1990 with a view to help the Directorate of Waters, Forests, Hunting and Wildlife conservation to identify and manage bushfires.
Animal diseases	The DSV has set up a National Epidemiological Surveillance System (NESS) to monitor priority diseases. This surveillance system is carried out through a ***passive surveillance*** based on field reports, entered in a data sheet and sent to the veterinary laboratory of The Senegalese Institute for Agricultural Research (ISRA) for confirmation or invalidation and an ***active surveillance*** based on the follow-up of a network of sentinel herds and during periods of risk, samples are taken and analysed following a very rigorous quantitative protocol.
Climate and feeding	As of July 28, 2008, an initiative resulting from a public private partnership (PPP) resulted in the establishment of the National Fund of Agricultural Insurance of Senegal (CNAAS), a public limited company. For the 'livestock' component, the CNAAS aimed to gradually cover the national herd with an average unit premium of 5% of the animal's value, i.e. 2.5% to be paid by the farmer. Amongst instruments, there is a 'rainfall deficit' policy that combines traditional and index insurance programs. However, given the persistent intensity of climate shocks, the GoS has undertaken a complementary initiative by investing in the programming and implementation of a disaster risk management system based on the Livestock Safeguarding Operation that organizes distribution of feed supplements to protect at-risk breeding livestock (lactating females, calves). In addition, some risks have been transferred to the Pan-African drought index insurance facility under the Agricultural risk capacity (ARC) initiative, a joint venture launched by the African Union to provide parametric insurance to cover climate shocks. The ARC uses satellite data sets to monitor rainy seasons, followed by a Water Satisfaction Index developed by the Food and Agriculture Organization of the United Nations (FAO) as a drought indicator, and estimates potentially threatened populations to establish emergency response costs.
Markets	While receiving technical and financial support from the World Food Programme, the Commissariat for Food Security (CSA) develops monthly bulletins on agricultural markets, expanded to include price monitoring on sentinel cattle markets. Beyond this, the CSA also has the duty of regulating the markets for local cereals, providing transversal studies and taking appropriate measures for the decision-making process.
Cattle theft	With the growing concern over livestock theft, the GoS has set up the Livestock Theft Unit, a structure attached to the cabinet of the Ministry of Livestock to provide a framework for the implementation of policies and reforms. Livestock thefts are subject to passive surveillance based on the reports of thefts reported at the level of the gendarmerie services which establish hand-rails recorded on cards sent to the Directorate of Livestock.
Conflict	Beyond the multiple consultation frameworks locally initiated throughout the country, Senegal needed a long-term vision to secure pastoral land. In March 2013, the new authorities of Senegal decided to initiate the process of drawing up a pastoral code with the aim of enabling the country to have a legal framework updated and adapted to current realities of livestock in Senegal. The Senegalese Pastoral Code will make it possible to update all existing laws and to formalize the livestock development framework in Senegal.

Population-specific discussion and conclusion

In Senegal, smallholders' attributes, along with uncertainty in outcomes, general socio-economic context (prices, rural practices, political and logistical challenges), environmental risks and the potential risk aversion of decision-makers, contribute both to limit access to finance and to constrain livestock productivity. To insufflate a real growth dynamic in the sector, livestock stakeholders have to invest, and in most cases, they depend on credit to do that. However, credit rationing, due also to persistent risks in the livestock sector, is one reason for the mismatch between credit supply and demand. The link between overall persistent risks and reduction of available credit is very weakly addressed even if in Senegal, this was already evoked during the 1988–91 banking crisis, showing how drought precipitated the closure of seven banks (Caprio and Klingebiel, 1996).

Policy developments in recent years seem to be moving forward towards creating an enabling environment. For risk mitigation, risk transfer, and risk coping, GoS launched various initiatives to address different degrees of severity. Amongst them, livestock insurance development, as a risk transfer instrument, should contribute both to reducing vulnerability by giving compensation options against economic losses that prevent smallholders in particular from using suboptimal coping strategies that further weaken a precarious food and nutritional status, or keep people away from limited basic infrastructures (school, health centres, markets etc.); and to developing productivity through revitalized investments.

In conceptual terms, the time has also come to begin thinking seriously about the best way to go beyond short-term loans and to design dynamic models that allow decision-making under uncertainty and incorporate long-term borrowing with a view to stabilizing the emerging of a real business environment.

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Contributed papers session 2: Value chains and market participation

Influence of microfinance participation on dairy commercialization: The case of small-scale dairy farmers in Kenya

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Abstract

Dairy commercialization is constrained by several factors, including lack of funds. In Kenya, smallholder farmers have limited internal capacity and resources to purchase farm inputs, and face high transaction costs. Overcoming the supply-side constraints related to feeding, breeding and animal health is important in achieving productivity, and access to microfinance institutions (MFIs) has been identified as playing a critical role in enhancing smallholder farmers' access to finance, thus curbing the supply-side challenges. The study sought to establish how microfinance participation influences dairy farming performance amongst smallholder farmers in contributing towards dairy farming commercialization. The study was conducted in Bomet County, Kenya and a multistage sampling method was used to obtain the sample of 150 dairy farmers interviewed using structured questionnaires. A Tobit model was used to determine the influence of microfinance participation on smallholder dairy farming commercialization. SPSS and STATA computer programs were used to process the data. The extent of milk commercialization by smallholder farmers was significantly determined by membership of groups, off-farm income, gender, age, years of education, household size, years of experience, microfinance access, access to credit, applicable interest rates and acquisition of a savings account. These findings offer insights on the importance of access to finance in facilitating agricultural commercialization. The study recommends the need to make MFIs easily accessible to farmers for greater depth of outreach. Furthermore, the study encourages dairy farmers to join farmer groups to improve their collective action and thus increase their bargaining power in the milk market.

Keywords: participation, commercialization, microfinance institutions, small-scale farmer, Tobit

Introduction

Since early 1910, Kenya has developed a dairy industry that ranks among the largest in Sub-Saharan Africa (SSA) (Ngigi 2004). It is estimated that currently 800,000 smallholder households depend on dairy for their livelihoods in Kenya and the dairy sector employs over 350,000 people in milk collection, transportation, processing and sales (Smallholder

Dairy Project (SDP) 2005). The demand for milk and milk products has also risen in Kenya, where the annual per capita consumption is now estimated at 145 litres, more than five times higher than milk consumption in the other East African countries (SDP 2005). With arable land and grazing fields becoming smaller in Kenya due to population pressure and land sub-division, zero grazing has grown to be a famous option for small-scale farmers who face land constraints.

Market access has also continued to be the main constraint facing smallholder commercialization of agriculture (Poulton et al. 2006), making smallholder farmers produce mainly for subsistence. According to Jaleta et al. (2009), agricultural commercialization technically entails a shift from subsistence production to a more complex market-based production and consumption system, leading to a strengthening of the linkages between the input and output sides of the market. Despite the various success stories in the Kenya dairy subsector, there is still a big gap between actual yield and attainable potential yield (Karanja 2003). This is mainly due to the fact that milk production by smallholder farmers is constrained by a number of factors: animal genetics, increased reliance on purchased feeds, diseases and insufficient financing (Staal et al. 1997).

The growth of this sector is mainly attributed to the dairy liberalization of 1992 enhancing informal milk market participation. The liberalization to include small-scale milk vendors (SSMVs) led positively to the growth of the dairy subsector (Wambugu et al. 2011). This led to the emergence of new institutional arrangements in milk collection, marketing and processing. The success of the dairy subsector is also attributable to the fact that milk provides a continuous stream of cash throughout the year for households growing other cash crops whose income is realized only once or twice a year, like coffee.

Small-scale and commercial dairy farming is widely practised in Kenya, managed at family level and ranging from natural pasture free grazing to zero grazing (stall-fed cut-and-dry systems, supplemented with concentrate feeds). Generally, smallholder farmers in Kenya have 3 to 5 acres (1.2 to 2.0 ha) of land and about two to five head of cattle yielding about 5 kg of milk per cow per day but producing up to 80% of the country's milk. Most of the smallholder farmers, however, operate below fund-secure levels to help them in meeting their production needs. The low credit supply limits the productivity of the subsector. According to Akanni (2007), the agriculture sector depends more on credit than any other sector of the economy because of its seasonal variation in returns and the changing trend from subsistence to commercial farming.

Since most smallholder farmers do not have collateral to access bank loans, microfinance institutions (MFIs) have gained considerable recognition in providing financial services to these low-income farmers. Through MFIs, the poor can access collateral-free loans at relatively low interest rates and use the money to expand their dairy farming and thus increase their incomes. Access to microfinance services is assumed to be leading to increased productivity among dairy farmers since they are able to acquire quality breeds for high productivity, purchase of quality feeds, proper milk storage facilities and the marketing of milk. Provision of financial services such as credit, savings and money transfer to smallholder farmers is considered to be an instrument able to break the vicious cycle of poverty, and ensure food security (Amha 2008).

Access to finance is therefore crucial in enhancing productivity of dairy animals and thus increasing the incomes of smallholder farmers. This study therefore sought to fill the knowledge gap in identifying the role and the influence of microfinance on commercialization among smallholder dairy farmers.

Methodology

Study area and sampling technique

The study was conducted in Bomet County, located in the southern Rift Valley region of Kenya, 300 km northwest of Nairobi. The county occupies a total area of 1997.9 km2 and lies in the mid-altitude range of 1489 to 2000 m above

sea level. It is divided into three agro-ecological zones, depending on rainfall level and soil type (red volcanic soils, black cotton soils, loam soils and sandy soils).

A multi-stage sampling method was used to obtain an appropriate sample size. Bomet County was purposively selected because of its dairy potential and the presence of many MFIs operating in the area. Using a list of credit borrowers obtained from existing MFIs, a stratified random sampling approach was used whereby the population was purposively divided into two strata: microfinance participants and non-participants. A list was prepared for each stratum using the serially numbered names of the farmers. From each MFI, farmers were selected proportionate to the size of the microfinance using a systematic random sampling procedure to give a total sample of 150 farmers (75 microfinance participants and 75 non-participants).

Analytical framework

A Tobit model was used to determine the influence of microfinance participation on dairy commercialization. The level of dairy commercialization was used as a dependent variable, referring to the mean level of commercialization determined by the mean value of milk sold divided by the mean value of milk produced by the smallholder farmers. The commercialization level helps to show the extent of market access. The Tobit model is based on the maximum likelihood technique (Gujarati 2004).

The structure of the Tobit model is given as:

$$Y_i^* = \beta' X_i + \varepsilon_i \tag{1}$$

Where: Y_i^* is a vector of the latent variable that is not observed for values less than zero and greater than one; ε_i, represent vectors of the independent variables; X_i is a vector of the unknown parameters; β is a vector of the error terms that are distributed normally with mean 0 and variance δ^2; and i=1, 2, 3. . .n represents the number of observations.

The implicit functional form determining the influence of microfinance participation and other factors on the performance of the dairy sector in terms of milk commercialization is given by:

$$Y_i^* = \alpha + \beta 0X1 + \beta 1X2 + \beta 2X3 + \beta 3X4 + ... + \beta nXn + \varepsilon \tag{2}$$

Commercialization:

$$(Y_i^*) = \alpha + \beta_1 age + \beta_2 gender + \beta_3\ Education\ level + \beta_4 Experience + \beta_5 Household\ size + \beta_6 FarmSize + \beta_7 Off\text{-}farm\ income + \beta_8 Savings + \beta_9 Credit\ access + \beta_{10} Group\ membership + \beta_{11} Interest\ rate + \beta_{12} Milk\ selling\ price + \beta_{14} Market\ distance + \varepsilon \tag{3}$$

Results and discussion

Socio-economic characterization of participants and non-participants

The gender of the household heads is shown in Table 1. The results indicate that a lower proportion of farmers who participated in microfinance were females (46%) while males constituted 54%. However, females were 28%, while males were 72%, of non-participants. The findings are supported by Langat (2009) who found that male-headed households in Bomet district participate more than female-headed ones in credit programs.

The age of the household head as an important demographic factor, measured in years, provides a clue as to the working ages of households. The microfinance non-participants had a slightly higher age than the participants, at

43 and 41 years, respectively. The dairy farming households in the county can therefore be regarded as young and belonging to an economically active group. The aggregate mean household size was five persons, as indicated in Table 1, with the mean household size of nonparticipants and participants being six and five persons, respectively.

Table 1. Household characteristics by farmer type

Variable	Participant average	Non-participant average	Aggregate average
Gender (% of Female)	46.00	28.00	
Age	40.70	43.08	41.89
Household size	5.77	4.90	5.34
Years of education	11.10	9.84	10.47
Experience(years)	12.28	11.54	11.91
Land size (acres)	3.05	2.89	2.97
Distance to market(km)	1.28	1.57	1.42
Selling price (Kenyan shilling (KES))	31.88	30.70	31.29
Quantity produced (l /week)	55.47	39.18	48.26
Quantity sold (l / week)	39.18	24.24	31.71
Quantity consumed (l / week)	15.49	13.99	14.74
Off-farm income (KES)	78,646.67	90,078.57	84,362.62

Source: Survey data (2015)

Years of education, as indicated in the results, shows that the mean number of years spent by the household head in school was 11.1 for the participants, while the non-participants spent less (9.8 years). This indicates that most people in the study area had primary education. Years of experience, on the other hand, shows that the aggregate mean in dairy farming was 11.91 years. Farmers participating in microfinance had more years of experience (12.28 years) in dairy farming, while the non-participant farmers had experience of 11.54 years on average

The findings showed that aggregate land size measured in acres was 2.97. The non-participants had a land size of 2.89 acres, while the participants had a slightly greater land size of 3.05 acres. The results in Table 1 also indicate the distance to the market or milk collection point, showing that farmers engaged in microfinance activities travelled a shorter distance (1.28 km) on average to sell their milk, while the non-participants had an average of 1.57 km to cover.

The amount of milk produced by participants in microfinance was an average of 55.47 litres per week, about 14 litres higher than the amount produced by non-participants (41.04 l). The results also show that the participants had higher quantities of milk sold and consumed, at 39.18 litres and 15.49 l, respectively than the non-participants, who sold 24.24 litres and consumed 13.99 l. The implication here is that the participants not only had a higher commercialization level (ratio of milk sold to milk produced) but also consumed more milk per week than the non-participants. The commercialization for participants was 70.63%, while the non-participants had the lower level of 59.06%.

The results of the selling price show that the aggregate milk selling price was KES 31.29 per litre. The microfinance members sold their produce at the higher price of KES 31.88 per litre, while the non-participant farmers sold at KES 30.70 per litre. the higher selling price among participants reveals the importance of collective action through microfinance groups in enhancing the bargaining power of farmers in terms of output price. Off-farm income, as expected, was high among the nonparticipants (KES 90,078) than the participants, who had an annual income of KES 78,646. Off-farm income comprised of annual average income from business, employment and other incomes apart from the farm income.

Factors influencing smallholder dairy farming commercialization

The Tobit regression analysis results in Table 2 were utilized to determine the influence of microfinance participation on smallholder dairy farming commercialization. The dependent variable is commercialization index (continuous

variable ranging from 0 and 1). Access to microfinance positively influenced dairy commercialization of the farmers at the 10% significance level. Access to microfinance services increases the probability of dairy commercialization by 3.3%. This implies that as the access to services offered by MFIs (credit, savings and insurance) increases, dairy farmers are highly motivated.

Table 2. Tobit marginal effects ($\delta y/\delta x$) regression outcome on influence of microfinance on dairy farming commercialization

Variables	$\delta y/\delta x$	Std. Error	P>/z/
Gender(*)	-0.001***	0.004	0.001
Agehh	0.038**	0.016	0.019
Land size (acres)	-0.535	0.597	0.370
Household size	-0.028*	0.634	0.095
Education level (years)	0.071*	0.039	0.077
Distance to market (km)	-0.197	0.468	0.674
Selling price	0.528	0.397	0.183
Off farm income	0.005*	0.003	0.080
MFI access	0.033**	0.048	0.038
Access to credit	0.061*	0.035	0.089
Interest rate	-0.039*	0.029	0.081
Savings account	0.054***	0.018	0.002
Farmer group membership	0.096**	0.048	0.047
Extension access	0.477	0.206	0.882
Number of observations	150		
Wald chi ^{2}(18)	37.54		
Prob> chi ^{2}	0.0000		
Pseudo R^2	0.0690		
Log likelihood	-257.217		

(*)$\delta y/\delta x$ is for discrete change of dummy variable from 0 to 1
*, **, ***: significant at 10%, 5% and 1% level respectively

Credit access, defined by Diagne and Zeller (2001) as the ability of a household to borrow from a source or not, had a positive and significant influence on dairy commercialization. The results show that access to credit increased the probability of commercialization by 6%. This result is in line with that of Javed et al. (2006), who found that access to credit has a significant positive influence on technology adoption. Through provision of credit, MFIs help to improve the liquidity of the farm and therefore enhance the improved adoption of dairy technology and household incomes.

Interest rate had a negative significant influence on commercialization. The results indicate that a 1% increase in interest rates leads to a 4% decline in commercialization. The implication is that an increase in the cost of credit has a negative effect on agricultural commercialization. The lack of capital, coupled with high interest rates by some MFIs, therefore places dairy industry profitability and productivity at stake. Hussain and Thapa (2012) found that expensive credit exploits the smallholder farmers' profitability, resulting in more reliance on informal credit than formal credit. According to Meyer (2007), the affordability of high interest rates, even if the clients are willing to pay them, is questionable since it generates lower profits to rural smallholder farmers than to large-scale farmers.

Possession of a savings account also had a positive and significant effect on the level of milk commercialization. Savings have a positive influence on the demand for credit. This finding is supported by Osoro and Muturi (2013), who found that small and medium enterprises (SMEs) increased their profit margin after opening savings account with MFIs.

This study further used a set of socio-economic variables theoretically linked to dairy commercialization to examine their influence on this. Membership of farmer groups, as expected, was statistically positive at 5%, influencing

the commercialization of dairy farming. The results indicate that membership of a producer group increases the probability of participating and commercializing dairy farming by 9.6%. This implies that belonging to a producer group increases the likelihood of a household improving its milk commercialization. The findings are consistent with Mukundi et al. (2013), who argue that producer groups can be good platforms for social capital formation and market information access.

Households with a higher proportion of off-farm income are more likely to increase the sale of milk. The level of milk commercialization increases by 0.5% for each additional unit of farm income. The result implies that households that have a higher farm income engage more in dairy farming. The result is also consistent with the findings by Agwu and Ibeabuchi (2011), who stated that high income leads to an increased amount of produce traded and the expansion of the enterprise because of reduced dependence on agricultural produce.

The gender of the household head significantly and positively influences market participation. Being a female-headed household increases the probability of participating in the dairy market by 1%, all other factors being constant. This suggests that female-headed households are more market-oriented than male; hence, they participate more in dairy farming and marketing and have relatively higher chances of joining farmer groups and MFIs, thus accessing funds to purchase dairy animals. The age of the household head also significantly and positively influences dairy commercialization. An increase in the age of the household head by one year increases the probability of increasing milk sales by 3.8%, all other factors being constant. The aggregate mean age of the sample was 42 years, implying that younger people are more enthusiastic about participating in dairy farming. Barret (2007) stated that younger people participated more in the market because they are more receptive to new ideas and are less risk averse than older people.

Years of education, as expected, positively influenced dairy farming commercialization. A unit increase in the years spent in education by the household head leads to increased commercialization of milk produced by 7.1%. This can be explained by the fact that as an individual accesses more education they are empowered with skills and knowledge about production and marketing, which enhances participation in dairy farming and marketing. Simonyan et al. (2010) also found education to be significant in augmenting farmers' ability to make important decisions. As hypothesized, household size was negatively related with the dependent variable (significant at 1%). As household size increases by one person, the commercialization of dairy products decreases by 2.8%. Mathenge et al. (2010) argue that household size accounts for the supply of family labour and household consumption level. This implies that as a household grows in size, the amount of milk for sale decreases due to increased home consumption.

Conclusion and recommendations

Access to MFIs was associated with higher commercialization since farmers are able to access micro-credits and micro-savings. Interest rates, as hypothesized, had a negative influence on dairy commercialization, an increase in interest deterring people from borrowing and hence reducing inputs and productivity. Maintaining a saving account had a positive influence on the level of commercialization: a savings account is associated with credit, leading to an increased variety of baskets of food; hence, an increase in the amount of milk sold translates into improved commercialization. Farmers should also be encouraged to engage in off-farm employment that buffers household income and makes them more creditworthy to achieve greater credit access. Furthermore, membership of farmers' groups had a positive effect on dairy commercialization. Therefore, dairy farmers should be encouraged to join farmers' groups, which improve their collective action and thus increase their bargaining power in the milk market. The study recommends policies that extend low-cost and timely microfinance to small-scale farmers and will lead to reduced inefficiency and promote increased dairy performance.

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Analysis of the beef cattle value chain in the forest-savannah transitional zone of Ghana

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Abstract

The production of beef cattle is an important agricultural activity in many Ghanaian communities. This study performed a value chain analysis and identified the constraints of the beef cattle value chain in the forest-savannah transitional zone of Ghana, using primary data obtained from 200 value chain actors through the administration of a questionnaire. The empirical results revealed that the key actors in the beef value chain were producers, wholesalers, butchers and secondary processors. The results revealed that butchers earned the highest margin but with the least value added. The empirical results of the Kendall's coefficient of concordance revealed that the high cost of production inputs, poor market infrastructure, high cost of transportation and high material cost were ranked by the various actors as the most pressing constraints. These results have implications for the development of the livestock value chain in the study area.

Keywords: beef cattle, value addition, value chain actors, marketing, constraints, Ghana

Introduction

The livestock subsector plays an integral role in the Ghanaian economy and has contributed significantly in supplying animal protein to the entire population. However, the contribution of the livestock subsector to the agricultural gross domestic product (GDP) is estimated to be very small compared with that of the crops subsector. The low contribution of the livestock subsector to the agricultural GDP can be attributed to the low livestock populations caused by inadequate attention being paid to the development of the subsector (Ministry of Food and Agriculture (MoFA) 2010). Over the years, the beef cattle industry has remained a key component of the livestock subsector and made a significant contribution to food security, wealth and income in most pastoral communities in Ghana (Food and Agriculture Organization of the United Nations (FAO) 2008; International Livestock Research Institute (ILRI) 2007). Yet demand for beef and its products far exceeds supply in the market and livestock farmers can take advantage of this fact to increase their production level. At the production level of the chain, different challenges facing producers have been observed. Adzitey (2013) identified feed and water scarcity during the dry season, low prolificacy and poor feed

conversion efficiency, the high cost of inputs and veterinary services, a high mortality rate, diseases and pest infections as well as theft in livestock production. The cost of veterinary services in Ghana is considered high by smallholder farmers (Adzitey 2011). Therefore, the problem of producers' inability to afford the cost of inputs and veterinary services when their animal is sick has resulted in the incidence of a high mortality rate among producers (Adzitey 2011). This has resulted in the country being an importer of both live cattle and beef from other neighbouring countries in West Africa to meet local consumer demand. Numerous studies have revealed that Ghana relies heavily on meat imports to bridge the ever-increasing meat demand in the country. These imports of animal products have been detrimental to the development of local production chains, notably in the country's livestock sector (Adzitey 2013; Asuming-Brempong and Nyantang 2003; Annor 1996). Furthermore, feed scarcity has always been problematic during the dry season in Ghana. During the dry seasons, there is low production because producers are not able to provide enough formulated feed for the animals. The consequences are that when smallholder producers are not able to add the needed value to the formulated feed, other intermediate actors (butchers, traders and processors) are also affected when supplied with these low-fed animals; intermediate actors may thus not gain substantial benefit from their meat businesses. As a result, producers are limited in terms of their capacity to fully invest in the production of livestock (MoFA 2004). Their inability to create the needed value has led to non-improvement in current production, processing and marketing in the beef cattle chain, which has resulted in low production and increased poverty and, relatively, has lowered the margin of smallholder farmers. Under this same circumstance, returns on investment in their production are not fully realized.

The second objective of the Food and Agriculture Sector Development Policy II (FASDEP II) was to link institutions and actors in the market (MoFA 2007). Despite this objective, one unique problem that has affected farmers and actors in the Ghanaian value chain is the inability of FASDEP II's implementation to ensure the market participation of stakeholders to effectively link up in the market chain to perform their initiated roles, activities and functions. Value chain linkages can be vertically or horizontally integrated to meet the marketing constraints of actors in the chain (Kit et al. 2006). Therefore, if chain actors are not vertically and horizontally integrated, value chain analysis (VCA) will help to identify pressure points and make market improvements in weaker links where returns are low (Schmitz 2005). Vermeulen et al. (2008) reported that both vertical and horizontal integration require capacity and capability that resource-poor farmers and chain actors lack, making integration impossible without support.

Although there are abundant agricultural activities, developing efficient marketing strategies for the supply of beef cattle requires management of the animals for high off-take and to maximize their value for meat production. Lack of proper selection of these beef cattle and market information have resulted in a low take-off rate among pastoral farmers, which has lowered the value of beef cattle during the value addition period to maintain their potential contribution and raise earnings from them. This implies that producers may not get a reasonable benefit from their marketed beef cattle supply unless appropriate marketing improvement strategies are put in place. However, to reduce this low trend of production, efforts should be made to develop beef cattle value chain development. This is because the value chain approach provides the basic understanding needed to design and implement appropriate development programs and policies to support market players' participation. Therefore, understanding the value chain approach will be crucial to bridge the gap in the beef value chain in the Ghanaian economy. Hence, the objective of the study is threefold: first, to map and describe the main actors, their activities, roles and marketing channels of the beef value chain; second, to estimate value added and profit margins of each actor along the main chain; and third, to identify and rank the challenges confronting the actors along the value chain.

Materials and methods

Method of analysis

Data were analysed using SPSS software to derive the descriptive statistics. In mapping and describing the various actors and roles, and the direct and indirect influence they have on chain performance, the source, make and delivery approach used by Foreign Investment Advisory Services (FIAS) (2007) was adopted. At every operational stage, a

link is drawn between the source of the major inputs used by an actor and the end receiver of the finished product. Likewise, a horizontal linkage was drawn to depict the policies and institutional service providers that affect the beef cattle industry.

Estimating of cost, return, value addition and profit margin of each actor

Table 1 presents a summary of statistics adopted in estimating profits and value addition in this study. It is worth noting that estimations of production costs, revenue and margins were strictly based on a common standard of measurement. All estimations were reduced to a per kilogram basis to allow comparison among actors. Secondly, estimations and analysis were based on the individual production/operation cycle of actors.

Table 1. Framework for the estimation of cost, value addition and profits per actor in the beef cattle value chain

Actors	Costs (GHC)/kg				Revenue (GHC)/kg				Margin (GHC)/kg	
	Total cost	Cost of primary inputs	Added unit cost	% Value unit cost	Unit price	Unit profit	Value added	% Total chain profit	Unit Gross chain margin	% Gross chain margin
Producers	A	B	A-B	(A-B)/O	C	C-A	C-B	(C-A)/P	C-N	C-N/Q
collectors/ wholesalers	E	D	E-D	(E-D)/O	F	F-E	F-D	(F-E)/P	F-N	C-N/Q
Butchers	H	G	H-G	(H-G)/O	I	I-H	I-G	(I-H)/P	I-N	C-N/Q
Processors	K	J	K-J	(K-J)/O	L	L-K	L-J	(L-K)/P	L-N	C-N/Q
Total			O	100			P	100	Q	100

Source: M4P (2008); Kuwornu et al. (2013). N = Unit VC; Value added = unit selling price-cost of primary input

Return on investment

To compare an individual actor's share of value added to that of other actors in the chain, the return on investment (ROI) is calculated. The ROI is estimated by dividing the profit created by the actors by cost incurred in producing an output. This is presented mathematically as:

$$ROI = \frac{P_0}{C_0} * 100 \qquad (1)$$

Where: *ROI* denotes return on investment; *Po* denotes the profit of output; and *Co* denotes the total cost of producing an output.

Estimating the return on investment per day

The return on investment per day is given as:

$$ROID = \frac{ROI}{T} \qquad (2)$$

Where: *ROID* is *ROI* per day; *ROI* is as defined above; and *T* denotes the number of days it takes to generate the returns.

Identifying and ranking the constraints that actors face along the chain

Kendell's co-efficient of concordance was used to test the agreement and significance levels among the actors. The formula is expressed as:

$$W = \frac{12\left[\sum T^2 - \frac{(\sum T^2)}{n}\right]}{m^2 n(n^2 - 1)} \qquad (3)$$

Where: W denotes Kendall's coefficient of concordance, T denotes the sum of ranks for each constraint being ranked; m denotes number of respondents; and n denotes number of ranking.

Statement of hypotheses

H0: There is no agreement among the ranking of constraints by the actors. Ha: There is agreement among the ranking of constraints by the actors.

Decision rule

If t-calculated is greater than t-critical, the null hypothesis (H0) is rejected in favour of the alternative hypothesis (Ha), that there is agreement among the ranking of constraints.

Method of data collection and sampling procedure

A pre-tested structured questionnaire was used for the collection of primary data from 200 value chain actors, comprising 80 producers, 40 traders, 40 butchers and 40 secondary processors. The study again employed the two-stage random sampling technique and snowball sampling technique during data collection.

Brief description of the study area

The transitional zone in Ghana is the second largest zone after the Guinea and Sudan Savannah (Oppong-Anane 2006). The four districts which make up the transitional zone are Wenchi, Techiman, Ejura-Sekyeredumase and Atebubu-Amantin. The zone covers an area of 10,630 km^2 with a population of 544,131. The main farming activities practised in the zones are mixed farming, mono-cropping, crop rotation and pastoral farming. The main animals reared include cattle, sheep, goats, poultry and pigs. The crops that are also grown include cassava, plantain, maize, rice and soybean. The rainy season occurs between April and October, with a short dry spell in August. The average annual rainfall is between 1,140 and 1,270 mm and the dry season occurs between November and February.

Results and discussion

Value chain actors' characteristics

The respondents were predominantly male. About 97.5% of 78 cattle producers from the 80 respondents were male, whereas the remainder, representing 2.5%, were female. This shows that males are dominant in beef cattle production and marketing activities in the study area. This is, however, not surprising considering the rigorous work involved in cattle production and the resultant stress on market participants. Livestock production in the northern parts of Ghana was dominantly carried out by males, representing 81.3%, as against 18.7% females (MoFA 2012). Likewise, the results show that 49% of the respondents had not undertaken any form of formal education and cannot read or write. On the other hand, about 51% of the total sample had undertaken formal education, with at least 13% of them acquiring primary/basic education, 22.5% acquiring junior high school/middle school education, 10.5% acquiring secondary education and the remaining 5% acquiring post-secondary or tertiary education.

Description and mapping of actors' roles, activities and functions

Figure 1 presents a flow chart to identify the actors, their activities and functions as well as their core processes and value adding activities in the beef cattle chain in the transitional zone of Ghana. The actors that were identified are beef cattle farmers (producers), traders (collectors and wholesalers), butchers and beef processors. The core functions along the beef cattle value chain were input supply, production, marketing and distribution, processing and consumption.

Beef cattle marketing

There were no contract relationships among actors. The most common form was the spot market relationship. Transportation plays a key role in the marketing of beef cattle. The results revealed that 68.5% of the respondents transport the main material by tricycle while 11% transported their cattle by truck. Only about 2% also transport their animal by motorcycle whereas about 5.5% of the total respondents used small pick-up trucks to transport animals to the market place. Interestingly, about 13% haltered the animal and walked it to the marketplace/abattoir, probably because of the absence of means of transportation or the inability of actors to afford transportation to market centres. The commonest mode of sale was by physical estimation. About 59% of the respondents from the pooled data usually do not weigh the animal before purchase, whilst 21% purchased/sold on live weight. On the other hand, 20% of the respondents (processors) purchased the slaughtered beef on count. Approximately 78% of the total respondents sold on spot cash while the remaining 22% of the total respondents sold their products on a credit basis. About 83% of the total respondents sold their animal for business in order to keep their production while approximately 14% sold their animals basically to pay their household expenses and provide basic necessities for their family. Some of these needs include clothing and shelter, paying fees etc. Only 4% of the pooled results sold for the sake of social obligation/festivals such as Christmas, Ramadan, Eid-Adhar and others.

Source of market information

Table 3 presents information on sources of market information for actors along the value chain. About 63.5% of the respondents indicated that they had received market information within the past 12 months while 36.55% indicated that they had not received any market information within the same period. The most important source of market information for the various actors (producers, traders, butcher and processors) was friends, representing 79.5%, while 7.7% of respondents sourced market information on the radio. About 12.8% of respondents obtained market information through their respective actor associations. Interestingly, none of the actors sourced or received any market information from government agencies.

Result of access to credit

About 23.5% of producers, 12.5% of butchers and 7.5% of traders source credit from friends and relatives with the remaining having no access to credit. Some farmer-based organizations also provided some benefits, such as advancement of credit to farmers.

Distribution of value added along the beef cattle value chain

The results revealed that, on average, beef cattle secondary processors add the highest value, of GHC 8.70 (Ghanaian cedi), representing a proportion of 48.96%. This is followed by the producer, with a value of GHC 5.1 (28.7%) per 1 kg of the beef cattle produced. Meanwhile, collectors/wholesalers added a value of GHC 2.11, representing a proportion of 11.87%, and, finally, the butchers added the least value, of GHC 1.86, representing a proportion of 10.49%. These results are consistent with work done by Gyakah (2014) on small ruminant value chain analysis in the Nadowli district of Ghana. It was realized in that study that the processors of small ruminants add the highest value of all the actors.

Distribution of profit margin

In the beef cattle value chain analysis, the profit share for the various actors (producers, collectors/wholesalers, butchers and processors) was estimated for the 2015 season. The results indicated that the butchers accrued the highest profit, of GHC 1.39, with a share of chain profit of 35.28% along the chain on every 1 kg of the processed and slaughtered beef cattle. The study concurs with findings by Kadigi et al. (2013), who found that beef cattle producers obtain the lowest prices and profit margins. In their studies, the largest share of profit margins was earned by butcheries and beef shop owners, who generated an average daily profit margin of about TZS 106,000 (Tanzanian shillings) per head of cattle at 200 kg of carcass; followed by traders who fatten their beef cattle before selling and earn an average profit margin of TZS 255,700 per head of cattle at 300 kg of live weight during the normal season and a profit margin of TZS 505.700 per cattle at 300 kg live weight during the peak season. They also reported that producers accrue less profit as a result of factors such as information asymmetry, lack of farmer-based organizations, distance to market and their inability to purchase quality production.

Figure 1. Flow chart of the beef cattle value chain
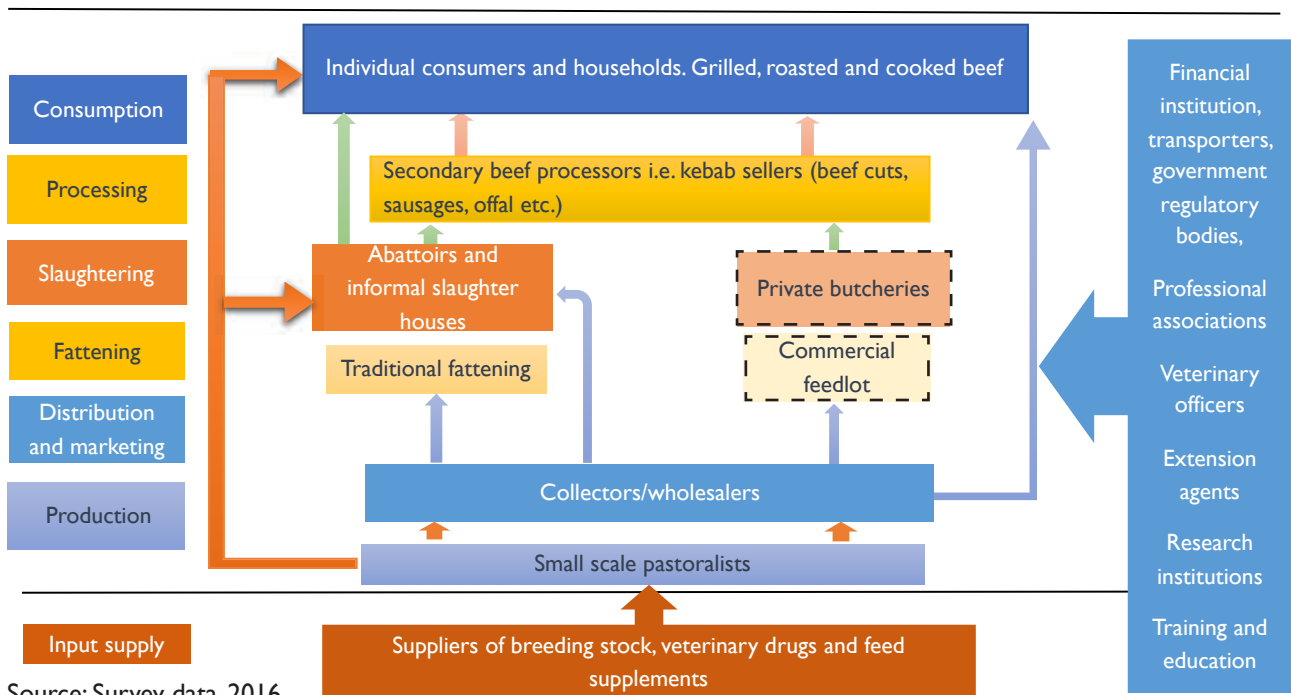
Source: Survey data, 2016.

Table 2. Beef cattle marketing information among actors in the chain

Variable	Producer		Trader		Butcher		Processor		Pooled	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Mode of transportation										
Truck	6	7.5	15	37.5	1	2.5	-		22	11
Tricycle	68	85	15	37.5	14	35	40	100	137	68.5
Motorcycle	4	5	-		-		-		4	2
Pick-up/ vehicle	1	1.3	10	25	-		-		11	5.5
On foot/ wheelbarrow	1	1.3	-		25	62.5	-		26	13
Mode of sale										
By weight	1	1.3	1	2.5	40	100	-		42	21
By physical examination	79	98.8	39	97.5	-		-		118	59
By count	-		-		-		40	100	40	20
Form of payment										
Spot cash	67	83.7	27	67.5	21	52.5	40	100	155	77.5
Credit payment	13	16.3	13	32.5	19	47.5	-		45	22.5
Main reasons for sale of main product										
Business	45	56.2	40	100	40	100	40	100	165	82.5
Household expenses	27	33.8	-		-		-		27	13.5
Social obligations/ ceremonies	8	10	-		-		-		4	4
Total (N)	80		40		40		40		200	

Source: Field survey (2016)

Table 3. Sources of market information by actors of beef cattle value chain

Variable	Producer		Trader		Butcher		Processor		Pooled	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Market information										
Yes	47	58.8	34	85	33	82.5	13	32.5	127	63.5
No	33	41.3	6	15	7	17.5	27	67.5	73	36.5
Source of market availability information										
Friends	42	89.4	21	61.8	17	51.5	13	100	93	79.5
Radio	5	10.6	4	11.8	-		-		9	7.7
Association	-		9	26.4	16	48.5	-		15	12.8
Government agencies	-		-		-		-		-	
Total(N)	80		40		40		40		200	

Source: Field survey (2016)

Return on investment per day

The butchers recorded the highest ROI value, of GHC 8.66, for every investment in their cycle with a ROID value of GHC 8.66. Of the remaining actors, collectors/wholesalers and secondary processors realized a ROI value of GHC 5.90 and GHC 3.53 for every cedi invested and a ROID of GHC 0.843 and GHC 3.53, respectively (Table 4). It can be concluded from the table that secondary processors' ROID was better than that of collectors/wholesalers as they operate daily. These results are consistent with Kadigi et al. (2013), who revealed that butchers obtained the highest return and efficiency ratio.

Table 4. Return on investment per day

Actors	Unit profit (GHC)	Unit TC (GHC)	ROI (%)	Days	ROID
Producers	0.71	14.39	4.93	1095	0.005
collectors/wholesalers	0.97	16.45	5.90	7	0.843
Butchers	1.39	16.06	8.66	1	8.660
Secondary processors	0.87	24.63	3.53	1	3.530

Source: Field survey 2016

Constraints along the beef cattle value chain

Table 6 shows the results of the constraint analysis. Poor market infrastructure was ranked first whilst unsatisfactory market price was ranked third by the producers. This concurs with the finding of Jabbar and Benin (2004), who revealed that due to the poor association and poor access to market information, producers complain of unsatisfactory market prices. High transportation was ranked first among traders. Butchers ranked high material costs and high market information and storage as the fifth constraint. Lastly, processors ranked high material costs as the most pressing constraint. There were agreements among rankings by the value chain actors (p<0.01).

Table 5. Marketing constraints of the value chain actors

Marketing constraint	Mean score	Rank
Beef cattle trader		
High transportation costs	3.88	1
High material (animal) costs	3.75	2
Poor market infrastructure	3.72	3
Inadequate credit	3.65	4
Unsatisfactory market prices	3.46	5
Theft incidence	3.43	6
Poor handling of cattle	3.25	7
Butcher		
High material (animal) costs	4.6	1
High slaughtering costs	4.58	2
High transportation cost	3.03	3
Lack of ready market	2.8	4
Lack of access to market information	2.78	5
Inadequate storage facilities	2.78	5
Beef cattle processors		
High material (animal) costs	4.22	1
High processing costs	3.9	2
Lack of ready market	3.38	3
High transportation costs	3.08	4
Lack of access to market information	2.75	5
Lack of access to credit	2.13	6
Problems with storage	1.97	7
Beef producers		
Poor market infrastructure	4.13	1
High transportation costs	3.98	2
Unsatisfactory marketing prices	3.46	3
Unavailability of market information	3.09	4
Diagnostics statistics of Kendell's concordance ranking		

	Traders	Butchers	Processors	Producers
Sample size	40	40	40	80
Kendell's W	0.21	0.42	0.56	0.38
Chi-square	39.78	84.67	133.29	66.24
Degree of freedom	6	5	6	3
Asymptotic significance	0.000	0.000	0.000	0.000

Source: Field survey 2016

Conclusions and recommendations

The study assessed the beef cattle value chain to map and characterize the beef actors' activities, role and function and value addition in selected transitional zone areas in Ghana. The key actors were producers (farmers), collectors/ wholesalers, butchers (retailers) and, finally, secondary processors. Core functions identified were input supply, production, distribution and marketing, processing and consumption. There was no contractual relationship and therefore the most common market identified for the sale of beef cattle by producers was spot market. There were no standardized measuring scales; hence, the commonest mode of sale was by physical examination. Likewise, the commonest means of payment at sale was cash. From the value addition estimation, secondary processors added the highest value, of GHC 8.7, of the chain. They were followed by the producers, at GHC 5.1, collectors/wholesalers, at GHC 2.11, and, finally, butchers, who added the least value, of GHC 1.86. From the results, producers, who undertook the majority of the activities, were perceived to get the least profit margin, of GHC 0.71/kg, followed by processors (GHC 0.87/kg) and collectors/wholesalers (GHC 0.97/kg), and butchers received the highest profit margin (GHC 1.39/kg). Per cedi invested per day, butchers recorded the highest ROID, of GHC 8.66, followed by secondary processors (GHC 3.55), collectors/wholesalers (GHC 0.843) and producers (GHC 0.005). In conclusion, butchers in the beef value chain perceived the highest ROI; therefore, the business seems lucrative and viable for other investors to venture into. The most pressing constraints on producers and traders are poor market infrastructure and high transportation costs, respectively. On the other hand, the most pressing constraints on butchers and processors are high material (animal) costs.

The study provides the following recommendations for improvement of the livestock value chain in the study area. First, the government of Ghana, through the livestock department and the veterinary directorate under the MoFA, should roll out a sensitization program and conduct effective training for the actors to create a harmonious operating system along the entire value chain from primary production to consumption, particularly at the producers' stage of the value chain, where they perceived that they received the lowest profit margin. The training should encourage producers to set aside a few animals for off-take in a year, undertake fattening practices to attract good prices and improve their animal husbandry practices to have good-quality animals for sale. This will enable farmers to take beef cattle production seriously in order to be able to reap more from the enterprise. Second, it is imperative to standardize trade among actors along the value chain, especially trade between producers and traders, as well as trade between producers and butchers. Transactions should be based on live weights of beef cattle instead of the existing arbitrary sales codes. This will go a long way to minimizing the disparities in profit shares along the value chain, thereby ensuring more equity. Third, the respective government institutions should identify the beef subsector as a very important sector, and take the lead in promoting marketing and providing supportive infrastructures such as a road network, transportation and other incentive regimes to attract the international market in future. This market development will also boost beef production among producers. Finally, there is a need to strengthen horizontal integration among the livestock value chain actors (i.e. farmers, butchers, traders and secondary processors). This requires that strong action plans be made, especially by bringing together all stakeholders who can articulate their needs and, together, build solid business relationships and better organize the whole value chain.

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Smallholder goat farmers' market participation in Choma district, Zambia

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Abstract

With recent increases in demand for animal products, smallholder goat producers have an opportunity to improve their livelihoods by increased market access and market participation. Thus, this study was carried out to identify the live goat chain actors, their role, linkages, power relations and practices in the supply chain; and to establish the institutional support services and enabling environment under which the smallholder goat farmers operate in the Choma district. To accomplish these tasks both qualitative and quantitative data were collected through use of semi-structured interviews, focus group discussions (FGDs) and a household survey of 105 smallholder household goat farmers selected randomly. Based on this information, goat market channels were mapped and profit margins calculated. Descriptive statistics were used to analyse the household data. The study outcomes indicate that live goats from the Choma district are marketed through three major channels, namely the urban trader, rural trader and trader Choma market channel, which are all indirect marketing channels. The market actors in these channels were producers, traders (urban and rural), wholesalers, retailers and input service providers, with a significant number of goats channelled through the urban trader channel. To analyse the performance of the goat market, costs, profit and market margins were calculated for each market channel. The majority of the respondents were male, at 65.4%, while 34.6% were female; the mean family size was nine and 51.9% of the respondents had attained a primary level of education. Respondents had been involved in goat production for an average of 9.2 years, with 49% producing an average of 12 goats annually. Farmers identified high disease prevalence, lack of production skills, lack of access to market information, high cost of transportation, lack of access to credit and lack of market infrastructure as the constraints in the goat chain. Results of the Kruskal-Wallis nonparametric test of independence (P = 0.05) revealed that there is no statistical difference between the three market outlets with regard to experience of the farmer, farm size, herd size, annual household income and family size. Cost of production was significant across the groups. Study findings highlighted that there is a need to enhance production through the improved provision of veterinary services, access to credit and extension services. The study recommends the fostering of partnerships among the chain actors to ensure that an enabling environment is created for the easy flow of market information, and infrastructure development to improve the goat marketing system.

Keywords: chain dynamics, constraints, market chain, market participation, transaction cost

Introduction

The livestock industry plays a significant role within the sub-Saharan African (SSA) region. On average, the livestock sector contributes around 35% to the agricultural gross domestic product (GDP) in the region (Otte and Knips 2005). It provides direct livelihood opportunities to 10% of the population of SSA while a further 58% depends, indirectly, on livestock. Similarly, the livestock sector in Zambia contributes 28% to the agricultural GDP (African Development Fund Zambia (ADFZ) 2013) and supplies raw materials to agricultural industries, which account for 35% of manufacturing value added in the country (Otte and Knips 2005; ADFZ 2013; International Bureau for Animal Research 2013).

The livestock production system in Zambia follows a dual structure, comprising a large traditional sector and a small commercial sector (Chilonda et al. 2000). Smallholder livestock producers own 70% of the livestock in the country, predominantly cattle and goats (Lubungu et al. 2012). This translates into a total of 253,539 households raising goats, which constitutes 38.7% of all livestock-raising households (Central Statistical Office 2003). Goats play a critical economic and social role in the lives of smallholder producers, as a source of wealth in the absence of formal financial institutions and other missing markets (Negassa et al. 2011).

Rapid urbanization, coupled with diet diversification, increased household income and population growth, has enhanced the demand for livestock products, including goat meat, in Zambia (Hichaambwa 2012; Pingali 2010). Thus, it is crucial to harness these emerging market opportunities by enhanced market participation by the smallholder goat producers. This participation has been identified as a potential pathway out of poverty for millions of smallholder goat-producing households in Zambia (Rich et al. 2009; Daka 2002).

Despite the potential opportunities that the livestock sector offers in enhancing economic growth and poverty reduction, the livestock sector in Zambia is yet to capture these emerging benefits due to its poor marketing infrastructure and information, high and uncoordinated regulatory charges, limited access to livestock services and lack of credit facilities (Lubungu and Mukuka 2012; Mwamba 2011). Thus, it has been argued that the Zambian smallholder livestock sector is characterized by low levels of market participation (Lubungu et al. 2012). Therefore, by adopting a value chain approach, this study aims to understand the factors that influence the level of smallholder goat farmers' market participation in Zambia. It is thereby intended to identify appropriate development intervention programs and policies that could support pro-poor market participation.

Methodology

The Choma district is the provincial headquarters of Zambia's Southern province, which is surrounded by five districts, namely Pemba, Kalomo, Sinazongwe, Monze and Gwembe. Eighty-four per cent of the farmers in the Choma district are smallholders while only 0.4% are considered to be large-scale farmers (Food and Agriculture Organization of the United Nations (FAO) 2011). A majority of the rural households in the Choma district are involved in livestock rearing with 54% of them keeping goats, 49% cattle and 7% pigs (Ministry of Agriculture and Co-operatives 2005). The district therefore has a high potential for livestock production, which is one of the main farming activities undertaken by smallholder subsistence producers.

This study adopted a mix of both quantitative and qualitative research methodology. Secondary data collection involved the reviewing of documents and publications from different institutions, organizations and offices that covered issues pertaining to the study. Primary data were collected from the actors in the goat market chain who were involved in production, marketing, consumption and providing support services. The household surveys of goat-producing farmers focused on production, marketing and constraints encountered therein. Apart from surveys, key informant interviews and personal observation methods were employed to understand how the goat chain functions in the Choma district.

A questionnaire was designed to gather in-depth information on socio-economic characteristics of individual households, the production and marketing of their goats, and constraints encountered in each of these stages. Interview guides were designed to source information related to actors in the goat market chain and their

relationships, as well as constraints encountered in the goat market chain. Upon obtaining the required ethical clearance from the School of Agriculture and Food Sciences at the University of Queensland, the questionnaire was pre-tested with ten households that were not included in the survey. Amendments were made to the instruments based on the results of the pre-test.

A two-stage sampling procedure was adopted in selecting the sample from the Choma district. Moyo and Muzoka camps were chosen based on their accessibility—with regards to road network—and goat population. On average the two agricultural camps had nine villages with an average of 380 households, of which four villages from each of the camps were chosen randomly. Using the farmer register maintained by the Ministry of Agriculture and Livestock, 20% of the total number of households of each village was selected randomly and the remainder of the households were identified with the aid of the camp extension officers. In total, 110 smallholder household surveys were completed with the assistance of trained enumerators.

In addition to the smallholder household survey, two FGDs with smallholder goat farmers were conducted with a view to understanding the chains' input suppliers, traders (buyers), providers of supporting services, constraints in production and marketing of goats, enabling environment and potential solutions to identified constraints. The discussions were carried out with seven participants in two sessions (four in session one and three in session two). Based on the discussions with goat producers, follow-up contacts were made with relevant buyers. By adopting a snowball approach, nine goat traders were identified and interviewed. Functions and negotiations of one major wholesaler in Chibolya (Lusaka) were not observed due to his reluctance to participate in the research. In addition, providers of government and non-government support services were interviewed so as to get a detailed understanding of the goat chain. Consumer insights were gathered at the point of purchase by talking to consumers at Choma market. Primary data collection was carried out between November 2013 and January 2014 in the Choma district of southern Zambia.

Qualitative data originating from FGDs, key informant interviews and personal observations were used to map the goat value chains in the Choma district and to identify the functions of each actor and then the chain dynamics. Thematic analysis was employed in this process. Primary data from the questionnaire survey were analysed by using descriptive statistics and non-parametric statistical techniques. Based on the following formula, market margins were calculated for each of the chains identified:

$$\Pi UT = PUT - PC,$$
$$\Pi RT = PRT - PC, \text{ and}$$
$$\Pi TCM = PTCM - PC - TCSMF$$

Where: π is the respective market margin; PUT is the average price paid by an urban trader at farm gate; PRT is the average price paid by a rural trader at farm gate; PTCM is the average price paid by traders in Choma market; PC is the average cost of production of goats (calculated based on the survey) and TCSMF is transaction costs incurred by smallholder farmers.

Results

Sample characteristics

The study revealed that 35% of the respondents were female, 49% of the respondents were within the age range 36–50 years, 57.7% had attained primary school education or had no formal education and 63.5% had a family size of 6–11 members. With regards to land tenure, 99% of the sample revealed that they own the land, with 51.4% owning 6–10 ha, 49% produce 10 goats annually and 39.4% own on average 5–9 goats. The majority (40.4%) of the respondents had been rearing goats for nine years.

The reasons for rearing goats were for income generation (98.1%), meat (80%), traditional ceremonies (79%) and milk (56%). When they were asked to prioritize these reasons according to the level of importance, they ranked income

generation (98.1%) as the first priority while production of manure and provision of meat for home consumption were ranked as the second and third, respectively.

Live goat market chains in the Choma district

Typically, goats in Zambia are sold as live animals due to the religious and cultural practices of end consumers. It was evident that almost all farmers sell their live goats to final consumers in the Choma and Lusaka districts through middlemen. Live goat marketing is characterized by traders (urban and rural) who move from one village to another to buy goats. Smallholder farmers in the Choma district predominantly use three different market outlets – urban traders (61.5%), rural traders (20.2%) and traders in Choma town central business district (18.1%), who are typically town dwellers found at markets who function by buying goats from farmers that transport goats from the farmsteads to Choma town. Both urban and rural traders are itinerant local buyers. Although rural traders live within the village, urban traders travel to the villages from Choma or Lusaka towns. They then buy goats directly from the local farmers and sell directly to consumers or urban wholesalers.

Nine interviews with key informants and two FGDs with farmers revealed that the goat chain is characterized by input suppliers, producers (goat farmers), rural traders, urban traders, urban wholesalers and rural and urban consumers. The chains are supported by service providers in the form of transporters, district councils, the Department of Livestock and the Zambian police. Through a process of snowballing, the product flow was traced to rural traders, urban traders and traders in the Choma district.

Input suppliers: These actors are based in the central business district (CBD) of Choma town, which is 76 km from where the smallholder farmers are based. The inputs that are procured by farmers are limited to drugs such as de-wormers or drugs related to disease prevention and treatment.

Goat producers: Production of goats is carried out as mixed farming, with goats reared alongside crops. Farmers provide shelter, herd goats during feed times and treat them when they are sick.

Rural and urban traders: The traders' functions are limited to procuring, storage and transportation to urban wholesalers at the Chibolya market, Lusaka.

Urban wholesalers: The largest traders of goats in the chain consolidate goats from all small traders. They sell goats to retailers and final consumers. They provide storage facilities, and feed goats prior to offloading and sale to final consumers and retailers.

Support services: Goats are transported from villages to Choma CBD by individuals who own light trucks which carry 10–15 goats per load. Goats are then offloaded at Choma CBD and transported in bigger trucks to Lusaka, where the urban wholesaler is located. Veterinary services such as disease prevention and curative services are provided by the veterinary officers from the Department of Veterinary and Livestock Services. In addition, the department provides certificates to indicate that goats are not carrying any form of disease. The Choma district council provides the certificate of consent to transport goats across district boundaries, while the Zambia police provides the certificate to indicate that goats are legally owned by the person transporting them. Annex 1 illustrates the functions of all the players in the goat value chain.

Transaction costs

Annex 1 gives an overview of the live goat market channels used by smallholder goat producers. These channels attract transaction costs as illustrated, thus impacting on their profitability. Transaction costs associated with each respective market outlet as incurred by individual actors in the chain during the marketing of live goats vary and it was revealed that urban traders have the highest transaction costs (Annex 2).

Market margins received by smallholder goat farmers who use the three existing market outlets were calculated based on their cost of production, and transaction costs associated with different market outlets (Annex 3). In addition, potential margins that could accrue to smallholder goat farmers in the event that a farmer decides to venture out and sell directly to the urban wholesaler in Lusaka were calculated. This could be done via two possible market channels: one is selling directly to the urban wholesaler while the second is to sell directly to the consumer in Lusaka for premium prices.

The most profitable outlet for smallholder goat farmers is the urban trader channel, followed by the rural trader channel and, lastly, the Choma market channel trader. An analysis of the possible profit that can be accrued in the event that a smallholder farmer decides to transport their goats to the urban wholesaler in Lusaka would require them to incur a number of transaction costs, as illustrated in Annex 3.

Smallholder farmers incurred 34.51 Zambian kwacha (ZMW), which accounts for 20.3% of the farm gate price, when they used the urban trader channel. Under the rural trader channel the farmer incurred the same costs though the farm gate price was different; the costs accounted for 31.4% of the farm gate price. The total marketing costs under the trader Choma market channel was ZMW67.51, which accounted for 51.9% of the traders' price. The results indicate that it is more lucrative for the farmer to sell their goats at farm gate than using the urban trader channel.

Upon computing the margins in the three market outlets, a Kruskal-Wallis non-parametric test of independence was used to find out whether the experience in goat farming, annual herd size, farm size, number of goats sold annually, annual household income and cost of production were significantly different across the categories of market outlets. Results indicate that there is no significant difference in experience in goat farming, annual herd size, farm size, number of goats sold annually and annual household income among the three market outlets ($P > 0.05$). However, there was a significant difference among the groups with respect to cost of production ($x^2 = 8.983$; p-value= 0.011). This shows that the higher the cost of production, the less likely it was that a farmer would use a market outlet that requires them to incur additional costs. This validated the survey findings that indicated that the majority of the farmers opted to sell their goats at farm gate where the only costs they incur are production costs.

Discussion

Although it is commonly argued that livestock production is mostly associated with males (Montshwe 2006), it is evident that in the Choma district 35% of those rearing goats were female. This could be attributed to the fact that small ruminants are easy to look after compared to large ruminants. The majority of the respondents who rear goats are within the age range of 36–50 years, which is considered to be the most productive age of a farmer. Similar findings were evident in a study conducted based on small ruminant production in the southern Guinea savannah, Nigeria (Umunna et al. 2014). This highlights that farmers of this age cohort tend to manage their farming risks by venturing into other practices, such as small ruminant production, compared to farmers of other age cohorts. In the sample, 57.7% of the smallholder farmers had primary school education or no formal education. This study finding is in consonance with other study findings; for instance, it has been found that 54.3% of the respondents who rear pigs in northern Nigeria had no formal education (Ajala and Adesehinwa 2007). The low levels of education of these smallholder farmers could contribute to a number of inefficiencies along the chain, including their ability to select the type of market outlet and use the existing market information. Umunna et al. have asserted the same based on the context of Nigeria (Umunna et al. 2014).

The lack of market access can be attributed to the distance to Chibolya market, where their goats are sold for a premium price. Similar studies have highlighted that some of the major constraints that affect the efficiency of livestock marketing include poor marketing infrastructure, lack of market information, high transaction costs and lack of access to formal credit sources (Ajala and Adesehinwa 2007; Beneberu et al. 2012; Kochoa et al. 2011).

The lack of access to market information clearly highlights that smallholder goat farmers are at a disadvantage as they have to make their market decisions without access to up-to-date market information. This exposes them to the risk of obtaining biased information from opportunistic traders (buyers). This corresponds to the findings of an earlier

study which opined that the lack of a formal system aimed at provision of market information to goat traders results in the receipt of unreliable information (Oludimu and Owokadeb 1995).

Conclusions

The study reveals that smallholder farmers rear goats for a number of reasons, including household consumption (meat and milk), as an income generating activity and for traditional ceremonies such as paying for bride price. Though this has been the case, a number of constraints were identified by respondents as major impediments to goat production, which were high disease prevalence, lack of goat production skills and insufficient contact with area veterinary officers.

Smallholder goat farmers use three predominant market channels to market their goats: farmer to urban trader channel, farmer to rural trader channel and farmer to trader Choma market channel. Goats are sold at farm gate using the first two channels while the third channel requires farmers to travel to Choma and sell at the CBD market. Apart from producers, other chain actors include traders (urban and rural), urban wholesalers (located in the Lusaka district), retailers and consumers. The chain receives institutional and support services from non-governmental organizations (NGOs) and government through the Ministry of Agriculture and Livestock. Though present, butcheries are insignificant in the chain in that the products that pass through this channel are negligible. These channels were dotted with a number of constraints that impede the efficient functioning of the market, namely lack of market information, lack of access to formal credit sources, poor state of roads and high transport costs. These constraints result in an increase in both the market and transaction costs incurred by a smallholder farmer. Despite these aforementioned constraints live goat marketing is profitable in the study area; this is attributed to the high demand for goat meat which is currently not being met by production levels. It is therefore possible to improve smallholder goat farmers' livelihoods by improving the marketing systems.

Recommendations

Based on these study findings it is evident that improvement of the provision of veterinary officers in the goat-producing communities to facilitate and train farmers on technical skills in goat production and management would significantly assist the health of the goats and thus improve quality in the market chain.

Consequently, this will equip goat producers with knowledge on such issues as goat health, reproduction, housing, watering and feeding, which would increase productivity. Extension officers should be reoriented so that their messages do not revolve solely around production issues but include aspects of marketing so that smallholder goat farmers gain knowledge in that regard. Improved marketing infrastructure, such as the establishment of an auction market, would provide a platform for smallholder goat farmers to interact with final consumers. Such a platform would ensure that farmers venture into the consumer market that offers the premium price. The use of the proposed auction markets would ensure that there are regular sales of goats, standardized pricing systems and provision of prices beforehand, giving smallholder farmers an opportunity to plan ahead. Auctions would also contribute to providing a place for farmer and trader interactions, which would beneficially increase knowledge across the market chain.

An enabling environment needs to be championed and created so as to foster the development of favourable regulatory frameworks and market infrastructure which would support efficient goat marketing systems, thus enhancing the development of competitive goat markets and creating sustainable relationships among the live goat chain actors that are based on mutual trust through advocating for a change in the mindset of the players on how they view each other during the process of marketing.

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A triple-hurdle model of small ruminant production and marketing in the highlands of Ethiopia: Implications for commercial transformation

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Abstract

The over 55 million sheep and goats in Ethiopia serve as important sources of cash income and protein for rural households. Despite the policy direction of commercial transformation of smallholder agriculture for over a decade in Ethiopia, little transformation has been observed in the small ruminant subsector to date, calling for a rigorous empirical analysis of the factors that influence household decisions to produce and market small ruminants. The confluence of productivity-increasing technologies and practices and profitable market opportunities is essential to achieve sustainable development and transformation of the agricultural sector. We use the triple-hurdle econometric model to analyse household decisions to engage in small ruminant production, their market position and the intensity with which they participate in the market. By integrating production, market position and volume of sales, the triple-hurdle model estimates parameter values that can be used to make inferences about the study population, where some part of the population are non-producers. Results are based on a data set collected from 5,000 households and 497 rural communities in the highlands of Ethiopia. Our results show that access to credit encourages engagement in small ruminant production, suggesting that liquidity constraint is an important barrier to overcome in promoting market-oriented small ruminant production. Engagement in small ruminant production is also more likely in relatively remote areas that are farther away from markets and roads and higher altitude areas with adequate grazing and browsing resources. However, in areas where small ruminant production is likely, market access stands out as an important determinant of household market position. Younger households with limited land resources, male-headed households and households with a relatively higher labour supply are also more likely to be engaged in small ruminant production. Flock size is an important determining factor of market participation and volume of sales. The small ruminant subsector is price non-responsive, suggesting that households liquidate their animals because they are in need of cash, not necessarily to maximize profit. Implications to facilitate the commercial transformation of produce are drawn.

Keywords: Triple-hurdle model, commercial transformation, small ruminants, market access, Ethiopia

Introduction

Ethiopia is endowed with more than 55 million sheep and goats (Commissariat for Food Security (CSA) 2014), which serve as important sources of cash income and protein for the rural households (Ayele et al. 2006). Cognizant of the importance of small ruminants to the livelihoods of the rural population, the government of Ethiopia (GoE) has been transforming the subsector into a market-oriented production system for more than a decade (Ministry of Finance and Economic Development (MoFED); National Planning Commission (NPC) 2016). However, the transformation process of the subsector has been sluggish at best.

The confluence of productivity-increasing technologies and practices and profitable market opportunities is essential to achieve sustainable development and transformation of the agricultural sector (Haggblade et al. 2010; Minten and Barrett 2008; Omiti et al. 2009). The small ruminant subsector is no exception. Small ruminant market development is expected to generate important market signals for smallholders to invest and actively participate in the market and improve their wellbeing (Tiffen et al. 1994).

The Ethiopian small ruminant subsector falls short in both productivity and market participation measures. The yield per carcass weight of sheep and goats for Ethiopia in the 2012/13 production season was estimated at 10 kg/animal and 8.5 kg/animal, respectively, while the average for Africa was 14 kg/animal and 11.2 kg/animal for sheep and goats, respectively (Food and Agriculture Organization of the United Nations (FAO) 2014). Poor management practices and lack of adequate health services also lead to high mortality and morbidity. In the 2012/13 production season the mortality rate was estimated at 18% and 16% for sheep and goats, respectively, while the morbidity rates were estimated at 22% for sheep and 19% for goats (CSA 2014), which obviously would affect commercial off-take rates.

The sluggish transformation of the traditional small ruminant subsector in Ethiopia calls for a rigorous empirical analysis of the factors that influence household decisions to produce and market small ruminants. Such an analysis is important in order to draw policy implications to facilitate the transformation process. Several studies have been conducted on small ruminant production and marketing practices in Ethiopia (Kebede et al. 2012; Kocho et al. 2011; Legesse et al. 2013, 2010, 2008; Tadesse et al. 2014, 2015). However, to our knowledge, no study has integrated production, market participation and intensity of market participation decisions by smallholders.

Moreover, market participation studies on small ruminants in Ethiopia have been mainly based on small sample sizes that are limited to particular production areas such as a district or a few districts, making generalization at national level difficult. Our analysis is based on data collected from a representative sample size of 5,000 households in the major four highlands regions of Ethiopia (Tigray, Amhara, Oromia and Southern Nations, Nationalities and Peoples (SNNP)), where about 75% of the country's small ruminant population is produced. Using the data set from such a broad sample of small ruminant producers, the paper aims at identifying factors that influence household decisions with regard to production, marketing and intensity of market participation using a triple-hurdle model that integrates the three decision choices.

Our results show that engagement in small ruminant production is more likely in relatively remote areas that are farther away from markets and roads and higher altitude areas with adequate grazing and browsing resources. Younger households with limited land resources, male-headed households, and households with a relatively higher labour supply are also more likely to be engaged in small ruminant production. Flock size is an important determining factor of market participation and volume of sales. The small ruminant subsector is price nonresponsive, suggesting that households liquidate their animals in need of cash, not necessarily to maximize profit.

The paper is organized as follows. The next section presents our conceptual framework. Section three describes estimation approach. Section four presents data and descriptive statistics. Section five presents and discusses the econometric results of the triple-hurdle model. Section seven concludes the paper and presents implications.

Conceptual framework

The conceptual framework followed in this paper is based on the theoretical framework developed by Barrett (2008) and Boughton et al. (2007). The key features of the models are that farm households' access to markets is not uniform because households face differential transaction costs due to household- and farm-specific characteristics as well as meso-level factors related to market infrastructures and institutions, and the degree of competition among market intermediaries. Participation in small ruminant production and marketing are, therefore, modelled as functions of transaction cost factors (tc), household characteristics (hc), farm characteristics (fc), asset endowment (ae), access to services (as), community level variables (cc), agro-ecological zones (az) and prices (p). Hence, the full triple-hurdle model is specified as follows:

srprod = srprod (tc, hc, fc, ae, as, cc, az, p)
srmrpos = srmrpos (tc, hc, fc, ae, as, cc, az, p)
netsell = netsell (tc, hc, fc, ae, as, cc, az, p)
netbuy = netbuy (tc, hc, fc, ae, as, cc, az, p)

Where: srprod is a binary indicator of whether a household is involved in small ruminant production; srmrpos is a multinomial indicator of the market position of the household (1 = net buyer, 2 = autarkic, 3 = net seller); netsell is the net number of small ruminants sold by the household; and netbuy is the net number of small ruminants bought by the household. The net quantities of buying and selling are modelled separately as the effects of the right-hand side variables on these outcomes may be different (Key et al. 2000). Exclusion restrictions are possible so not all explanatory variables may be included in each model (Burke et al. 2015).

Estimation

A household's market participation decision can be thought of as a three-stage decision problem where clearance from the previous stage is required for each successive stage. The first stage is production decision (i.e. whether to engage in small ruminant production or not), followed by the decision on market position (net buyer, autarkic and net seller) for producers. Conditional on the decision on market position, the last stage is the decision on intensity of market participation either as net seller or as net buyer.

The estimates for the parameters can be obtained by running a relevant separate regression model for each stage (Burke et al. 2015). Since the dependent variable at the first stage is binary, a probit model is used. For the second stage an ordered probit model is used to estimate the parameters. Finally, a lognormal regression model is estimated to examine the intensity of market participation for net sellers[1]. All estimations are made using Stata, version 14 (StataCorp. 2015).

We used household labour supply as an exclusion variable to estimate the second-stage model since the availability of labour is expected to affect the decision of whether or not to produce small ruminants but not the decision on market participation. We also used variables that measure access to market information as exclusion variables to estimate the third-stage models. Access to information can be considered as a fixed transaction cost factor, which affects only the decision on market participation but not the intensity of participation.

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1   Since we could not find effective identification variables for net buyers, we only present and discuss estimation results for net sellers.

Data and descriptive statistics

Results are based on analysis of data from a survey of 5,000 smallholder households and 497 rural *kebeles*[2] in the four highland regions of Ethiopia (Tigray, Amhara, Oromia and SNNP). Ten zones were selected for the study from which 62 districts[3] were identified. The study area accounts for about 13.6% of the national area, 30% of the national sheep population and 22.5% of the national goat population[4]. For sampling purposes, the study districts were stratified into 10 agro-ecological zones, and farm households were selected randomly based on proportional to size sampling technique. Data were collected on household characteristics, farm operations, household asset ownership, farm characteristics including land holding, flock and herd size and structure, access to physical and institutional infrastructure and household cash earnings. The survey was conducted in 2014 and referred to the 2012/2013 production season.

Female-headed households account for less than one fifth of the total households (Table 1). Female-headed households also account for about 16% of those involved in small ruminant production. Among net sellers, 15% are female-headed households.

For those who engaged in small ruminant production, the average herd size is about 7.85 animals, with corresponding average sizes of 9.73 for net sellers and 5.05 for net buyers. More than two thirds of the small ruminant stock are female animals. During the production year, a household on average lost about 10% of its flock, mainly due to diseases, which accounted for about 71% of the deaths. Other causes of small ruminant deaths include ageing, injuries due to accidents and predators.

Landholdings are small, at about 1.38 ha on average. The value of household physical assets, which include agricultural tools, water cans, water pumps, wheelbarrows, animal carts, mobile phones, radios, television, bicycles, motorcycles and other goods, pack animals, beehives and urban property, is estimated at ETB 17,660 (Ethiopian birr[5]) and this slightly increases for small ruminant producers. Based on the large standard deviation, it looks as if household wealth varied considerably. About 43% of household heads are able to read and write, with 18%, 19% and 5% of households having formal schooling of 1–4 years, 5–8 years and more than 8 years, respectively.

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2   A rural kebele is the lowest administrative unit in Ethiopia and comprises of 4–5 villages. Among the surveyed districts, 31 are intervention
3   districts of the Livestock and irrigated value chains for ethiopian smallholders (LIVES) project implemented by the International Livestock Research Institute (ILRI) in partnership with other national and international organizations to demonstrate market-oriented transformation of smallholder agriculture in Ethiopia. The remaining 31 districts are control districts for impact evaluation. For more information, please visit www. lives-ethiopia.org.
4   The national figures used to compute these percentages exclude the lowland non-sedentary zones of the Afar and Somali regions.
5   The official exchange rate of USD 1 was equal to ETB 20.4322 as of 23 February 2015

Table 1. Distribution of explanatory variables

Explanatory variables	Total households (N=4618)	
	Mean	Std. Dev.
Household characteristics		
Age of household head *(year)*	45.32	12.18
Male-headed household *(yes=1)*	0.81	0.39
Dependency ratio	1.06	0.83
Number of working age household members (no.)	3.18	1.48
Land owned *(ha)*	1.38	1.36
Value of physical assets[6]*(ETB 1,000)*	17.66	56.12
Household non-farm income *(ETB 100)*	36.6	77.03
Large ruminant herd size *(no.)*	4.19	4.25
Small ruminant flock size *(no.)*	-	-
Proportion of female animals in the small ruminant flock *(%)*	-	-
Number of dead animals in the small ruminant flock	-	-
Head education		
No formal education *(yes=1)*	0.57	0.49
1 to 4 years *(yes=1)*	0.18	0.38
5 to 8 years *(yes=1)*	0.19	0.39
More than 8 years *(yes=1)*	**0.05**	**0.23**
Access to services and infrastructure		
Distance to nearest all-weather road *(walking minutes)*	48.08	71.84
Distance to nearest livestock market *(walking minutes)*	86.38	62.62
Credit use *(yes=1)*	0.19	0.39
Involvement in extension program for small ruminants *(yes=1, no=0)*	-	-
Access to market information on small ruminants *(yes=1, no=0)*	-	-
Ownership of radio *(yes=1, no=0)*	0.39	0.49
Community characteristics		
Population density (persons/ha.)	3.15	2.97
Availability of communal grazing land (ha/tropical livestock unit (TLU))	0.07	0.12
Wage rate (ETB/hour)	59.67	22.23
Agro-ecological zone 1(=1 if altitude is > 2300 m)	0.26	0.44
Agro-ecological zone 2 (=1 if altitude is 1,500–2,300 m)	0.67	0.47
Agro-ecological zone 3 (=1 if altitude is <1500 m)	0.07	0.26
District prices[7]		
Small ruminant average selling price (ETB)	723.03	122.31
Large ruminant average selling price (ETB 1,000)	5.40	1.13
Average selling price of butter (ETB/kg)	104.92	18.83

The nearest all-weather road and livestock market are located on average within 48.13 and 86.63 minutes of walking distance from a homestead, respectively. About 19% of households took out an agricultural loan during the year. Not surprisingly, about two thirds of small ruminant producers are located in the higher altitude areas where the altitude ranges from 1500–2300 miles above sea level and where the annual rainfall ranges from 900 mm to more than 1400 mm. In the study area, cattle (oxen) and dairy products (butter) represent potential alternative sources of income to

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6 Excluding small and large ruminants.

7 These are district level averages of observed prices collected in the survey.

small ruminant production. Thus, in addition to the price of small ruminants, district market prices of butter and oxen are included in the analysis.

Results and discussion

This section first presents estimation results for the triple-hurdle model consistent with the choice models outlined earlier. To identify the market position model, we imposed an exclusion restriction on the household labour supply variable, which is found to be statistically significant in the production decision equation (P=0.000) but not in the market position equation (P=0.386). Then, in order to check whether the error terms in the first and second stages are conditionally uncorrelated, a standard t-test is used on the coefficient estimate of the IMR1. We failed to reject the null hypothesis that the coefficient estimate for IMR1 is not different from zero (P=0.116), and IMR1 is excluded from the second-stage estimation on market participation.

Similarly, to identify the market intensity model, we used access to market information variables (ownership of radio and access to small ruminant market information) following Goetz (1992), who argues that information costs are fixed transaction costs that influence market entry but not intensity of market participation. The Wald test of the hypothesis that the coefficients of the two variables are jointly equal to zero is rejected in the market participation equation (x^2 = 5.58, 2 degrees of freedom, P = 0.062). Nevertheless, we fail to reject the same null hypothesis in the intensity of participation equation for net sellers F (2, 1176) = 0.826, P = 0.442, indicating that these two variables can be used to identify the intensity of participation equation for net sellers.

To test whether the error terms in the second and third stages for net sellers are uncorrelated, a standard t-test is used on IMR_s for net sellers. We failed to reject the null hypothesis that coefficient estimates for IMR_s are not statistically significantly different from zero (P = 0.526). Thus, IMR_s is excluded from the regression equation for net sellers.

Regression results of the first, second and third stages (for net selling only) are given in Table 2. The probit model for production decision correctly predicts 64.7% of the categorical outcomes. The overall percentage correctly predicted by the ordered probit model of discrete market participation is about 43%. The R-squared for the log-linear model (continuous values) of net sellers is about 0.30.

Table 2. Model estimates for production, market position and volume of sales/purchases in small ruminant production in Ethiopia

Explanatory variables	Production (Stage 1)	Market position (Stage 2)	Net sales (Stage 3)
Household characteristics			
Age of household head (*year*)	0.0220**	0.0002	0.0053
	(0.025)	(0.989)	(0.575)
Age of household head squared (*year*)	-0.0002***	0.0000	-0.0000
	(0.009)	(0.956)	(0.808)
Male-headed household (*yes=1, no=0*)	0.1447***	-0.1351	0.0064
	(0.007)	(0.848)	(0.891)
Dependency ratio	0.0416	0.0189	0.0028
	(0.139)	(0.564)	(0.900)
Number of working age household members (*no.*)	0.0735***	–	–
	(0.000)		
Land owned (*ha*)	-0.0540***	-0.0127	0.0208)
	(0.002)	(0.543)	(0.164)
Household wealth (*ETB 1,000*)	-0.0001	-0.0004	0.0000
	(0.717)	(0.369)	(0.959)
Household non-farm income (*ETB 100*)	-0.0000	0.0001	0.0002
	(0.966)	(0.783)	(0.190)
Large ruminant herd size (*no.*)	0.0736***	-0.0188***	-0.0121**
	(0.000)	(0.002)	(0.016)
Small ruminant flock size (*no.*)	–	0.1169***	0.0659***
		(0.000)	(0.000)

Explanatory variables	Production (Stage 1)	Market position (Stage 2)	Net sales (Stage 3)
Small ruminant flock size squared (*no.*)	–	-0.0016*** (0.000)	-0.0005*** (0.000)
Proportion of female animals (%)	–	-0.0053*** (0.000)	-0.0029*** (0.001)
Number of dead animals	–	-0.087*** (0.000)	-0.0534*** (0.000)
Head education			
1 to 4 years (*yes=1, no=0*)	0.0779 (0.154)	0.0590 (0.379)	-0.0630 (0.150)
5 to 8 years (*yes=1, no=0*)	0.0663 (0.231)	0.0703 (0.305)	-0.0271 (0.537)
More than 8 years (*yes=1, no=0*)	0.1702* (0.070)	0.0003 (0.998)	-0.0527 (0.477)
Access to services and infrastructure			
Distance to nearest all-weather road (*walking minutes*)	0.0007** (0.010)	0.0003 (0.323)	0.0001 (0.724)
Distance to nearest livestock market (*walking minutes*)	0.0005* (0.092)	-0.0010** (0.016)	0.0001 (0.634)
Credit use (*yes=1, no=0*)	0.1322*** (0.008)	0.0150 (0.805)	-0.0148 (0.696)
Involvement in extension program (*yes=1, no=0*)	–	0.0992 (0.142)	0.0652* (0.050)
Access to market information (*yes=1, no=0*)	–	-0.0797 (0.272)	–
Ownership of radio (*yes=1, no=0*)	0.2094*** (0.000)	-0.1061** (0.039)	–
Community characteristics			
Population density (*persons/ha.*)	-0.0280*** (0.000)	0.0099 (0.360)	0.0116 (0.116)
Grazing land (*ha/TLU*)	0.3861** (0.023)	0.2210 (0.270)	0.1408 (0.311)
Wage rate (*ETB/hour*)	0.0042*** (0.000)	-0.0023** (0.049)	-0.0021*** (0.007)
Agro-ecological zone 1(=1 *if altitude is > 2300 m*)	0.8405*** (0.000)	0.3528** (0.003)	0.2701*** (0.003)
Agro-ecological zone 2 (=1 *if altitude is 1,500–2,300 m*)	0.4062*** (0.000)	0.1480 (0.199)	0.1897** (0.030)
District prices			
Small ruminant average selling price (*ETB 100*)	0.0002 (0.992)	0.0001 (0.996)	-0.0056 (0.740)
Large ruminant average selling price (*ETB 1,000*)	0.0348 (0.159)	0.0062 (0.842)	0.0744*** (0.000)
Average selling price of butter (*ETB/kg*)	0.0003 (0.810)	-0.0025* (0.098)	-0.0037*** (0.000)
Constant	-2.1102*** (0.000)		0.1746 (0.554)
Ancillary parameters			
Constant cut1		-1.4783*** (0.000)	
Constant cut2		0.0064 (0.987)	
IMR_b			
Percent correctly predicted/goodness of fit	64.7%	42.9%	30.41%
Observations	4,618	2,442	1,208

Note: P-values in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We find that household age has a parabolic relationship with involvement in small ruminant production with the negative effect kicking in at age 44, which is about the same as the average age in the sample households. A 30-year-old (the 10th percentile) farmer has a 52.3% probability of involvement in small ruminant production compared to a 70-year-old, who has a probability of 45.6%. This is probably because younger households have relatively limited access to other productive resources such as crop land (Bezu and Holden 2014) and, as such, would tend to depend on agricultural activities that require less land, such as small ruminant production.

The average probability of a given female-headed household being a small ruminant producer is 49%, as compared to 54% for an otherwise similar male-headed household. This is in agreement with the finding of Duku et al. (2011) in Ghana. Access to credit also has a statistically significant and positive effect on the probability of engaging in small ruminant production.

Education, as source of power to process and interpret information, and ownership of a radio as a source of information seem to encourage engagement in small ruminant production. Households who keep large ruminants are also more likely to keep small ruminants, suggesting that there is complementarity in production between the two enterprises, such as in grazing behaviour (Schwartz 1983).

Population density detracts from involvement in small ruminant production. An increase of one standard deviation in population density (three persons per ha) decreases the probability of participating in small ruminant production by 8.3 percentage points. The negative effect of population density on small ruminant production may be due to its effect on land degradation and thus the availability and productivity of grazing and browsing resources (Sibanda et al. 2011).

As expected, households with smaller farm land sizes are more likely be engaged in small ruminant production, indicating that those households who face shortage of land are likely to diversify away from land-based enterprises (Barrett et al. 2001). For example, an increase of land size by one standard deviation (1.36 ha) decreases the probability of engaging in small ruminant production by about 7.2 percentage points.

Despite the complementarity between large ruminants and small ruminants in production, the two enterprises seem to be substitutes as sources of cash income to the household. Households with large cattle ownership are more likely to be autarkic than to be net sellers and are more likely to be net buyers than to be autarkic. Income from large ruminants may also be used to purchase small ruminants, either for consumption or as an investment. We also find a negative relationship between sales volume for a given net seller and number of large ruminants. However, the average partial effect of inflow of large ruminants on the unconditional expected value of net sales was found to be positive, at 1.8% for each additional large ruminant that joins the farmer's herd.

As expected, small ruminant flock size and structure have a strong and statistically significant effect on the market participation decision as well as volume of sales. A household with a larger small ruminant flock is more likely to be autarkic than a net buyer and more likely to be a net seller than autarkic. Wanyoike et al. (2015) found a similar result in northern Somalia for small ruminants and Lubungu (2016) for cattle in Zambia. Flock size does have a quadratic effect on market participation, where the negative effect sets in at 38 head of animals, under the current production system. The turning point flock size is almost five times the average flock size, showing that the current flock size is suboptimal to promote market participation of households, holding other factors constant. The average producing household in our sample has a 35% probability of being a net selling household if its flock size is three (the 25th percentile), as compared to a 60% probability for a flock size of 10 (the 75th percentile). Flock size also has a quadratic effect on net selling, where the turning point flock size is 68 animals. Each additional animal that joins the herd increases the volume of unconditional expected sales by 8.7 %. These results strongly indicate that increasing flock size needs attention in efforts aimed at promoting market-oriented transformation of the sector.

Results also show that the proportion of female animals in the flock is significantly negatively associated with market participation. Given that a household is engaged in small ruminant production, a typical household with a third of its flock size (5th percentile) being female animals has about 56% probability of being a net seller, as compared to a 48% probability if female animals account for three fourths (75th percentile). Similarly, among net sellers, proportion of

female animals has negative effect on the number of animals sold. Our results predict that on average a 10 percentage point increase in proportion of female animals decreases the unconditional expected number of small ruminant sales by about 5.7%. This is because female animals are mainly kept for reproduction purposes (Wanyoike et al. 2015).

Animal death, likewise, exerts a negative effect on the ordered market participation variable. The more animal death a flock suffers in a period, the more likely it is to be autarkic than a net buyer and the more likely to be autarkic than a net seller. The negative effect also extends to the net sellers, where each additional animal death leads to an 8.5% decrease in the number of animals sold.

Although being further away from markets or all-weather roads favours small ruminant production, conditional on being a producer, distance to market detracts from being a net seller over being autarkic or net buyer. The average producing household in our sample would have a 51% probability of being a net selling household if the walking distance to the nearest livestock market were 40 minutes (25th percentile), as compared to a 48% probability if the livestock market were located some two hours away (75th percentile). This is probably because remote villages offer less opportunity for off-farm employment (Renkow et al. 2004) and, as such, engagement in small ruminant production becomes an attractive livelihood diversification strategy. We do not find a statistically significant relationship between sales volume for a given net seller and distance to a livestock market.

Involvement in small ruminant-focused extension services increases volume of net sales by 10%, all else equal. This is consistent with other studies where extension services have been linked with market orientation in developing countries (Holloway et al. 2000; Lerman 2004). This suggests the potential positive effect of extension services in promoting market participation of households.

We find that household decision to engage in small ruminant production, market participation and intensity of market participation in the small ruminant market are not affected by the price of small ruminants, suggesting that small ruminant production is not price responsive. Small ruminant producers may be selling animals primarily because of cash needs while market-oriented production is low (Kocho et al. 2011). Butter price has a negative effect on both market participation and intensity of participation, suggesting that butter is considered a substitute source of cash income for households. We find a positive association between prices of large ruminants and volume of small ruminant sales, perhaps because cash proceeds from the sale of small ruminants is used to invest in large livestock. In a previous study in eastern Ethiopia, it was observed that involvement in small ruminant fattening was used as a stepping stone to large ruminant fattening (Gebremedhin et al. 2012).

Conclusion and implications

Despite the policy and operational direction of smallholder commercialization pursued by the GoE for over a decade now, the small ruminant sector has seen little transformation to date. The sluggish market-oriented transformation of the small ruminant sector requires an empirical analysis of the factors influencing household decisions in the production and marketing of small ruminants. Such analysis would inform policymaking and development practice to facilitate the transformation process. This paper is an attempt to respond to the need for better understanding of small ruminant production and marketing in Ethiopia.

Using a cross sectional data set from 5,000 households in the highlands of Ethiopia, we estimated a triple-hurdle model to analyse the determinants of household decision to engage in small ruminant production; their market position as net buyers, autarkic or net sellers; and the volume of sales for net sellers.

We find that small ruminant production is preferred by younger households with limited access to land, implying that targeting young people and the landless for market-oriented small ruminant production may serve as a source of employment and income for such segments of the population. The grazing and browsing system of small ruminant production and management also seem to provide better comparative advantages to male-headed households than to female-headed households, suggesting that a change in production practice may be needed to make female-headed

households beneficiaries of the sector. Introduction and promotion of zero grazing can be one option. Access to credit encourages engagement in small ruminant production, suggesting that liquidity constraint is an important barrier to overcome in promoting market-oriented small ruminant production.

Although large and small ruminants seem to be complementary in production, they tend to be substitutes as sources of cash income to the household. Small ruminant flock size is an important determinant of market position and volume of sales, with the likelihood of being a net seller continuously increasing up to a flock size of 38 animals, compared with the average flock size of 7.8. Moreover, net selling households with larger small ruminant flock size are more likely to sell more, showing that the current flock size is suboptimal to promote a market-oriented small ruminant sector. The insight gained from the effect of flock size on marketing behaviour of households is reinforced by the negative effect of animal deaths on market position and volume of sales. These results imply improvements in fertility, productivity, management to improve growth rates and disease control to reduce young mortality are crucial requirements in the sector.

We find that small ruminant production in the highlands of Ethiopia is not price responsive, suggesting that small ruminant producers may be selling animals primarily because of cash needs, while market orientation is low. The negative effect of butter prices on market position and volume of sales of small ruminants indicate that households consider the two products as substitute sources of cash income. The positive association between prices of large ruminants and volume of small ruminant sales shows that cash proceeds from the sale of small ruminants is used to invest in large livestock.

Acknowledgement

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Inclusive value chain and marketing among smallholder goat farmers in rural Limpopo Province, South Africa

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Abstract

Livestock production is one of the most important agricultural activities in South Africa with goat production being a viable source of livelihood with huge potential for welfare improvement. This is because goats are very hardy and cheap to raise and yield about 40% return on investment. Available information shows that the bulk of goat production in South Africa is carried out by smallholder farmers. They usually keep them for security against economic shocks. This paper therefore examined the dynamics of the goat value chain in Limpopo province with a view to increasing the net returns to smallholder farmers in the study area. Data for this study were gathered from three villages in the Limpopo province of South Africa, using a random sampling method. Data were analysed using descriptive statistics. Analysis of data revealed that the average age of these farmers is 57, with more women participating in goat husbandry than men. Although there is an established but underserved goat market in the study area, limited access to information, low level of education and religious beliefs were the dominant factors constraining these farmers from accessing the formal market. Thus, the goat value chain in Limpopo province is characterized by the dominance of smallholder farmers who sell directly to consumers and those using it for religious rites; hence the preference for white goats in the study area. There are also few commercial producers involved in the exportation or selling of goats and goat products to retailers who later sell to consumers. The study found that considerable profits can be made in generating place and form utility for goats in the study area. Based on the foregoing, the study recommends capacity building of smallholder farmers through education and the use of extension officers in providing relevant, timely and up-to-date information on market outlets for increased profitmaking and enhanced livelihood.

Keywords: goat, inclusiveness, Limpopo province, smallholder farmers, value chain, welfare

Introduction

Goat husbandry in South Africa can be a very lucrative enterprise if conducted properly by choosing the right breeds of goats and a good location in combination with having the relevant expertise in the management of the animals. Raising goats is considered by many governments, development partners, non-governmental organizations (NGOs)

and research centres as a veritable tool for poverty reduction in developing countries (International Goat Association (IGA) 2014). This is because it can be used to raise the income of the rural poor. The National Agricultural Marketing Council (NAMC) (2005) defined indigenous goats as the collective name for all varieties of South African goat breeds. They include speckled goats, Loskop South Indigenous goats, KwaZulu-Natal goats, Nguni goats and the Delfzijl goats (Roets 2004). Indigenous goats are more pronounced in the Eastern Cape, Limpopo and KwaZulu-Natal provinces as they account for 72% of live goats in South Africa (Department of Agriculture, Forestry and Fisheries (DAFF) 2012).

South Africa accounts for approximately 3% of Africa's goat and less than 1% of the global goat production (NAMC 2005; Soji et al. 2015). Boer goats, Savanna and Kalahari red are the commercial goat breeds for the production of meat and skins and small quantities of cashmere. Saanen, Toppenburg and Alpine goats are mainly kept for milk production while Gorno Alti goats produce cashmere. The acceptability of goat meat is implicit in its tenderness, flavour and juiciness.

The South African meat industry was deregulated in 1992 and this led to the formation of the new Marketing of Agricultural Products Act, Act no. 47 of 1996. The act made provisions for producers to sell animals to buyers at mutually agreed prices (Soji et al. 2015). South Africa's population is growing at almost 2% per year. Therefore, the population, which was 49 million in 2009, is projected to rise to 82 million by 2035 (Goldblatt u.d.). Given the rising population of South Africans and the attendant food demand, the demand for animals and animal products is increasing. Meanwhile, urbanization and growing disposable income resulting from an emerging middle class and health needs are capable of creating good market for goats. Most of the South African land surface (69%) is suitable for grazing. Livestock production is the largest agricultural subsector in the country (Goldblatt u.d.). In fact, livestock production accounted for 49.4% of the gross value of agricultural production in 2011/12 (Taha and Hahn 2012).

Meat production chain in South Africa is made up of formal and informal sectors. The formal sector consists of commercial farmers while the informal sector comprises of small-scale (subsistence) and emerging farmers (NAMC 2005; Soji et al. 2015). There are about 6.7 million goats in South Africa (DAFF 2014) of which indigenous goats owned by communal farmers account for 63%, the bulk of them produced in the rural areas. Meanwhile, there is domestic and international demand for goat meat; hence the need to raise investments in the enterprise. However, the profitability of goat husbandry is a function of transportation costs, institutional factors (policies, social constructs and cultural norms) and the willingness of the stakeholders to engage in business (trade).

Methodology

Data sources and study location

This study made use of both primary and secondary sources of information. While the primary source includes the use of structured questionnaires administered to 84 respondents to gather information on socio-economic characteristics of goat farmers and relevant stakeholders, the secondary source entails the use of information gathered from journals, past reports and statistics South Africa publications. Respondents were drawn from Marobala-Matheding and Sebayeng villages in Capricorn District, and Ga-Masemola and Ga-Mareshane in the Sekhukhune district of Limpopo Province, using a random sampling method based on probability proportionate to size.

Results and discussion

Age and household size of respondents

The result presented below is the age and gender distribution of respondents. The average age is 57 years while there are more women goat farmers than men, as depicted in Table 1. This shows that the respondents are still within the economically active period of their life.

Table 1. Distribution of respondents by age and household size

	Frequency	Percentage (%)
Age		
< 30	06	7.1
31–40	13	15.5
41–50	24	28.6
51–60	37	44.0
> 60	04	4.8
Gender		
Male	33	39.3
Female	51	60.7
Total	84	100

Source: Author's computation from survey data

Respondents and type of farming activities engaged in

Figure 1 shows that 54.55% engage in crop farming as the main economic activity. Meanwhile, 18.18% are involved in livestock farming while 27.27% combine crop and livestock production. This implies that livestock production plays a significant role in the economic lives (sources of livelihood) of households in the study area.

Figure 1. Respondents' distribution by type of farming
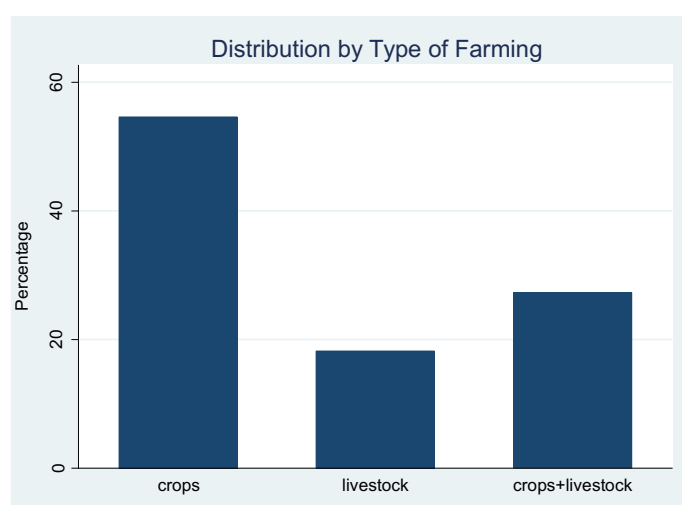
Goat population distribution (value in heads)—Africa and worldwide

As indicated by FAOSTAT (2005), over 96% of all goats were produced in developing countries while the remaining 4% were found in developed countries, with the Far East producing more than 56% of the total population of goats globally. Notable countries in the world producing goats include China (23%), India (16%) and Pakistan (7%), with Africa producing approximately 29% of the total world population. However, goat population distribution in Africa in 2005 revealed that Sudan produces approximately 18%, closely followed by Nigeria, producing 12%, while South Africa accounts for only 3% of the goat population in Africa, as depicted in Table 2. The population of goats had increased astronomically in Africa by 2015, with Nigeria producing more goats than Sudan. In general, the population of goats has increased by more than 3% because of improvements in breeding programs and advancement in technological innovations in animal husbandry.

Table 2. Goat population distribution globally and in selected African countries

Global	Population	Africa	Population
Africa	223,466,000	Cameroun	4,400,000
Bangladesh	34,500,000	Ethiopia	21,709,428
China	172,921,000	Kenya	13,966,000
Europe	18,511,000	Mauritania	5,600,000
India	124,500,000	Mozambique	5,000,000
Iran	26,000,000	Nigeria	52,488,200
Pakistan	52,800,000	Somalia	12,700,000
North America	1,230,000	South Africa	6,265,280 (1% of World goat population and 3% of Africa)
South America	22,068,000	Sudan	42,980,000
World	867,968,573		

Source: FAOSTAT 2011, 2015

Provincial goat production in South Africa

The Eastern Cape is the largest producer of goats in South Africa, with Limpopo province second highest, as shown in Table 3. This is attributable to the prevailing favourable conditions in terms of environmental and sociocultural factors required for goat husbandry. The other notable provinces producing goats are KwaZulu-Natal (13.1%), and Northern Cape (7.5%). The distribution further attests to the potential of goats and their products as an income-generating enterprise not only for residents of poor rural communities but also the country at large.

Table 3. Distribution of goats by province in South Africa

Province	Population	Percentage (%)
Eastern Cape	3,200,000	46.7
Free State	90,000	1.3
Gauteng	9,000	0.1
KwaZulu-Natal	900,000	13.1
Limpopo	1,000,000	14.6
Mpumalanga	100,000	1.5
Northern Cape	513,000	7.5
North West	771,000	11.3
Western Cape	256,000	3.7

Source: NAMC 2014

Meanwhile, there was a slight change in the distribution of live goats from 2004 to 2013 according to the Department of Agriculture, Forestry and Fisheries (DAFF) (2014). Goats are found throughout the country with Eastern Cape, Limpopo and KwaZulu-Natal Provinces being the largest producers, accounting for approximately 71% of the total live goats in the country. Recent estimates show that the Eastern Cape owns most goats in South Africa, accounting for 38% of the total flock, followed by Limpopo, KwaZulu-Natal and North West, taking up 19%, 14% and 11%, respectively. The mentioned four provinces account for a total of 82% and the other five provinces share 18%. The Western Cape and Free State provinces account for 1% each.

Goat meat and other meats in the world market

There is no gainsaying the fact that goat meat is a very good healthy alternative to beef and chicken because of its lower calorie, fat and cholesterol totals. A staple in North African and Middle Eastern cuisine, goat meat comprises 63% of red meat consumed worldwide, according to Osti et al. (2016). Goat meat contains a lower value of saturated fats and cholesterol and a high value of unsaturated fats; thus, it is safe for the heart and reduces the risk of

cardiovascular disease and other chronic problems. As shown in Table 4, goat meat constitutes approximately 2% of the meat in the world market and, with the increasing risk associated with other meats, is becoming the preferred alternative.

Table 4. Comparison of goat meat with other meats in the world market

Meat	Metric tonne	Percentage (%)
Beef and veal	58,922,239	23
Chicken	65,014,504	26
Goat meat	4,198,885	2
Mutton and lamb	8,025,027	3
Pork	98,506,662	39
Others	18,860,683	7

Source: FAOSTAT 2011

Marketing outlets for goats in the study area

While a sizeable number of goats and their products are sold informally, below are the available marketing outlets for goats and their products in the country. The distribution of marketing outlets, as shown in Table 5, reveals that more than one third of goats produced are sold for rituals; hence the preference for the white goat. Selling of live goats by the side of the road (about 16.7%) is also very common, especially around the festive seasons of the year. Restaurants and supermarkets form an important avenue because the nutritional benefits of the consumption of goat meat have provided more leeway for goat meat to enter the formal market through some big supermarkets, restaurants and hotels. Again, about 9.5% are sold at different butcheries/abbatoirs across the country and these outlets are patronized by both low- and middle-income earners.

Table 5. Distribution of outlets for goat marketing

Outlets	Number	Percentage (%)
Rituals (traditional rites)	36	42.9
Religious rites	10	11.9
Butcheries/abbatoirs	08	9.5
Supermarkets	05	5.9
Restaurants	07	8.3
Roadside	14	16.7
Others	04	4.8
Total	84	100

Source: Author's computation from survey data

Local active players in the goat value chain

The result shown in Figure 2 reveals a majority (91%) of the respondents sell their goats and goat products in the informal market while the formal market accounts for 8% of their sales. This indicates that the informal market (community members and traditionalists) has developed and gained relevance among goat farmers in the surveyed area. The community members who buy goats for traditional, ritual and cultural uses are the main actors in the value chain.

Figure 2. Distribution of respondents by market outlets
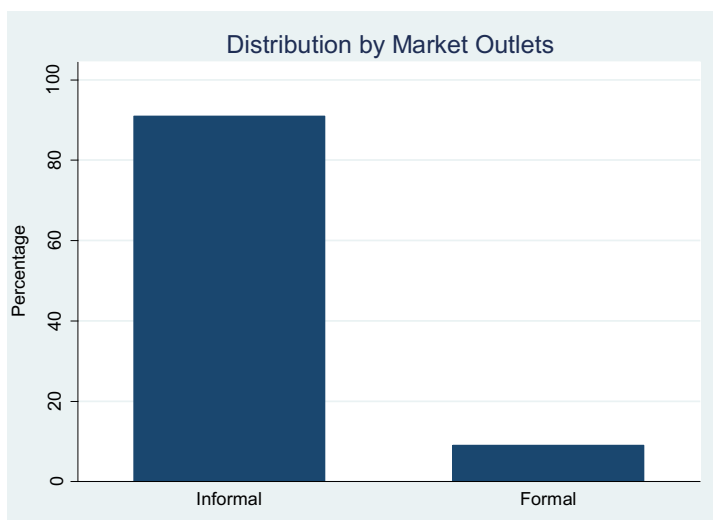
Goats and goat products sold in the study area

Figure 3 shows that majority of the goats produced in the study area are sold live. While about 27% of the respondents sell goat meat and 27% sell leather and skins, only a small number (7%) sell goat milk. This implies goats are mainly sold live while a sizeable number of sellers sell meat and leather and skins. Therefore, a huge supply gap exists in the goat milk market of South Africa.

Figure 3. Distribution of respondents by products sold
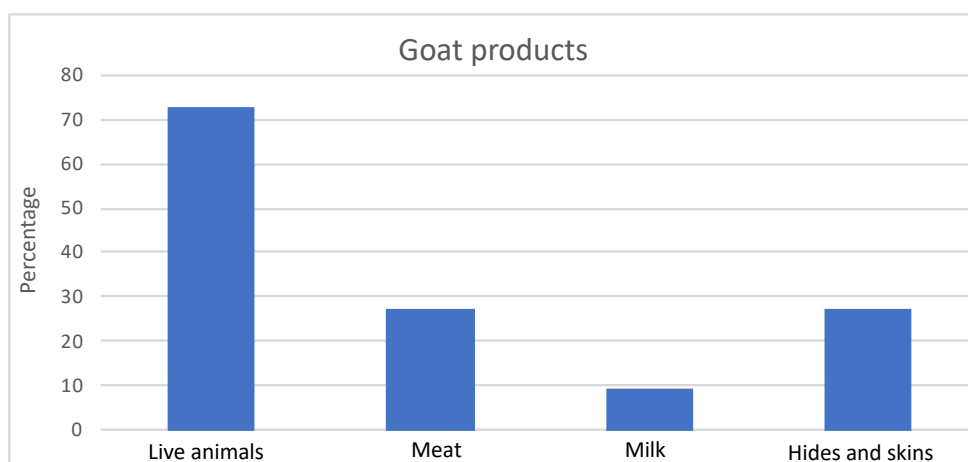
Potential of inclusive value addition/profitmaking in goat husbandry

Goats are known to be very hardy and can survive in harsh environments. They have survived centuries of periodic droughts and harsh temperatures. They also have the attributes of being resistant to the majority of tropical diseases and parasites. Goats are a great source of income. Because of their small size, adaptive feed behaviour and low management, goats are a viable alternative in enhancing household cash flow. They are also a valuable source of rich milk and tasty meat. Goats also provide skins of commercial importance and manure for gardens and crop fields.

Goat is particularly useful in meeting household nutritional requirements because of its wide range of products. The products are milk, meat, yoghurt and cheese while the by-products are hides and skin (Anaeto et al. 2010). Goats produce food for humans and help with weeding and waste management (especially in the consumption of farm by-products). Goats can utilize pasture and forage which cattle find difficult to consume. This implies that the cost of

feeding may not be as high as the feed cost of sheep and cattle. Goats have a short generational interval as they are early-maturing. In fact, they reach puberty as early as four months while it takes sheep six months to do so. However, it is better to delay breeding till the goat is eight months old to achieve better results (Department of Agriculture and Rural Development (DAR) 2015). It therefore follows that goats have a short investment gestation period compared to cattle and sheep.

Goats also have their place in the culture. Goats are used to pay dowry and are eaten during community meetings (tribal meetings, parties, land conflict resolution and circumcision ceremonies). Their horns and bones are used in the traditional craft industry. Goat production requires limited financial resources, local knowledge and the utilization of natural resources. Goat production is commercially viable as it yields an investment return of more than 40% (IGA) 2014). Goats have received little attention in literature but have grown more than the other animal production sectors. South Africa has one of the fastest growing demands for livestock products in the South African Development Communities (SADC) owing to strong urbanization rates and high national incomes (Tui et al. 2013). The economic terrain of livestock production has changed from export-based in the 1990s to import-driven in the 2000s because of the increase in goat meat imports. South America and Australia account for the bulk of the meat imports of South Africa. In 2010, the total red meat import of South Africa was valued at USD110 million (Tui et al. 2013). This implies there is a supply gap which local farmers can bridge and profit from.

Challenges/constraints faced by goat farmers

Goat farmers in the surveyed area highlighted some of the constraints/challenges faced, as shown in Figure 4. The notable underlying constraints to goat production include theft of live animals, grazing land scarcity, pests and diseases, water scarcity and inadequate access to funds.

Figure 4. Challenges in the goat value chain
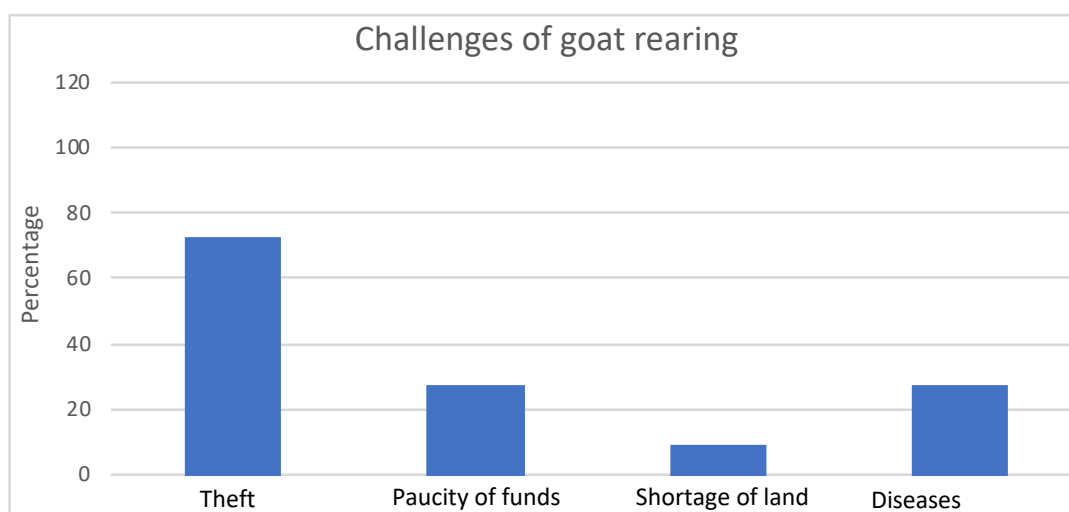
Conclusion and recommendations

The study findings reveal that there is great potential in goat production in Limpopo Province and the country at large, considering a number of untapped avenues for profitmaking and livelihood enhancement opportunity in this enterprise. One of the main challenges is identifying the active roles of players and actors in the value chain. Based on the foregoing, the following recommendations are made:

1.   Goat farmers' associations/cooperatives should be properly coordinated and assisted with the needed funds by government and relevant stakeholders so as to be able to take advantage of the opportunities inherent in goat husbandry.

2.   Government, local and tribal or traditional authorities should assist with providing grazing land and all the necessary infrastructural facilities (water, information and communication technology etc.) to enhance improvements in the quality of goats and their products. This will further enhance accessibility to the formal market.

3.   Capacity building of goat farmers through regular training on basic management practices should be prioritized to enhance productivity and profitmaking.

4.   Investment in fencing infrastructure should be made a priority to forestall goat theft and other hazards associated with management and housing.

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Contributed papers session 3: Governmental schemes and private funding models

An innovative approach to cattle fattening in Swaziland: A financial perspective

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Abstract

Livestock production is a major agricultural activity, and cattle are the main investment assets for many Swazi households. Most cattle produced and traded by smallholders is managed on common grazing land and there is considerable potential to increase the economic contribution of this very unproductive system by integrating smallholders into the well-developed beef cattle value chain.

The innovative approach to fattening offers smallholders a viable business model to engage in the value adding activity of beef cattle fattening. The Micro-Finance Unit (MFU), Swaziland Water and Agriculture Development Enterprise (SWADE) and International Livestock Research Institute (ILRI), supported by the International Fund for Agricultural Development (IFAD) (project sponsor), have cooperated to implement the innovative approach to fattening in Swaziland.

To engage in cattle value addition utilizing the approach, smallholders require funding. A funding model was designed by drawing on learning experiences from other financial schemes (past and present at the time) and a holistic approach to funding was adopted, which included the necessary framework required for lending to the target market.

The funding model proposed for a pilot was structured around the critical linkages between:

- Providers of technical and business support.

- A financial partner for the administration and monitoring of loans allocated to selected and trained groups of borrowers, where 90% of a loan issued would be backed by a guarantee provided by the project sponsor.

- Commercial market participants for the offtake of 'fat/finished cattle'.

- External producers and traders for the consistent supply of 'thin cattle'.

Loan terms were structured to be attractive to borrowers but still required borrowers to have some level of contribution and risk. Loan terms were also proposed so that the pilot funding model could transition into larger similar and existing financial schemes or run independently of other schemes (post the pilot).

Financial institutions were approached and requested to participate in the funding model. Positive feedback was received from all financial institutions, which displayed a willingness to participate whilst offering flexible terms. A

single financial institution was selected to participate in the pilot funding model and an agreement was finalized with this institution.

Several challenges were, however, observed during the preliminary stages of implementation, which include (amongst others):

• Challenges with capacity available for the provision of technical support.

• Delays in responses from stakeholders.

• Problematic contracting (for the supply of cattle and guarantees from market with flexible terms).

The pilot funding/lending model was then tailored to account for some of these challenges, where necessary. In order to replicate the model successfully in other regions, the following is required:

• Local technical capacity and support are key (e.g. universities for research capability and assistance with activities such as construction of feeding structures; agencies of ministries, e.g. MFU, SWADE for the provision of technical support etc.).

• Borrowers need to possess a basic level of education.

• The value chain should be sufficiently developed, e.g. availability of inputs, heath services, cattle supply, logistics, market etc.

• Partnering financial institution(s) with an appetite for small and medium enterprise (SME) development and risk is/are required (availability of funds for loans, financial support, affordable terms, availability of funds especially initially, for guarantee).

• Financial and business expertise, in order to develop the business case(s), tailor the financial model based on conditions, obtain funding/buy-in from financial institutions, negotiate terms to govern the funding model etc. are needed.

• The ongoing presence and drive of a dedicated project manager is vital.

The environment in Swaziland possessed the fundamental variables/factors required for success and the main challenges experienced relate to capacity constraints during the implementation of the proposed model (challenges were largely overcome).

Keywords: funding model, smallholders, cattle fattening, innovative approach

Introduction

The 'innovative approach to fattening' is an approach which offers smallholders a viable business model to engage in the value adding activity of beef cattle fattening. The approach utilizes grass- or forage-based fattening diets. Crop residues, particularly sugarcane tops and molasses, which are currently not being used efficiently in Swaziland, can also be utilized (at a reduced cost when compared to other fattening approaches). It is estimated that feed accounts for 75%-80% of fattening costs so a significant reduction in feed costs ultimately leads to a more profitable and sustainable approach to fattening.

The MFU, SWADE and ILRI, supported by IFAD, have cooperated to implement the innovative approach to fattening in Swaziland. The approach has enjoyed international success. It initiates a smallholder shift from subsistence-based cattle production to one that is commercially focused. Finally, the approach offers the country an option for diversifying agricultural income (which is mainly sugar-related) in the long term.

JALTECH is a boutique corporate finance and actuarial advisory firm focused on financial solutions in Africa and was mandated by ILRI and the MFU to provide the financial expertise necessary for the project to:

- Develop the business case for the innovative approach to cattle fattening in Swaziland.

- Develop the pilot funding model which allowed smallholders to access finance.

- Engage financial institutions and acquire participation in the pilot funding model from these institutions.

- Assist with the financial aspects required for implementation.

This paper discusses funding models proposed in the past (and those that existed at the time of the project start) in Swaziland to draw key learning experiences and positive takeaways from these schemes. From these learnings, a summary of the key factors necessary for a successful funding model is provided. The proposed pilot funding model, the various stakeholders involved and the roles of stakeholders are then discussed.

The paper also describes practical experiences and challenges associated with implementation of the proposed pilot funding model, which includes experience from interactions with potential funders and stakeholders involved.

Finally, the paper concludes with the institutional environment necessary to replicate the model in other regions.

Preliminary context—an overview of beef cattle production in Swaziland

Livestock production is a major agricultural activity and cattle are the main investment assets for many Swazi households. Sixty-five per cent of homesteads own cattle. Most cattle are managed on common grazing land and there is considerable potential to increase the livestock economic contribution of what remains a very unproductive system (World Bank 2011).

Co-existing alongside the traditional system is a small but very well developed commercial cattle industry, comprising production of both beef and dairy products.

The table which follows highlights fundamental differences between commercial livestock production on Title Deed Land (TDL) and smallholder production on Swazi Nation Land (SNL).

Commercial production on TDL land	Smallholder production on SNL land
Grazing on natural pastures and crop residues to fatten animals— this is supplemented with manufactured feed concentrates.	Almost exclusively communal grazing on natural pastures and crop residues.
Categorized by medium to high input production expenses.	Low investment.
Centred on profit-oriented management practices that feature improved genetics and nutrition.	Most smallholder farmers regard cattle as assets and have been unwilling to sell in the past, unless circumstances required it (financial need).
Cattle stocking rates are carefully managed to ensure that animals reach slaughter weight rapidly and cost effectively.	Animals are late to mature, reaching slaughter weight at advanced ages. This is a combined effect of poor genetics, overstocking, poor management practices and poor nutrition.
Some commercial producers take advantage of public health care services but many employ private veterinarians.	Cattle stocking rates are excessively high, leading to land overgrazing and degradation.
	Benefits from free health care provided by a government-run tick dipping program.
	Benefits from government breeding ranches.

Source: FAO (2012), World Bank (2011)

There are three primary value chain participants: producers, traders and fatteners (excluding providers of input services, processors and markets). The majority of cattle traded, sold and slaughtered by smallholders are lean/thin cattle. Traders link smallholder producers to buyers and provide market information for producers as well. Lean cattle are usually sold to rural butcheries or other smallholders, from where they are taken home for slaughter (informal markets). In a minority of cases smallholder traders/producers with access to finance send cattle for fattening before sale. Fattened cattle attract significantly higher prices from commercial markets. Overall, the beef cattle value chain is well developed compared to other livestock value chains in Swaziland (World Bank 2011).

A diagrammatic view of the value chain is included in the appendix (Section 9.3.)

The table which follows outlines the main participants in the beef cattle value chain and provides an overview of the role played by these participants.

Participant	Overview of role
Input and supply provision	Supply of cattle, health services, feed etc.
	Government plays a key role in providing extension services (health services) for smallholders.
	Private suppliers of inputs and services are used by commercial producers.
Breeding and fattening ranches; feedlots	Established by government to provide quality breeding bulls for farmers to improve their herds.
	Fattening ranches help farmers fatten/finish their animals.
	Almost all commercial farmers, regardless of their size, use a combination of grazing and feedlots.
Sales platforms	Sales from smallholders are mainly transacted using face-to-face negotiations (mainly at dip tanks or home states – the use of auction yard sales is limited for smallholders).
	Traders are generally producers also involved in cattle trading.
Traders—agents and individuals	Traders buy and sell cattle or secure cattle markets for cattle producers (charging a commission, thus behaving like brokers).
	Some traders are also involved in meat processing and have their own butcheries.
	Agents for commercial buyers purchase cattle for their relevant establishments.
	Individuals purchase cattle for personal needs.
	Three types of slaughtering occur in Swaziland (home, commercial and export)
	Swaziland Meat Industries (SMI), registered as a public company in terms of the Swaziland Companies Act, is the sole licensed exporter in the country:
Markets/ slaughtering and processing	SMI is involved in the breeding, buying, feeding, slaughtering and processing of cattle and pigs.
	SMI sells its products at both wholesale and retail levels.
	About 215 butchers slaughter animals on a commercial basis.
	Other large abattoirs engage in a combination of wholesale and retail selling.

Source: Mamba (2016)

Swaziland could benefit from reduced tariffs for slaughtered beef exported to the European Union (EU) under the Lome convention. Currently, this export benefit is not being maximized as more than 90% of supply is consumed locally. Smallholders are also initiating cross border sales by transacting with cattle purchasers from Mozambique, who are willing to pay a premium for cattle. The markets exist and demand is significant.

Learning experiences from past and current agricultural financing in Swaziland

To design and create a practical funding model it is vital to take cognisance of funding schemes proposed in the past (and those that exist) to draw key learning points and positive takeaways from them. This section discusses some of the main schemes reviewed before finalization of the funding model proposed for a pilot.

Previous schemes offered in partnership with a financial institution

The Smallholder credit and marketing project (SCMP) was established in 1985 to support SMEs. An international agricultural fund loaned funds to a financial institution for lending to the target market (SMEs involved in agriculture). The funds loaned to the financial institution would be administered as a revolving fund, with the provision that they were managed in a sustainable way.

A contribution of 25% was initially required from the borrowing SME but this was often waived during the first borrowing stages. All SCMP facilities were seasonal and repayment schedules were synchronized with project cash flows, with a stipulated maximum repayment period. The scheme was characterised by lacklustre performance and high levels of default.

In 1995, a second phase of the program, the Smallholder agricultural development project (SADP) was initiated. The SADP was designed along the same principles as the SCMP with the exceptions of an emphasis on group lending and the introduction of borrower training to improve project viability.

A provision for linkages between the financial institution and NGOs was made where NGOs were expected to provide group dynamics training expertise (for groups of borrowers). Trained groups were then referred to the financial institution to apply for funding. The Ministry of Agriculture (MoA) was responsible for the selection and mobilization of participating NGOs. Groups were expected to have been operating for at least a year and to have a 25% contribution before being eligible to apply.

The funds were provided at a low interest rate to the institution. A margin was added to the final beneficiary interest rate, which was capped. The margin on the interest was to be apportioned between the financial institution and the participating NGOs, with a proportion reinvested into the revolving loan account.

Although an initial agreement was signed as early as 1993/4, the financial institution only began actively participating in the SADP in 2001 owing to its insolvency and subsequent restructuring process. By the end of the SADP project, the SADP had exhibited the same lacklustre performance as its predecessor, the SCMP. Linkages with NGOs and group training did not materialize (FAO 2012).

Key challenges and learning experiences identified:

- Borrower discipline was low and the target market was not financially literate: 'throwing money' at the problem without the required training and support is not a holistic solution.

- Waiving contribution requirements may be a way for borrowers to become eligible for finance but they then have no 'skin in the game' and little incentive to succeed.

- Coordination for the administration of groups and training under SADP did not materialize. This may be as a result of capacity constraints within the MoA/participating NGOs, as well as a lack of dedicated project drive and central point for coordination.

- Positive takeaways:

    - Loan repayment schedules were synchronized with cash flows to reduce the cash flow burden on borrowers.

- Group lending can increase lending viability from a transaction and risk perspective.

- Training is a fundamental requirement given the target market but this should not be limited to purely training on group dynamics (groups require other financial, technical and business skills).

Financial institution and SMI loan product

A financial institution and SMI engaged in a loan scheme to provide credit for smallholders to enable them to fatten cattle. The basic idea was that smallholders would approach SMI to obtain a guarantee for the purchase of fattened cattle, which would also provide SMI with a regular supply of fattened animals. On the back of this arrangement, the financial institution would step in to provide the finance required for the fattening process. The idea had merit but, practically, the scheme experienced several challenges which led to its eventual collapse.

Key challenges and learning experiences identified:

- The fattening approach using cereal- or commercial-based inputs was expensive and profit margins became tight:

  - The tighter the profit margin, the greater the sensitivity of the fattener to pricing and negative price changes.

  - Higher prices offered to fatteners from other buyers became significantly more attractive, which incentivized side selling.

- Cattle did not reach its predetermined destination (SMI) and loan repayments were not paid by the intended buyer (SMI) to the financial institution.

- A competitive market-linked price to nullify the incentive of side selling is required.

- Constrictive points in the value chain require consistent monitoring and intervention to further reduce undesirable behaviour.

- Positive takeaways:

  - The model did make technical and sector-specific market support available to borrowers.

  - Demonstration of market willingness to participate (off-take to guarantee sales could be arranged).

Central Bank of Swaziland—the Small-scale loan guarantee scheme

The Central Bank of Swaziland's (CBS) Small-scale loan guarantee scheme (SSLGS) was established in the early 1990s by the Swaziland government as a partial response to the challenge of inaccessibility of finance by SMEs, which were faced with a lack of collateral required by financial institutions. The scheme is managed by the CBS and administered through all commercial banks in Swaziland. The objective is to increase lending to SMEs by reducing the financial risk to banks. Banks have signed a participating agreement with the CBS.

The CBS, through the SSLGS, now provides a 90% guarantee to participating banks in respect of SME loans for which there is inadequate collateral. Loans are made from banks' normal financial resources. The maximum guarantee is capped per loan application (in amount and term). Borrowers are expected to contribute a minimum of 5% if they are start-ups and 15% if existing businesses. A new condition of the SSLGS is that borrowing SMEs must receive mentorship and entrepreneurship training from government-accredited service providers for a minimum period of four weeks (for start-ups). The performance of the SSLGS has historically been lower than expected (FAO 2012).

Key challenges and learning experiences identified:

- Cumbersome procedures for claiming against the guarantee for defaulting clients make it unattractive to financial institutions providing the loans.

- The charges for mentorship and training which have to be borne by the client have also been a contributing factor to low uptake.

- Positive takeaway: banks are required to have a portion of funds at risk, which acts as an incentive for responsible lending (own funds at risk).

The funding model proposed for pilot

Arriving at the funding model

The table below provides a summary of key learning points identified in the analysis of historic and existing funding schemes in Swaziland.

Key area of focus for consideration in funding model design	Learning points from previous schemes
Improving borrower discipline, capacity and incentivizing the right behaviour	Reducing initial contributions may be more effective than eliminating these entirely—clientele needs to have something at stake/risk to encourage the right behaviour.
	Technical support is a fundamental requirement.
	Capacity building programs with the right mix of modules are imperative.
	Formal business operating and governance processes and procedures should be developed and followed.
	The model should contain the necessary preventative mechanisms and oversight to reduce undesirable behaviour.
Capacity of providers of support is critical	Providers of support must possess the necessary capacity and coordination capability.
The market must exist; business model must be sustainable	There should be sufficient demand for the final product and the value chain should be sufficiently developed.
	The business model needs to be sustainable and practical:
	Inputs must be available and affordable.
	Off-take prices must be comparative with the market.
Financial partner to provide a suitable level of oversight and support	The monitoring and recovery rate of development loans should be comparable with the performance of a financial institution's own funds, i.e. the same rigorous processes to administer, monitor and recover funds should be used for sponsor-backed funds or guarantee schemes. Hence, financial institutions should be exposed to some level of risk.
Mechanics and terms of loan suitable for all borrowers	Loan repayment schedules that are synchronized with cash flows reduce the cash flow burden on borrowers.
	Interest rates should be suitable and sustainable.
Loan administration to be attractive to a financial partner	Group lending offers an opportunity to reduce risk and administrative costs, and initiate skills transfer (within a group).

The proposed pilot funding model and associated roles and responsibilities

The diagram below provides a graphical illustration of the proposed funding model. The model was structured around the critical linkages between:

- Providers of technical and business support

- A financial partner for the administration and monitoring of loans allocated to groups of borrowers.

- Commercial market participants engaged for the off-take of 'fat cattle'.

- External producers and traders engaged for the supply of 'thin cattle'.

A summarized description of the roles and responsibilities of various participants involved in the pilot funding model follows.

Figure 1. Illustration of proposed funding model
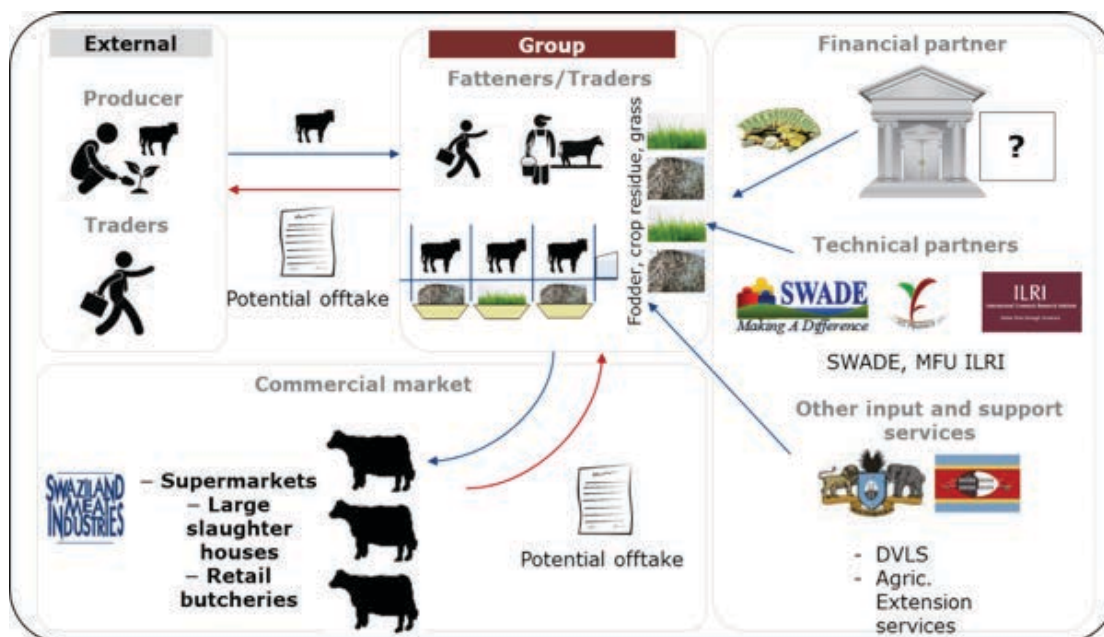
The table which follows provides a high-level description of the roles and responsibilities proposed for the various participants involved in the funding model.

Participant	Overview of role
Fattening groups	Group members are assisted to establish a formal company for the purposes of fattening.
	Groups, made up of different skills, are selected for the pilot—composed of traders and fatteners who own cattle and were required to sell cattle to the established group company for fattening.
	Group members who also breed are required to regularly supply cattle. Provide capital to fund cattle purchases and working capital for fattening.
Financial partners	Administer guarantee funds (see 6.3 below) and loans to groups.
	Provide extension officer services to assist and monitor fattening/trading groups.
	Engage with SWADE business support officers for coordinating support and payment approval system.
	Provide business development training (e.g. financial, business and people management), soft skills training (e.g. group dynamics, business ethics) and technical training (e.g. sustainable fattening approach, animal health care).
Technical partners (primarily SWADE, with assistance and oversight from ILRI)	A 90% guarantee to the value of USD100,000 (total value) is provided by project sponsor.
	Assist with business case development and budgeting.
	Undertake ongoing mentorship of groups, monitoring and intervention, especially during pilot stage.
	Provide support, both business and technical.
	Engage and coordinate with other providers of support, to provide assistance for groups.
Other input and support services	Engage with financial partners to process and approve release of funds. Assist with technical and healthcare support, where areas of expertise are beyond that which exist at SWADE.
Commercial market	Agreements are not sought from one large purchaser, thereby providing the purchaser with a monopoly on supply and the ability to pay lower prices (which, historically, encouraged side selling).
	Agreements are intended to be structured to secure off-take from a few of the largest commercial purchasers in the market on a competitive basis, thereby stimulating price competition (and higher prices).
External producers, traders and fattening groups	Purchase agreements are to be sought with large external producers and traders for cattle supply (where possible).

Given the pilot nature of the project, a single financial partner was required to assist with the administration of loans to selected fattening groups (reducing the complexity of loan processes and procedures and simplifying the coordination of participants involved in the model).

Funding terms and administration of ILRI guarantee funds

ILRI, through IFAD, made USD 100,000 available for the funding model, to be used either as a guarantee or a revolving loan account.

The pilot loan terms were designed to:

- Be attractive to fattening groups, whilst not providing groups with a 'free chance' at success – i.e. groups were required to have some form of contribution at risk.

- Provide the financial institution with a commercially viable product, i.e. they would be able to continue to lend post the pilot (using existing guarantee schemes or by introducing a collateral requirement etc.).

The table below outlines the terms of the proposed loan structure set for the pilot.

Basic structure	Description/explanation
Average loan size—loans capped per fattening cycle	The loan would provide capital for a single cycle, to:
	Purchase young animals ('thin cattle').
	Purchase inputs and cover operational costs.
	A 15% contingency to cover unexpected costs was included in the estimate of the total loan amount.
	Groups were required to contribute 5–10% of the loan required per cycle.
	The total contribution would be split equally amongst the members.
Contribution required from groups	Each member would be required to contribute their own equity, which could be in any one of the following forms:
	A predetermined number of labour hours
	Offset against cattle sold to the company
	Cash
No collateral required, off-take beneficial	In kind (as determined appropriate by SWADE)
	Ideally a soft requirement (as opposed to hard collateral such as cattle or buildings) in the form of off-take agreements with the market (market guarantee)
ILRI guarantee covers the majority of risk but institution to retain a portion	To be provided directly to banks by ILRI. Administered sustainability as a guarantee against loan default (guarantee is simple to administer and a financial institution preference)
	Guarantee to cover 90% of the financial institution's exposure (the amount outstanding to the institution) so that the financial institution retained a proportion of risk
Groups responsible as a company for loan	The loan would be provided at the company (group) level so the company would be liable for repayment
Interest charge sustainable for both the institution and the groups	Prime + 2% p.a.
Repayment schedule	Cash flow synchronized, early repayments allowed and to be made at the end of every cycle once cattle are sold
Training	Relevant training modules (group dynamics, technical and business subject matter) to be provided by SWADE

Financial institutions were not required to go above and beyond business as usual (in terms of existing credit processes and procedures). At the end of the pilot, the initial USD 100,000 provided by IFAD as the guarantee (or the remaining value thereof) would be returned. Financial institutions could then continue to lend to existing/new groups using existing schemes such as the CBS (to which the pilot loan terms could transition) or independently of a guarantee scheme.

Preliminary observations and the environment necessary to replicate the model

Feedback from financial institutions

Preliminary discussions with financial institutions were extremely positive. All the institutions that were engaged expressed a willingness to be involved and were prepared to offer very favourable terms. Feedback suggests that almost all institutions have a strategic objective to invest in SMEs in a way which involves the expansion and diversification of agricultural portfolios. Institutions have also been searching, with limited success, for suitable SME projects in which to invest. There appears to be sufficient capital available for investment in agricultural SME projects; however, the availability of sustainable projects has been limited.

A single financial institution was selected for the pilot and an agreement which governed the terms of the funding model was signed with the institution.

Challenges observed during implementation

The table which follows describes some of the preliminary challenges observed during early stages of funding model implementation.

Challenge	Description/explanation
Challenge with capacity for the provision of technical support	Availability of provider of technical support
	Number of business support officers insufficient
	Difficulty in coordinating groups and parties involved
Delays in responses from stakeholders	Collection, accuracy and maintenance of data (example results of fattening cycles)
	Other stakeholders involved required more time to respond than envisaged, which led to delays.
	Smallholder suppliers of cattle have a preference for verbal negotiations and are not experienced users of contracts.
Contracting problematic	Some market participants require exclusivity for the provision of a guarantee and so off-take agreements with flexible terms can be a challenge to acquire (without the requisite timeframes allocated).

Due to the contracting/off-take challenge the need for an off-take in the loan structure was relaxed. This was acceptable due to high market demand.

Requirements to replicate the model in other regions

The table which follows proposes key requirements for the implementation of the funding model in other regions.

Requirement	Description/explanation
Local technical capacity and support are key	Availability of local technical support, for example:
	Universities for research capability (assess the state of the target market, the value chain etc.) and assistance with activities such as construction of feeding structures
	Agencies of ministries, e.g. MFU, SWADE, to provide technical and business support
Basic level of borrower education is required	Borrowers need to possess a basic level of literacy, and business and financial acumen (group structures can enable borrowers to transfer certain skills to other members).
	Where the target market is still in very early stages of development, borrowers should be brought to the appropriate level of expertise required (through preliminary training programmes).
Developed value chain	The value chain should be sufficiently developed, e.g. inputs, health services, cattle supply, logistics and market etc. This is a key differentiator between beef livestock in Swaziland and other livestock sectors.
	Borrowers' business model/case supports the costs of borrowing.
	A financial institution is required to administer the loan scheme in coordination with the provider of technical services.
Partnering financial institution with the appetite for SME development	The institution should:
	Have an appetite/mandate for SME development.
	Possess the capacity to provide financial support (e.g. extension officers).
	Have funds available at affordable terms.
	Assume some level of risk.
Funds available from sponsor for guarantee	The availability of funds to provide a guarantee for loans issued to SMEs is a significant incentive for a financial institution, which could participate (and gain experience) in the model with reduced risk (before taking on more risk).
Financial and business expertise	To develop a business case, tailor financial model based on conditions, obtain funding from financial institutions, negotiate terms to govern the funding model etc.
Dedicated project management	Ongoing presence of a dedicated project manager to monitor, intervene and coordinate activities as necessary

The environment in Swaziland possessed the vast majority of the requirements for successful implementation of the funding model.

Conclusion

The proposed innovative approach to fattening offered smallholders a sustainable means to engage in beef livestock value addition by allowing them to engage in the activity of cattle fattening. The pilot funding model was designed by drawing on learning experiences from other financial schemes (past and present at the time) and adapting these learnings to the current environment, and a holistic approach to funding was adopted, which included the necessary framework required for lending to the target market.

The environment in Swaziland possessed the fundamental variables/factors required for success and the main challenges experienced relate to capacity constraints during the implementation of the proposed model. (The challenges were largely overcome).

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Appendix. Cattle value chain

The value chain diagram below illustrates the flow of 'thin cattle', which are low-value products generally destined for informal markets, and 'fat cattle', which have undergone value addition and are therefore usually destined for formal commercial markets (where they attract premium prices).
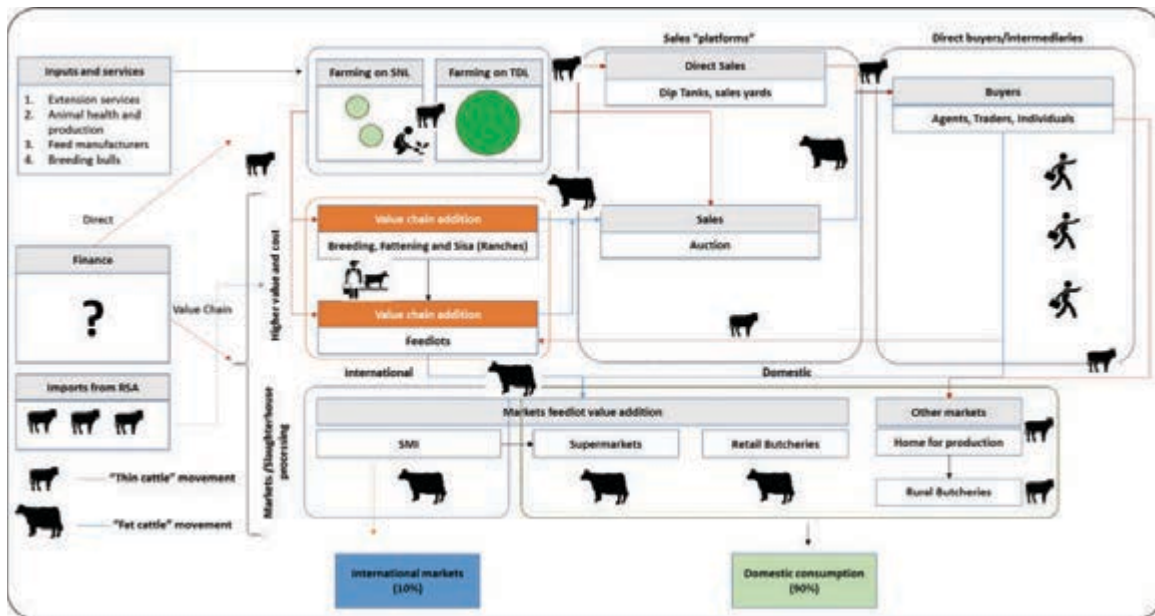
Rural financial services and their effects on livestock production in Ethiopia

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Abstract

The aim of this paper is to identify the types of rural financial services and their effect on livestock production in Ethiopia. Financial services are essential for protecting and improving the livelihoods of rural populations. The financial service offerings to the agricultural sector in Ethiopia face gaps in terms of demand and access to financial services. These gaps are due to there being few financial institutions which offer financial services to rural areas. A World Bank report in 2014 estimates that only 1% of Ethiopian rural households maintain bank accounts. The main financial institutions that give financial services in Ethiopia are banks, insurance companies, and microfinance, cooperative and informal financial institutions. Several studies have been conducted to examine whether microfinance can really help the poor. However, there is no consensus on results and studies contradict each other. In some cases, microfinance is said to have brought positive impacts, whereas in some other cases, it is found to play an insignificant role. The same is true for livestock production as the impact of credit on different groups of households (poor and better-off) is different. This is due to many problems that make financial services unsuccessful, particularly for the poor. Lack of finance (limited loans), lack of flexibility in the repayment period, low saving interest rates, lack of collateral (group collateral), diverting loans to other purposes, drought and animal diseases, lack of appropriate skills (training) and lack of follow-up are some of the problems. Recently, the demand for livestock and livestock products in the domestic and export markets increased. Therefore, the government and private sectors realized the available potential of the livestock market and took appropriate measures to solve the abovementioned problems.

Keywords: Rural financial services, microfinance, livestock production, Ethiopia

Introduction

Ethiopia's economy is based on agriculture, which contributes 43% of the gross domestic product (GDP) and 80% of employment, and generates an estimated 75% of the export earnings (National Bank of Ethiopia (NBE) 2015). Thirteen million smallholder farmers account for 95% of total production. The International Monetary Fund (IMF) ranks Ethiopia as among the five fastest-growing economies in the world and the first from Africa. The Ethiopian economy registered an average annual growth rate of 10.1% during the period 2010/2011 to 2013/2014. Agriculture grew by 5.4%, and industry and services expanded by 21.2% and 11.9%, respectively. However, the country remains one of the poorest countries and the average per capital income is less than half of the current sub-Saharan average. The largest group of poor people in Ethiopia is composed of small-scale farmers. This is due to the agricultural sector

suffering from poor cultivation practices and frequent drought. Therefore, rural financial services are very important to improve the livelihood of rural households.

The government of Ethiopia has made marked progress in agriculture over the past decade. However, from the point of view of the financial sector, agriculture is a less attractive field of business than other sectors of the economy such as construction, tourism, trade and other services. The main reason is lack of profitability of many small-scale farming activities due to a lack of economies of scale in land use and the use of outdated farming practices. Moreover, subsistence farming is likely to be a loss-making activity and even commercial farmers face an unfavourable, mostly weather-dependent, risk return. Ethiopia is highly endowed with livestock resources, ranking first in Africa, and is among the top ten countries in the world. It has more than 55.03 million head of cattle, 27.35 million sheep and 28.16 million goats (Central Statistics Authority (CSA) 2013). Even if Ethiopia is highly endowed with livestock resources, livestock production suffers from the unfavourable conditions.

Livestock is an integral part of the agricultural GDP (i.e. 45%) and serves the Ethiopian economy as a source of food traction. Livestock is closely linked to the social and cultural lives of millions of rural, urban and pre-urban households in Ethiopia. Because livestock is a source of employment and cash income for many people, it also acts as a security asset to credits and loans. It is also considered a common means of demonstrating wealth, cementing relationships through bride price payments and as social links, and important in crises (Ouma et al. 2004). Consequently, an increasing trend of livestock populations shows the country has substantial resource potential to attract investment and fosters the development of the leather industry (United States Agency for International Development (USAID) 2013). However, livestock and its products constitute a fifth of Ethiopia's exports. This indicates that there is a huge gap between the livestock resource base of the country and the growth of the sector. This is due to livestock production in Ethiopia being affected by many factors (drought, disease and others). In addition, government and non-governmental organizations (NGOs) have given more attention to crop production than livestock.

Lack of capital is among the prominent factors in developing countries which impede livelihood diversification (Gibson and Olivia 2008). Shortage of finance is particularly affecting the millions of Ethiopian rural households. The federal government of Ethiopia has formulated a rural development strategy and underlined the role of rural finance for the overall development of the agricultural sector. The objective of this paper is to identify the types of rural financial services and examine their effect on livestock production in Ethiopia by reviewing data from different articles, proceedings and research outputs. This paper consists of the following sections. Section one provides general information. Section two identifies and explains types of financial institutions in Ethiopia. Section three examines the impact of financial services on livestock production. Section four mentions the challenges of financial services and the final section gives concluding remarks.

Types of financial institutions in Ethiopia

Financial services play a critical role in sustainable economic growth, poverty reduction and food security in Ethiopia. Financial services are essential for protecting and improving the livelihoods of rural populations. The financial service offerings to the agricultural sector in Ethiopia face gaps in terms of access to financial services, and product quality and quantity. These gaps are due to there being few financial institutions offering financial services to rural areas in Ethiopia. For instance, credit is one type of financial service used for investments, to increase the productivity of agricultural operations or to diversify the economic activities of rural households. However, there is a huge gap between demand and access to credit in Ethiopia. A World Bank report in 2014 showed that Ethiopia ranks 109th in getting credit of 189 countries. The main financial institutions that give financial services in Ethiopia are banks, insurance companies, and microfinance, cooperatives and informal financial institutions.

In 2015, the total number of banks in Ethiopia reached 19 (16 are private) and a total of approximately 2,636 bank branches. Ethiopia is one of the most under-banked countries in sub-Saharan Africa (SSA), with a bank branch-to-population ratio of 1:34,171.54 (one branch for 35,000 customers). According to the World Bank report, only 1%

of Ethiopian rural households maintain bank accounts. This is because of the total bank branches, about 35.4% were located in Addis Ababa (the capital city of Ethiopia). In other words, these numbers indicate that millions of poor households in Ethiopia are excluded from formal financial services, particularly in rural areas where over 80% of households live, due to lack of collateral.

The other financial institution in Ethiopia is insurance companies. The number of insurance companies reached 17, of which 16 were privately owned. The number of branches increased to 369, of which about 53.4% are located in Addis Ababa. The total capital of the insurance industry increased by 34.7% on an annual basis and reached ETB 2.5 billion (Ethiopian birr), of which 81.1% was the share of private insurance companies. The Ethiopian Insurance Corporation is the only insurance company providing livestock insurance in Ethiopia and most of the farmers are not aware of livestock insurance.

Microfinance institutions (MFIs) most commonly provide financial services for rural areas in Ethiopia. In 2015, there were 33 MFIs with a total capital of ETB 6.6 billion, which provided services for 3 million clients. The services provided by MFIs include collecting savings, providing group and individual loans, micro-leasing activities, micro-insurance and domestic money transfer services. Currently, the contributions of MFIs are growing fast in both rural and urban areas. However, the demand for microcredit is far from the supply: an estimated of 80% of rural demand for loans is still uncovered. The top five largest MFIs are Amhara Credit and Saving Institute (ACSI), Dedebit Credit andSaving Institute (DCSI), Oromia Credit and Saving Institute, Omo Credit and Saving Institute and Addis Credit and Savings Institute. These MFIs constitute an 80% market share with 83.8% of the total capital, 93.7% of the savings, 89.8% of the credit and 90.4% of the total assets of the MFIs (NBE 2015).

Cooperatives are the other type of financial institution in Ethiopia. Cooperatives have higher comparative advantages than other forms of organization. Agricultural cooperatives help their members to increase their yield and incomes by pooling their resources to support collective service provisions and economic empowerment. In Ethiopia, agricultural cooperatives play a major role in providing farmers with inputs while ensuring members' social cohesion and economic improvement (Agricultural Transformation Agency (ATA) 2012). The Ethiopian ATA has been working closely with the Ministry of Agriculture to increase the number of smallholder farmers benefiting from participation in cooperative enterprises. There are around 27,000 multipurpose cooperatives, of which about 30% are saving and credit cooperatives (SACCOs).

The other and the most important sources of rural finance in Ethiopia are informal. These days, however, informal grain and cash loans are decreasing in magnitude and frequency. The major informal sources of finance are relatives and friends, money lenders and community-based Oorganizations (CBOs) like Iqqub and Iddir (Aredo 2004). Iddir is a non-formal insurance group intended to mitigate emergency situations for the death of household members, loss of livestock and other shocks. Iqqub is a non-formal rotating and saving and credit association. Besides these, keeping livestock and jewellery in kind are other saving options for rural households (Ali 2015).

The impact of financial services on livestock production in Ethiopia

In Ethiopia, both government organizations and NGOs consider micro-credit a prime policy instrument in reducing poverty and increasing the productivity of the poor. Several studies have been conducted to examine whether microfinance can really help the poor. There is no consensus on results, some of which are contradictory. In some cases, microfinance is said to have had positive impacts on the life of the program clients whereas in some others, it is found to play an insignificant role in mitigating the problems of the poor.

Studies by Tesfaye (2003) and Hailai (2010) on the impact of the DECSI in the Tigray region confirmed that the impact of households' participation in microfinance on reducing poverty and accumulating fixed assets is insignificant. Participation in microfinance may help households just to survive in times of shocks and vulnerabilities or for

consumption smoothening. Asmelash (2003) also pointed out that participation in microfinance has a positive impact on the clients' overall household income, acquisition of key household assets, access to education and access to health facilities. However, the survey findings did not give strong evidence regarding some of the impact variables such as women's empowerment, food security and coping with difficulties.

Other studies have been conducted on the role of the ACSI by Bamlaku (2004) and Getaneh (2005), and a comparative study of ACSI and wisdom was conducted by Kassa (2008) and Mekonnen (2008). ACSI is one of the largest MFIs operating in Ethiopia, providing a microfinance market to the low-income population, particularly of the Amhara region. All these study results showed that microfinance has a positive socio-economic impact on its clients through helping the poor increase their income, asset possession and empowerment status.

In most rural areas of Ethiopia credit is common for purchasing livestock. However, the effects of credit on livestock-producing households are different, because there are different groups of households (i.e. poor households and rich or better-off households). According to Siyoum (2012), the effect of financial services, particularly credit, is different in these two groups of households. His results showed that credit simply helped poor households to cover seasonal food shortages with no impact on long-term productivity and household food security. Poor households are risk averse, and this prevents them from using their loans to invest in agricultural productivity to improve their food security. Large numbers of better-off households, on the other hand, reported positively compared to the poor households. Credit enabled better-off households to buy additional oxen, seed and fertilizer, which helped them to increase their productivity.

For instance, 90% of the rich households bought livestock and only 69% of the poor households did so. This is due to poor households diverting part of the loan to other purposes such as seed, school fees, clothes, religious and social celebrations, medical expenses, house repairs or paying off debts. Consumption smoothing is the dominant use of loan diversion, followed by seed purchase and debt repayment. For instance, inability to pay back loans forces households to dispose of their assets at the risk of increasing their vulnerability. Sale of livestock to pay back loans, especially the sale of ploughing oxen, means that poor households may be obliged to rent out their land to another farmer, only to get from one quarter to half the produce as rent. This pushes poor households further into poverty.

The other difference between the two groups is source of credit. Credit for poor households mostly comes from informal sources (69%), whereas credit for rich households comes from formal sources (57%). In addition to this, the types of livestock purchased are different between the two groups. The poor acquired small livestock, such as sheep and goats, whereas the rich invested their money in large livestock, such as cows and oxen, for breeding and fattening. This indicates credit has a negative impact on household asset creation and asset holdings. Disease and drought are the main problems in livestock production in Ethiopia. Lack of proper clinic and veterinary services has aggravated the problems, forcing poor households to sell their livestock to pay back their loans. According to Siyoum et al. (2012), 49% of the poor were forced to sell the livestock that they had bought with a loan or that they had owned before the loan in order to pay the loan back. This drives most poor households further into poverty.

Challenges to financial services in Ethiopia

Access to credit is often viewed as a key to transforming semi-subsistence smallholder farmers into market-oriented producers. However, there are many problems that make financial services unsuccessful. Lack of flexibility in the repayment period and low saving interest rates were mentioned as most of the clients are not willing to save in the institution because the interest rate on saving is very small (3%) as compared to the lending interest rate (18%). The amount of loan clients are allowed to take at one time was also another problem. A new client is limited to borrowing an average of ETB 3,000. This loan is only important for the purchase of animal feed and small equipment. In addition, some of them are not happy with the group collateral arrangements. The other problem is many smallholder farmers lack immovable assets such as land, making it difficult for them to secure loans. Yet many own movable collateral such as agricultural machinery, products or receivables, livestock or warehouse receipts. Banks tend to be hesitant to accept such movable assets as collateral.

Tesfaye (2003) underlined that a significant number of clients consumed the loan they had taken or spent it on non-productive activities. The loan was used for non-productive purposes by 64.7% of the rural clients and 11.7% of the urban clients. It seems that there is a significant difference in the actual use of the loan between the rural and urban respondents. Lack of proper clinic and veterinary services is another problem, and the inadequate number of insurance companies in the livestock sector is another serious problem. Lack of appropriate skill training and lack of follow-up of the clients by the MFIs are also critical problems. Recently, the demand for livestock and livestock products in the domestic and export markets has increased. Therefore, the government and private sectors have realized the available potential of the livestock market and taken appropriate measures to solve the abovementioned problems.

Conclusions

Financial services, especially loans, enhance the welfare and economic situation of clients by making adequate finance available to help them engage in profitable activities. Credit not only has a limited impact on household asset creation but a negative impact on poor households' asset holdings by forcing households to sell their livestock to pay back their loans. This drives most poor households further into poverty. Most of the poor farmers failed to repay their loans, mainly because of lack of income from loan-financed business activities and poor crop performance caused by drought, pests and insufficient land holdings. Because of this, poor households sell their livestock to pay back loans, especially ploughing oxen, meaning that they may be obliged to rent out their land to another farmer. This pushes poor households further into poverty. On the other hand, credit enabled better-off households to buy additional oxen, seed and fertilizer, which helped them to increase their productivity.

Diverse and flexible financial services can provide positive incentives to attract the poorest and reduce the likelihood of their exclusion. As a result, financial institutions have to look over the repayment period, lending modalities and saving interest rate in order to make them attractive and successful. In addition to this, financial institutions should give attention to other important activities such as training, advice and follow-up (before, during and after) loans.

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Can value chain financing work for livestock in smallholder systems? Insights from the Zimbabwe Agricultural Development Trust

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Abstract

Across southern Africa more than 80% of the livestock is owned by smallholder farmers. Unlocking the full potential of this subsector is key to transforming agriculture in the region. Most national livestock development strategies have grappled with the challenge of finding viable and commercially sustainable financing models that support the building of vibrant and inclusive livestock value chains. Financing is required at all stages of the livestock value chain, from purchase of stock and sourcing of inputs through to marketing. With the majority of smallholder farmers still operating on the margins of value chains, poorly conceived credit schemes for financing livestock development have failed to transform production systems. In response to the dire shortage of agricultural finance in Zimbabwe, the Zimbabwe Agricultural Development Trust (ZADT) was created. The Trust delivers financing through financial institutions as intermediaries to invest in various stages of the agricultural value chain with a specific focus on smallholder farmers. After six years of existence, a review of the evolution of the Trust's model is bringing out important insights into financing inclusive livestock value chains. The paper interrogates the ZADT model, questioning whether it is helping to build more inclusive livestock value chains that have significant participation by smallholder producers who are otherwise constrained by limited access to capital. The assertion that a value chain financing vehicle that delivers finance to actors who share business linkages is the most effective approach is also tested. The paper examines whether this model is feasible in practice, and whether it is compatible with commercial imperatives of lending institutions and economic interests of farmers.

Keywords: value chain financing, livestock value chains, competitiveness

Introduction

This paper explores the question of whether value chain financing can solve the problem of lack of adequate and appropriate finance for smallholder livestock systems. Value chain financing is defined by Miller (2011) as all financial and support services flowing to or through value chain participants to address constraints to value chain growth. Financing though the value chain is considered to have the potential to improve access to finance, improve rates of payment, reduce delivery costs of finance and strengthen value chain relationships. In Southern Africa, 80% of

livestock is owned by smallholders. This level of smallholder involvement presents opportunities for improved smallholder livelihoods at scale through livestock value chains. However, smallholder livestock value chains often lack access to adequate and appropriate financing, which limits value addition and competitiveness.

This paper uses the case of ZADT, a trust established to mobilize and provide financing to agriculture value chains (including livestock) in Zimbabwe. As a local development finance institution (DFI), ZADT's objective is to improve food security and incomes for rural communities by providing funding for agricultural activities. The DFI responds to a serious lack of financing in the smallholder agriculture sector in Zimbabwe, as is the case in most African countries. Incomplete credit markets, which manifest in smallholders failing to access both short- and long-term capital, stifle the development of the livestock sector. Real and perceived constraints to finding smallholders include a high risk profile, high costs of serving small loans, often in remote locations, and weak linkages with the market. Therefore, a value chain model that benefits from collaboration along the chain to inform value adding activities of production, aggregation, processing and distribution of products is expected to reduce risk and costs of delivering and recovering credit.

The livestock sector deserves special focus and support. Globally, the sector employs an estimated 1.3 billion people and is a source of livelihood for an estimated 600 million smallholders in developing countries (Thornton 2010). Unlike in developed countries, where demand has stagnated, demand for livestock products in developing countries is growing rapidly, driven by rapid economic and population growth. Meeting this growing demand will increasingly require intensification of production systems and value addition along the chain. Smallholder livestock systems will require increased investments in order to benefit from the increasing demand, while contending with the constraints imposed by a changing climate. Appropriate finance is required at all stages of the value chain to enable a transition to more intensive livestock systems, from inputs such as breeding stock, stock feeds and vaccines, and infrastructure improvements up to marketing.

Appropriate[1] financial products enable smallholders to make profitable investments which enhance competitiveness, while enhancing smallholders' ability to repay (Christopher et al. 2015). In reality, this has not always worked as expected. A number of programs have experienced low repayment rates and viability problems and ended up with financial institutions becoming extremely risk averse and tightening lending measures for smallholders. As a case in point, the World Bank (2011) observes that despite the growing importance of trust funds (such as the ZADT), they have not been consistently effective in delivering financing. Substantial management changes have been recommended to boost their effectiveness and efficiency. This paper asserts that when appropriately developed and delivered, value chain financing through credit can be viable in smallholder systems, resulting in benefits for farmers that also strengthen value chain relationships.

The paper reviews how ZADT addressed the financing gap by developing and delivering value chain finance to the agriculture sector, with specific focus on smallholder livestock value chains. Specifically, three elements are addressed. First, the genesis and development of the DFI's value chain finance model over a period of six years is reviewed. Second, the ability of different value chain segments to access credit and the value chain finance-induced changes at smallholder level is assessed. Third, the emerging insights are applied to analyse the challenges and opportunities of value chain finance for livestock in smallholder farming systems. The case study provides an opportunity to use evidence to challenge the prevailing perceptions in value chain financing in Southern Africa.

The paper relies on secondary data from ZADT reports, as well as discussions with its staff, mainly the chief executive officer and the monitoring and evaluation officer. Between 2013 and 2015, ZADT conducted sentinel surveys[2] which systematically tracked changes in livelihoods of smallholders in value chains financed by the Trust, and which could be objectively attributed to its financing activities. These surveys provided useful data on the impact of ZADT's financial services to smallholder livestock producers as well as performance of the credit delivery model.

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1   'Appropriate financial products' in this paper refers to the extent to which a financial product addresses the constraints of value chain actors, including cost, tenor and adequacy.
2   Sentinel Survey tracked the impacts of ZADT's value chain finance at the smallholder farmer level. The survey took a longitudinal study approach of a selected sample of households within a selected site, tracking changes in smallholder incomes and production.

The structure of the ZADT

The ZADT is emerging as a major player in Zimbabwe's agricultural financing industry. Formed in 2010, the DFI was specifically meant to address the challenge of financing in smallholder-based agricultural value chains, whilst remaining profitable and growing. The Trust received funds from different sources, mainly donors interested in funding agriculture recovery and development in Zimbabwe for the benefit of smallholder farmers. Two organizations, SNV Netherlands Development Organisation and the Humanist Institute for Cooperation (Hivos) championed the formation of the Trust, donating USD 150,000 (ZADT notarial trust deed 2010). After the registration, the DFI received capital from a combination of bilateral donors and private philanthropy, as presented in Figure 1. In 2015, the ZADT was capitalized to the tune of USD 36.7 million, which was higher than the core capital levels of 12 out of 20 commercial banks in Zimbabwe (Monetary statement January 2015). In 2015, its credit fund accounted for just over 5% of the country's agricultural lending portfolio. The Trust is one of a few which focused specifically on agriculture due to perceived high levels of risk in the sector. As such, managing the risk-viability trade-off was one of the DFI's major challenges.

Figure 1. Growth of ZADT funds 2010–2015
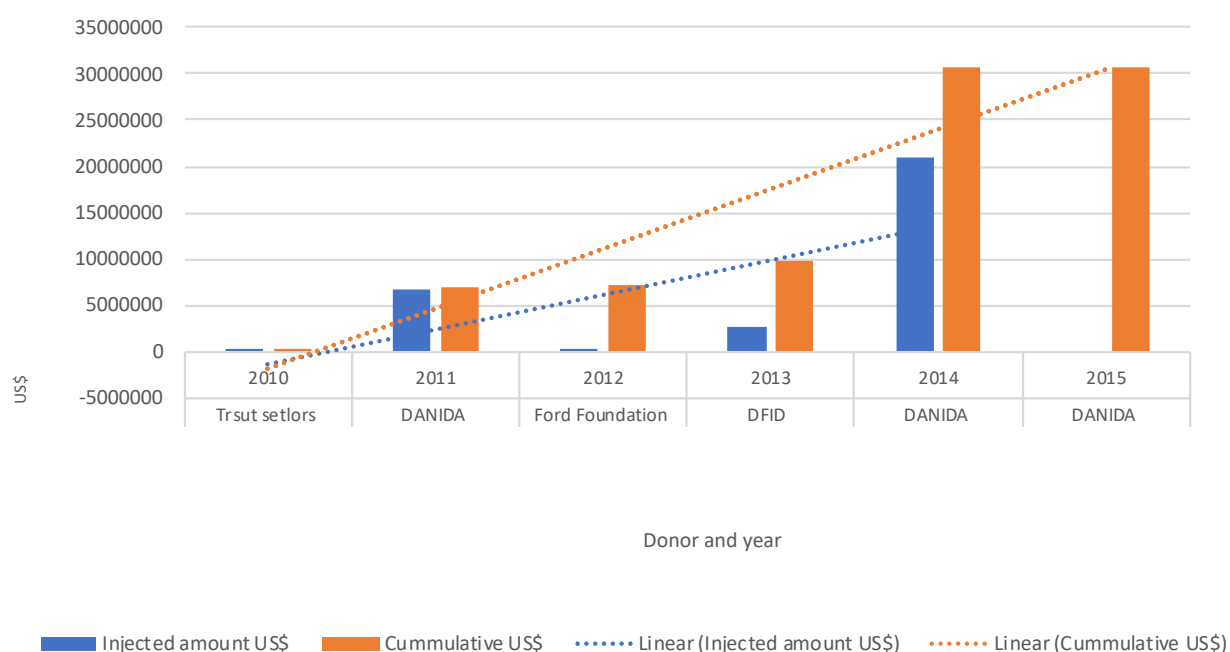
The ZADT delivery model

The ZADT aims to provide value chain financing to agriculture businesses that work with, and for the benefit of, smallholder farmers in Zimbabwe (ZADT Strategic Plan Review 2015–2018). The Trust's strategy is to deliver finance indirectly to smallholder farmers by targeting value chain segments, termed windows (see Figure 2), that represent key value chain activities, which are input supply, output marketing and processing and logistics. Through its partner finance institutions[3], ZADT lends money to agriculture value chain intermediaries who have some business relationship with the smallholder sector. These intermediaries are expected to grow and diversify their businesses using the loans, leading to increased business activity in the chain. This chain reaction is expected to trigger a trickle-down effect in economic benefits to smallholder farmers through increased supply of products and services, as well as off-take opportunities. The model of disbursing credit through financial intermediaries[4] allows ZADT to pass the

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3   ZADT selects and contracts finance institutions, mainly banks and, recently, microfinance institutions. These institutions borrow funds from ZADT at 5.5% per annum and lend the money to agriculture value chain businesses at an annual interest rate of 11.5% (ZADT Annual report 2014 p.vii).
4   Business entities that connect smallholders' products to the market in a value chain.

risk of lending to the disbursing financial institutions. The model does not specify targeted value chains upfront; hence, recipient value chains emerge a posteriori from disbursements.

Figure 2. ZADT's agriculture financing model
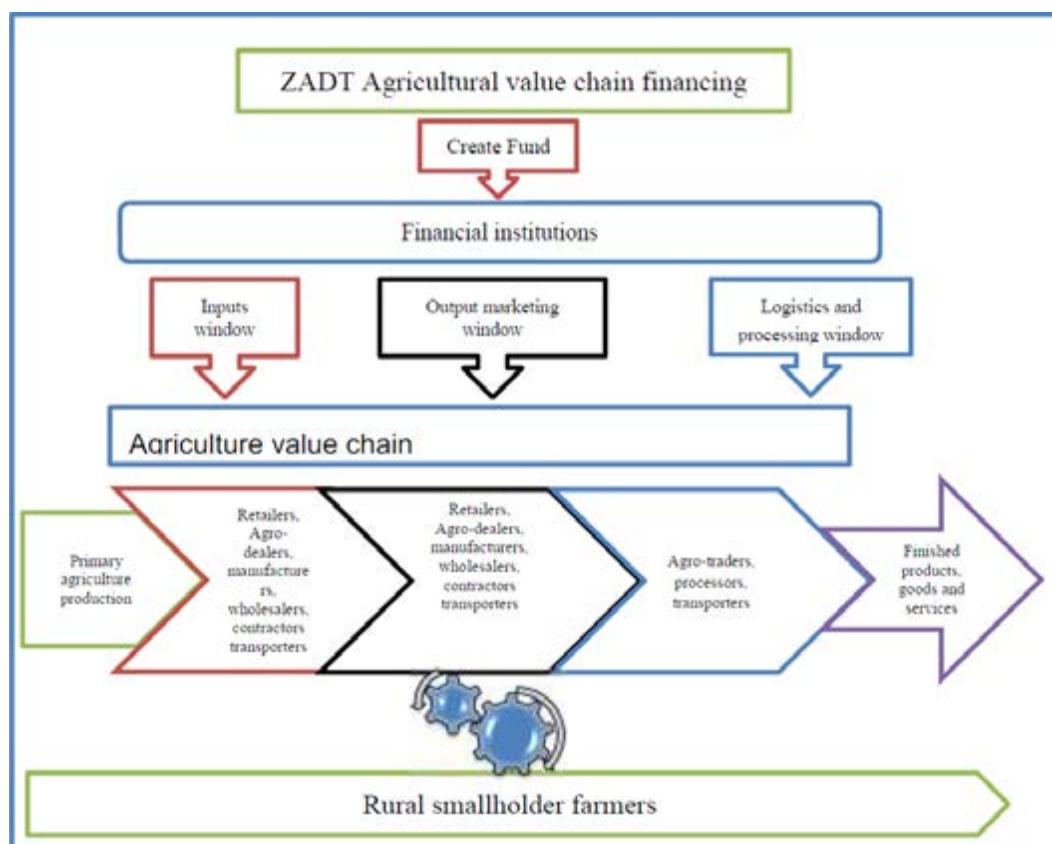
ZADT's financing instruments

ZADT's main lending facility is a basket revolving fund called CREATE (Credit for Agriculture Trade and Expansion). It was capitalized to the tune of USD 36.6 million in 2015. CREATE supported all crops and livestock with the exception of tobacco and cotton, which ZADT considers adequately funded. Key livestock-related value chains that the ZADT funded through loans[5] are poultry, stock feeds, beef and dairy (ZADT Annual Review 2014). These were funded under the CREATE fund's lending windows[6]. The DFI has identified the lack of adequate and appropriate products through which the loans could be packaged as a big challenge. Consequently, efforts are underway to design and expand the product range. An example of a product that was under consideration is a guarantee facility.

Loan distribution by value chain segment

The distribution of loans by value chain segment (see Figure 3) at the end of 2016 revealed that funding was concentrated (66%) at the input value chain segment, followed by marketing activities (27%) and lastly processing (7%). Figure 3 shows the various types of value chain actors that ZADT financed over a period of five years. Segments

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5   ZADT's loans had different tenors and sizes. However, ZADT considered loan sizes ranging between USD 5,000 and USD 200,000, although high impact loans could be considered. For working capital loans, the maximum tenor was 12 months while for capital investments the period was on average two years (and three years in exceptional cases). ZADT could also consider the option of a one-year grace period on capital repayments for high-impact capital expenditure loans (ZADT Annual report 2014 p.vi).
6   A window is a grouping of agricultural value chain activities (Mthunzi, pers).

that were not funded or received negligible amounts included production and distribution of finished products. The agricultural inputs window funded agro-input wholesalers, agro-dealers and companies that contract smallholders, with some minimal direct lending to smallholders. Both the inputs and output marketing businesses relied on linkages with smallholder farmers.

Figure 3. Loan distribution by type of value chain actor 2012 to 2016
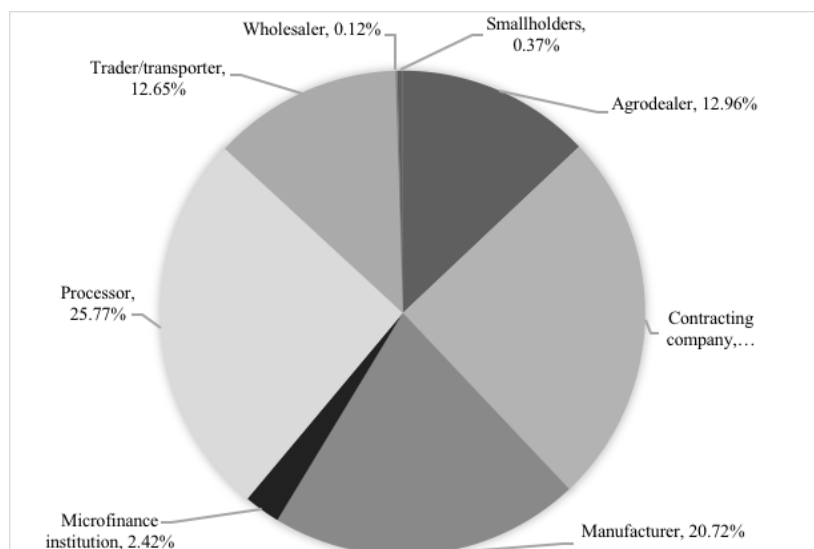
Livestock value chain actors accessed funding indirectly through the inputs window (stock feed manufacturers, wholesalers and agro-dealers) and directly through processors who bought products such as cattle, goats and eggs from smallholders. Livestock was supplied to meat processors, mainly through traders. The traders also received working capital for purchasing and transporting stock to abattoirs. About 25% of the funds went to companies that contracted smallholders (including livestock). Contract farming in livestock was through feedlots for beef, and in egg production. No loans were advanced directly to smallholder livestock producers. Only a small proportion (0.37%) financed crop farmers.

ZADT's lending to the livestock sector was concentrated in the output marketing window, specifically cattle trading. The recipient value chain actors in the portfolio were meat processors and buyers of livestock, sourcing cattle from smallholder farmers. Agro-dealers who supply inputs to smallholder livestock producers also accessed finance.

Portfolio performance

As in other Southern African countries, high default rates remain a challenge in Zimbabwe's agricultural sector. The study found that by the end of 2013, ZADT's disbursing banks owed the Trust about 43% of total borrowed money. This was more than double Zimbabwe's banking industry average default rate[7], which stood at 20.45% as of 30 September 2014. These high default rates discouraged participating banks from borrowing from ZADT's CREATE fund for on-lending to smallholder-linked value chains. Although ZADT does not assume risk on the borrowing value chain actors, it is affected by reduced demand from participating financial institutions facing high defaults from borrowers.

Livestock value chains

The main livestock value chains that were recipients of financing were cattle, goats, dairy and poultry. As the ZADT model was not designed to provide financing to primary production at smallholder level, no finance was advanced to

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7   Non-performing loans to total loans ratio

the smallholder production segment. The main value chain activity financed was livestock trading activities under which livestock traders and meat processors accessed loans to purchase cattle, goats and eggs from smallholders, mainly through local aggregators. In one case livestock farmers benefited more directly as they received stock feeds upfront from feed producers who received funding from ZADT for the purpose of finishing off their animals in feedlots.

Developments in the livestock industry also affected business relationships and access to finance for actors. For example, a merger of two meat processors led to reduced competition and lower prices to livestock traders and farmers. In addition, rising transport costs due to worsening conditions of rural road networks reduced demand for loans channelled to livestock value chains. Further, the design of the ZADT loan facility was deemed inappropriate for traders[8].

Table 1, Annex 1, presents the ownership, purchases and sales of livestock by households involved in financed livestock value chains. The data reveal that purchases of cattle exceed sales by 0.5 animals in 2015. The average proportion of households that own poultry and sheep fell between 2013 and 2015. The increase in number of head of livestock per household over the same period suggests that livestock keepers were moving towards specialization and growth. Most (76%) smallholder farmers participating in financed value chains had been in a relationship with livestock traders/buyers for between three and 25 years before the value chain was financed. From a gender angle, male respondents were dominant (95%) in livestock trading. Table 1 also suggests that smallholders tend to store their earnings in the form of stock, which was reflected in increased purchases. Livestock works as a bank, with households disposing of their stock to meet other financing necessities such as inputs, food and education.

The changes in livestock ownership between 2013 and 2015 point to a high risk of financing smallholder livestock production. The ownership generally shows a dip in 2014, which can be attributed to a severe drought in the 2013/14 season that affected southern Africa, reducing herd sizes through drought and disease-related deaths and forced sales. Such vulnerability increases the risk of lending to the smallholder livestock production sector

Discussion

While ZADT attempted to respond to the needs of agriculture value chains by specifying windows of financing such as input, output, logistics and processing windows, it does not seem to have responded adequately to the specific needs of livestock value chain actors. We assert that the needs of poultry, dairy, beef and related products, such as animal feeds and other inputs, are too diverse to be effectively addressed by the current financing windows. Furthermore, the findings show that ZADT's lending strategy avoids primary production (smallholders) to reduce risk, a strategy also employed by its partner financial institutions, which undermines the viability of the rest of the value chain. Related to this finding, we also found that ZADT was not using value chains to analyse portfolio performance, just as the products and services were not specific to the commodity value chain financed. This is a gap, as value chains like dairy and beef have different financing requirements. This assertion is supported by the fact that in 2014 ZADT had to encourage disbursing banks to restructure loan facilities that were outstanding after noting misalignment of repayment terms with the financed businesses model.

A look at the ZADT loan portfolio between 2012 and 2014 reveals a paradox whereby cumulative disbursements and active loans were always lagging far below the available funding level (Figure 4) amidst a dire need for finance in the livestock sector. The unmet demand in the livestock sector was confirmed in Zimbabwe's livestock development policy (August 2014), which observed that limited availability of credit and lack of appropriate financing mechanisms were stifling productivity and further expansion of the sector.

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8   The loans required upfront payment of interest and loan settlement fees, mostly with no grace period, and were deemed by traders as inappropriate for their activities. The loan tenors of three-four months forced livestock traders to sell even poor-quality stock to generate sufficient turnover to repay the loan. With longer durations, they could add value by pen-fattening prior to selling.

Figure 4. CREATE fund loan portfolio analysis as of 31 December 2014. Source: ZADT Annual report 2014
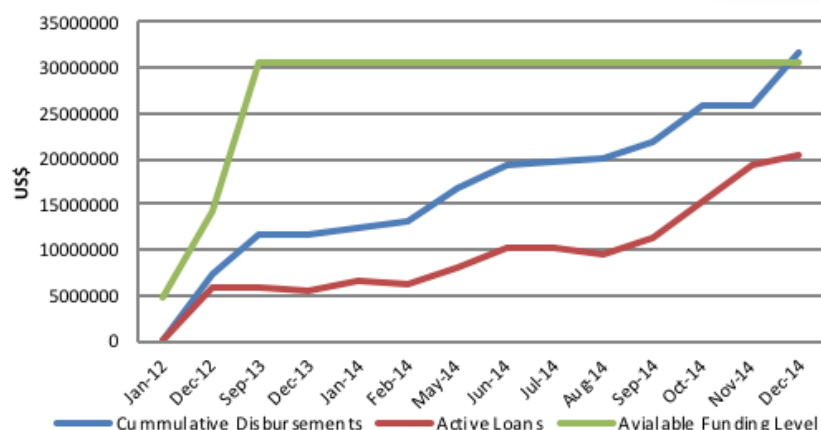
Lower uptake of the Trust funds is likely a result of the cost of CREATE funds, which were at an 11.5% interest rate per annum in January 2015, while those of mainstream financial institutions were below 10% per annum (Reserve Bank of Zimbabwe Monetary policy statement 2015). ZADT kept rates at a higher level in order to maintain the viability of their business model.

The results suggests that where relationships are strong, as in the case of ZADT over three years of business relationships, value chain finance has better chances of flowing indirectly to smallholder producers. This justifies ZADT's technical assistance, which goes along with funding to strengthen relationships. While strong relationships were a basis for accessing internal and external finance by livestock traders, there is evidence that the need for finance also encouraged traders to forge stronger relationships with meat processors as a strategy to access internal financing for purchasing livestock from farmers and stock feeds.

As observed earlier, ZADT delivers finance through financial intermediaries within agricultural value chains, as is the case with other international development finance institutions such as the African Development Bank (AFDB) (AFDB 2013). However, these intermediaries often serve large blue chip value chain actors, leaving out smallholders and small-to-medium businesses in rural areas. The model could be adjusted to include capitalizing financial institutions that often serve lower segments of the value chain such as microfinance institutions, savings and credit cooperative societies (SACCOS) and village lending and savings groups.

Conclusions and recommendations

The ZADT model is commercially viable but could be missing various opportunities to maximize its impact by shying away from financing smallholder production (where the biggest need is), and almost entirely relying on traditional commercial banks for distribution, and not exploring all financing opportunities along the value chain. As the model is too generic, it disadvantages livestock value chains, which inherently carry more risk and longer timeframes, leaving smallholders too far from the conduit of financing. Despite these limitations, the ZADT model provides some evidence that value chain financing benefits from, as well as contributes to, the strengthening of value chain relationships. Lastly, through the review of the ZADT case, the paper argues in favour of a financing model that exploits the value chain relationships and information to design products, and adapts products and services to the business environment.

Further, we recommend the following for financing of livestock value chains:

- Funding should target specific livestock value chains to understand and maximize the opportunities offered by the value chains. The AFDB, for example, targets specific commodity chains (such as livestock, rice and coffee) then provides customized financing and technical support at various levels (AFDB 2013).

- Value chain financing to the livestock sector needs to be accompanied by promotion of new technologies to reduce the risk caused by climate change through drought and diseases.

- Where agents are used (such as disbursing banks in the case of ZADT) to provide value chain financing and share risk, appropriate incentives should be provided for better targeting of under-served value chain segments and actors to reduce the development costs of agency problem. This requires in-depth understanding of target value chains, implying some investments in value chain research to inform product development.

- Value chain financing requires complementary products and services to manage risk and enhance competitiveness. Chief among these are guarantees (to encourage more lending in livestock) and livestock insurance.

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Annex 1.

Figure 3. Distribution of loans by value chain segment. Source: ZADT, January 2016
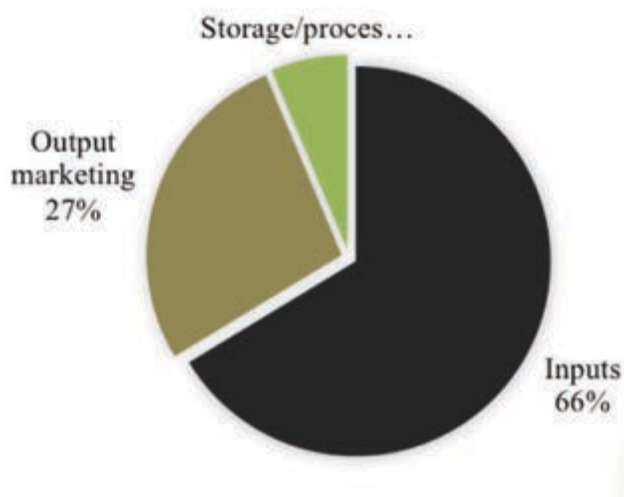
Table 1. Changes in livestock ownership 2013 to 2015

Type of livestock		Year		
		2013	2014	2015
Cattle	Ownership	66%	61%	67.4%
	Average number owned	6.4	6.7	10.6
	Average sales/year	1.3	0.5	2.1
	Average purchases	1.4	2.2	2.6
Goats	% ownership	61%	62%	66.4%
	Average number owned	5.6	6.4	8.0
	Average sales/year	1.8	0.2	1.1
	Average purchases	1.6	2.9	1.2
Sheep	% ownership	17%	10%	13.6%
	Average number owned	3	4.3	4.4
	Average sales/year	0	0.3	0.1
	Average purchases	3	4.5	0.6
Poutry	% ownership	89%	89%	84.3%
	Average number owned	21.3	16	20.3
	Average sales/year	-	1.6	7.8
	Average purchases	-	-	6.3

Source: ZADT Sentinel Survey 2013, 2014 and 2015 reports – data could not be verified

Bridging the financial gap for smallholder agriculture in Swaziland

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Abstract

The agriculture sector plays a significant role to the development of the country. This does not only provide the raw materials for the manufacturing sector but also account for 70% of the employment for the rural households. The potential market for farming is very significant as only 4.2% of the local households produce enough for their own consumption. Limited access to finance has however been indicated as one of the constraints to transforming small-holder agriculture to be more commercial. The lessons learnt from the Rural finance & enterprise development programme (RFEDP) established that there is a need to identify prepared farmer entrepreneurs, support for these to provide bankable Business Plans and the capacity of the financial institutions to better understand the sector and design appropriate financial products. The high risk perception of the sector, the limited business and financial skills, weak microfinance sector, as well as the high transaction costs associated with the sector is a key challenge for the financial institutions. Despite these challenges, there has been an increasing interesting from the banks to penetrate the SME sector. To address the financing gap for the farmer entrepreneurs, this Paper assesses and recommends the need to improve and disseminate reliable information on the profitability of the farm enterprises, enhance access to the credit guarantee facility and credit data to mitigate credit risks, strengthen the microfinance sector and improve the business and financial skills of the farmers to better manage and grow their farm enterprises.

Keywords: Access to finance, Financial Inclusion, microfinance, prepared entrepreneurs

Background

The Ministry of Finance identified the need to support the contribution of the microfinance sector to enhance access to financial services for small and medium enterprises (SMEs) and vulnerable households. The Micro-Finance Unit (MFU) was then established in September 2010 as a semi-autonomous wing of the ministry to implement the Rural Finance and Enterprise Development Programme (RFEDP) which shared a similar aspiration to enhance access to finance. The agreement between International Funds for Agricultural Development (IFAD) and government was that the program would be funded by a total cost of USD 9.315 million, of which USD 6 million (64%) was IFAD's

contribution and the government of Swaziland's (GoS) input was USD 2.29 million (25%) over the six-year period (IFAD 2012). The main aim of the RFEDP was to achieve the following:

i.   To provide the rural poor with access to efficient and effective financial services on a sustainable basis

ii.   To develop an enabling and enhanced environment for business development in rural areas

iii.   To establish/develop micro- and small-scale enterprises (on and off-farm) as well as business services in rural areas

On September 30 2016 the RFEDP came to an end and the Ministry of Finance facilitated the transformation of the MFU to the Centre for Financial Inclusion (CFI). The CFI will bridge the gap between the regulators, financial service providers and MSMEs, including vulnerable households, by facilitating access to relevant financial and business information to improve access to financial services and contribute to poverty alleviation.

Objective of this paper

The aim of the presentation is to assess the situation around access to finance for smallholder agriculture in Swaziland. This will highlight the context of the sector as it relates to finance, draw lessons from the experiences in the implementation of the RFEDP, and make recommendations to remedy the situation. It will also assess the aspiration by the financial regulator Central Bank of Swaziland (CBS) and policymaker (GoS) to embrace the Financial Inclusion Agenda to influence the financial system towards improving its contribution towards sustainable livelihoods of the bottom of the pyramid population through the provision of affordable, accessible and quality financial services and products. The MFU in September 2016 produced the State of micro finance in Swaziland[1] (2015), which provided a detailed analysis of the sector.

Context of smallholder agriculture

As the traditional backbone and key driver of Swaziland's economy, agriculture is a crucial sector. A considerable proportion of the manufacturing sector is value added through the processing of agricultural products such as sugar and timber. Despite the slowing of the country's gross domestic product (GDP) to 1.7%, compared with a revised estimate of 2.7% attributed to slow growth in the secondary sector, agriculture employs approximately 70% of the rural household population and contributes about 11.9% to GDP by sector (CIA World Factbook 2016).

The GoS allocated about 843 million lilangeni (SZL) to agriculture during the 2016/2017 fiscal year, a better allocation than the low SZL 537 million of 2015. Revised figures for this primary sector indicate slower growth during 2016, at -11.2%. However, a 9.6% growth is forecast for 2017 (Thompson 2017). Drought was a major crisis recently in Swaziland, resulting in spoiled crops and severe losses of livestock. Improvement was seen towards the end of 2016 with reasonable rainfall that began to improve dam levels.

Swaziland's agriculture comprises of two subsectors: formal and informal/traditional. Traditional agriculture takes place on Swazi Nation Land (SNL), which is acquired in terms of traditional law and custom, and, while most of the activity is undertaken for subsistence purposes, informal agriculture farmers are encouraged to perform on a commercial basis. The country continues to witness an increase of small cane growers who produce commercially on SNL with the assistance of the large estates and the Sugar Association. There is a need to emulate the best practice from the sugar industry to stimulate other viable and sustainable agriculture enterprises.

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1   The MFU outsourced Microfinanza Rating to conduct the assessment and finalize the Report.

Cattle comprise the largest component of Swaziland's livestock population with SNL farmers owning about 80% of the national herd. However, the tradition of keeping cattle until it is beyond its commercial value age persists as the traditional belief that cattle represents wealth continues. This limits beef production, causing overgrazing and soil erosion. This is one of the examples of the limitations existing in informal agriculture amidst interventions to commercialize the sector.

Smallholder agriculture entrepreneur

The smallholder agricultural entrepreneur typically operates on SNL, growing crops and rearing livestock for consumption. According to the Swaziland Agricultural Development Project (SADP) (Food and Agriculture Organization of the United Nations (FAO) 2011), efforts to encourage the smallholder entrepreneur to practise commercial farming have been welcomed by a number of SNL farmers who have thrived in the challenges encountered in smallholder agriculture. The SADP has been useful in improving the food security and nutrition of the vulnerable, and helping transform agriculture into a vibrant commercial sector. Over 20,000 smallholder farmers have learned to produce larger quantities of high-quality food and connect with new markets. The challenge is now to document and upscale the lessons learnt from these interventions.

According to the Swaziland Household Income & Expenditure Survey (2010), only 4.2% of the local households could produce sufficient food for their own consumption. Of the many challenges facing smallholder agriculture farmers, such as access to water and shortage of inputs, access to finance remains the biggest in the effort to promote the commercialization and growth of smallholder farmers.

Small business enterprise development is key to economic growth of most countries (Demirgiic and Huizinga 1999; Wurgler 2000). This is illustrated by examples of countries such as Japan, Malaysia and South Korea, which responded during the financial crisis by stimulating access to credit for small and medium enterprises (SMEs), including start-ups (Boocok and Sharif 1996; Uesugi, Sakai and Yamashiro 2010; Oh et al. 2009). However, to improve the growth of these businesses requires not just finance but other support, such as business and financial management skills and the capacity of bank staff to understand the sector (IFAD 2011).

Access to finance

Access to finance for small businesses is identified as a key issue in several studies (Stiglitz and Weiss 1981; Demirgu 2004; Berger and Udell 2006; Beck and Demirgu-Kunt 2006). This is despite the important role of these businesses as the key engine for economic growth through creating employment opportunities (UNIDO 2005). Beck and Demirguc-Kunt (2006: 2933) asserted that 'it is not the large number of the small businesses that really matters, but those enterprises that will be able to grow and not cease operations'. Access to finance in this sector can improve employment at a comparatively lower capital cost than the bigger industries and can address the inequitable imbalance between the rural and urban areas (Beck 2007). The GoS has prioritized SMEs in order for this sector to contribute to improved livelihoods and employment creation.

The Doing Business Report (2012) identified that the major constraints for business start-up in Swaziland were access to finance, soft infrastructure (telecommunication, internet etc.) and inefficient government bureaucracy. This was affirmed by the United Nations (UN) (2013) which, when assessing the state of youth entrepreneurship in the country, established that 84% of the respondents reported that access to finance was a major barrier to entrepreneurship development.

IFAD (2011), however, elaborated the issues in which they indicated that lack of access to finance was a result of limited bankable projects, low business and financial management skills from the entrepreneurs and the capacity of the financial institutions staff to deal with the sector. Hoff and Stiglitz (1990) highlight the issues of imperfect information with SMEs which result in financial institutions opting for stringent mechanisms for loan approval.

Current financial system landscape

Access to finance for smallholder farmers continues to be a major constraining factor for the development of the sector. At least 67% of adults in the country live in rural areas, where farming is a major vocation, 66% of the population is involved in farming and only 3% had farming as the main source of income (FinScope Swaziland 2014). The Enterprise Surveys (World Bank 2006) established that only 14.9% of SMEs reported having had bank loans for their businesses. However, this improved with the size of the firm as 30.9% of the larger businesses had a loan. IFAD (2011) asserted that as much as the local banks in Swaziland were high on liquidity, the deposits were not being transformed to credit for the private sector. The lack of credit to SMEs could be attributed to several factors, which include:

i.   The perception of the enterprises being very high risky to lenders.

ii.   Lack of collateral and insufficient documentation to enable the lenders to appropriately assess the credit risks with each project (Central Bank of Swaziland (CBS) 2015).

Scenario for the financial system landscape

A situational assessment of the feasibility to establish a credit line (IFAD RFEDP 2011) to alleviate lack of access to finance for the micro- and small businesses in the country established the need to address the demand- and supply-side issues that constrained access to finance for the businesses. The following were the findings.

Table1. Landscape mapping for local access to finance

Commercial Banks	MFIs	Small Entrepreneur
Long in liquidity	Limited financial resources vs. demand	Limited technical, management and marketing skills
Risk-adverse	Large outreach in rural areas	Limited collateral
Primary focus is not on rural areas	Dwindling financial performance—In 2008, MFI loan repayments were at 92%; in 2011, at 70–75%	Non-bankable projects
Limited outreach	Limited relationship with banks and unable to use savings mobilized for on-lending	Absence of diversification in activities

Source: Feasibility of the credit line for the RFEDP (IFAD RFEDP 2011)

Possible sources of finance

The Swaziland Poverty Reduction Strategy and Action Plan (PRSAP) (2006) expressed that financial institutions in the country viewed micro- and small businesses as being high risk, and that it was costly to manage their loans. There is a need for mechanisms to facilitate enhanced access to special credit guarantee schemes and equity funding, particularly for start-ups (Ministry of Economic Planning 2006).

Government funding schemes

To adequately assess the issue of access to finance for small businesses it is imperative to analyse both the supply- and demand-side issues. For the supply side, Demirgiic-Kunt and Huizinga (1999) provide a detailed analysis of the determinants that should influence the profitability of commercial banks, and highlight that the efficacy of the financial system in the country will have a positive impact on the growth of the economy. Illustrating the demand-side issues, Hoff and Stiglitz (1990) allude to the fact that failure of cheap rural credit was a result of the lack of understanding on how it works. A better understanding of the traits and characteristics of an entrepreneur (Ardichvilli et al. 2003) is essential to assist in analysing the demand-side issues for access to finance for small businesses.

The MFU (2014), in its review and reform of the Community Poverty Reduction Fund (CPRF), established that the portfolio at risk was 95%. The major key factors that led to the failure of the CPRF were the politicization of the facilities, lack of institutional capacity to manage the microfinance activities and poor monitoring. Several studies emphasize the importance of target selection.

The operation and performance of credit guarantee schemes (Uesugi et al. 2010, Boocok and Sharif 2005; Oh et al. 2009) should provide some relevance, even to the country. The Small-Scale Enterprise Loan Guarantee Scheme (SSELGS) and the Export Credit Guarantee Scheme (ECGS) managed through the CBS was established in 1991 to provide a credit guarantee for business start-ups and existing micro-, small and medium-sized enterprises (SMME). Hoff and Stiglitz (1990), when addressing the issues of imperfect information, highlighted the failures of such facilities to achieve their objectives. According to the assessment, 1,191 loans had been guaranteed through the credit scheme as of September 2016. The total gross loan value was SZL 100.5 million with a credit guarantee of SZL 40.5 million. The retail sector consumes the major share of the credit guarantee, at 50.1%, followed by services at 28.9%. Agriculture accounts for the lowest credit guarantee, at 1.7% (MFU 2016). To address the situation, there is an ongoing process to reform the guarantee scheme to better respond to the current prevailing credit needs.

Microfinance sectors

According to the State of microfinance in Swaziland 2016 report (MFU 2016) the microfinance sector in the country remains in a prolonged state of early-stage development, due to a number of challenges and weaknesses in the sector, both internal and external. Formal microfinance product offering has been volatile over the years but has never been robust enough to meet client demand. A microfinance portfolio is not commonly sought by profit-seeking financial institutions in Swaziland, so that provision of financial services to low-income people and non-salaried entrepreneurs is subject to donor or government grant interventions and ongoing support, which has not been stable. For the Inhlanyelo Fund, the average loan size was SZL 4,500 (USD 318) with a maximum loan of SZL 25,000 (USD 1,765) payable over a maximum period of 24 months. Imbita had almost the same financial product, although the delivery method was different[2]. The providers of microfinance services are summarized below.

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2   The Inhlanyelo Fund uses the traditional structures through the Tinkhundla Centres for the selection of potential beneficiaries before group lending is applied. Individual lending is, however, possible for repeat loans for beneficiaries that have developed a good credit history record. The Imbita Women Finance Trust has local management committees (LMCs) that mobilize the groups within the communities and use the group lending. For both providers the loan beneficiaries must first undergo business management training before they can be granted credit.

Table2. Characteristics of the credit products by local microfinance providers

	Inhlanyelo Fund		SWEET		IMBITA(inactive)	
Credit product name	Micro business loan	Emergency/Lusito	Groups Tfutfuka	Invoice financing (not yet launched)	Business loans	Consumptive loans
Credit methodology	Individual	Individual	Group	Individual	Individual and group	Individual
Type of interest	Flat	Flat	Flat	Flat	Flat	Flat
Interest rate(%)	1.25%p.m.	3%p.m.	2.5%p.m.	7.5%p.m.	2.50%p.m.	2.33%p.m.
Description of commissions	Assessment fee SZL50 (USD3.5) per SZL 1000 (USD71)	Credit life SZL1.3/ SZL1,000xmonths withdrawal fee SZL35 (USD2.5)-SZL50 (USD3.5) Administration and establishment fee (2%) stationery/ handling fee SZL 1.50	Credit life SZL1.3/ SZL1,000xmonths withdrawal fee SZL35 (USD2.5)-SZL50 (USD3.5) Administration and establishment fee SZL 1,000 (USD7) stationery/handling fee SZL 1.50	Credit life withdrawal fee Administration and establishment fee stationery/ handling fee	Application fee SZL30 (USD2) Contract fee SZL50 (USD3.5)	Application fee SZL30 (USD2) Contract fee SZL20 (USD1.4)
Min. credit	SZL 1,000	SZL 1,000 USD71	SZL 50,000 USD3529	SZL 2,000 USD141	SZL 500 USD36	SZL 1,000 USD71
Max. credit amount	SZL 25,000 USD1,765	SZL 50,000 USD3,529	SZL130,000 USD9,176	SZL 15,000 USD1,059	SZL 25,000 USD1,765	SZL 25,000 USD1,765
Max. credit amount- 1st loan	Na	SZL 15,000 USD1,059	SZL 125,000 USD8,823	SZL 10,000 USD706	SZL 5,000 USD353	33%of net pay
Average credit amount	SZL 4,500 USD318	SZL 3,000 USD212	SZL 125,000 USD8,823	SZL 2,000 USD141	Na	Na
Min. loan maturity (months)	4	3	5	2	12	12
Max. loan maturity (months)	24	9	6	2	24	24
Average loan maturity (months)	12	6	5	2	Na	Na
Frequency of interest payment	Project based	Monthly	Monthly	Monthly	Monthly/ quarterly	Monthly
Frequency of principal payment	Project based	Monthly	Monthly	Monthly	Monthly/ quarterly	Monthly
Grace period (months)	Term loan period	None	None	None	Monthly/ quarterly	Monthly
Collaterals/ guarantees	Not applicable	100% compulsory savings	20% - 70% of shares	Credit life	Household collaterals	Household collaterals
Target population	Micro entrepreneurs	Micro entrepreneurs	Micro entrepreneurs	Micro entrepreneurs	Micro entrepreneurs	Micro entrepreneurs

Source: State of the microfinance sector in Swaziland report 2016

Development of finance institutions

The main DFI is the Swaziland Development Finance Corporation (FINCORP), which was launched in 1995 by King Mswati III, originally with the name Enterprise Trust Fund (ETF) until a name change in 2003, with the objective to provide financing to locally-owned SMME. FINCORP is owned 80%[3] by the Swazi government and is represented by the Ministry of Finance on the Board of Directors. FINCORP offers both wholesale and retail credit, with a gross loan portfolio of SZL 468 million (USD 39 million) as of March 2015[4]. The portfolio is concentrated in SME financing for agriculture, sugar cane production, intercompany loans and business loans, with only <1% of portfolio in micro-loans[5]. It is worth noting that First Finance, a subsidiary of FINCORP, was created in 2010 to focus on the provision of consumption micro-loans to salaried individuals. FINCORP has an estimated outreach to 2,500 SMMEs and 11,000 payroll clients[6]. The SIDC, born out of a joint venture in 1987 between the Swaziland Government, DEG, CDC, FMO, Proparco and IFC, also provided finance to small-scale farmers, particularly cane growers.

Bank finance institutions

The banking sector in Swaziland is moderately developed, with stable actors operating for decades, namely Nedbank, Standard Bank, First National Bank and Swaziland Development and Savings Bank (Swazi Bank). Of these banks, three are subsidiaries of well-established South African commercial banks. In addition to these banks, the Swaziland Building Society is also active, and focused on long-term mortgage loans. These commercial banks have historically had an operating model focused on traditional banking products without activity in microfinance, even if recently some commercial banks have started moving into the payroll lending market, with loan sizes reaching as low as SZL 5,000 (USD 320).

There has been an increasing interest from the banks to increase their outreach to the SME sector as indicated by their participation in the financing of the smallholder sugarcane growers on SNL, the formation of SME departments within some of the banks and the development of some of the products to cater for SMEs and farmers. The provision of adequate information on farming businesses, profiling of the prepared entrepreneurs, provision of mentoring and coaching and well-structured government mechanisms to enhance graduation to commercial production are essential.

Bridging the financing gap

There has been a global trend to develop an all-inclusive financial system that will better contribute to economic growth and the wellbeing of the general populace, thus alleviating poverty. Amongst these are the World Bank, the G20, which went further to develop the GPFI, which solely looks after the issues of financial inclusion, the Alliance for Financial Inclusion (AFI) and the Gates Foundation. SADC has developed the SADC Financial Inclusion Strategy. The following strategies have been identified to bridge the finance gap.

i.   Consumer protection – promulgation of the Consumer Credit Act 2016 to regulate all credit providers, rationalize credit references and provide consumer education. The intention is to bring the law on credit into conformity with the constitution, the Financial Services Regulatory Authority Act, 2010 and other laws so as to promote fair and equal access to credit products.

ii. Profitability guides – develop, package and disseminate up-to-date information on production husbandry, input supply and market chains and gross margins for particular commodities that have a potential for commercialization;

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3   The other 20% is owned by Tibiyo TakaNgwane, a Swazi investment company created in 1968 by the Royal Charter to support the Swazi Government's development agenda.
4   FINCORP Annual Report 2015.
5   As per FINCORP's definition of microloans contained in the 2015 Annual report.
6   Financial sector development implementation plan for Swaziland, World Bank 2015.

iii.   Credit guarantee – ongoing review and reform of the Small-scale enterprise loan guarantee scheme (SSELGS) to improve performance and outreach to micro- and small businesses, inclusion of non-bank finance institutions (NBFIs), diversification of products to include agriculture and recapitalization of the scheme.

iv.   Training for bank SME staff – provision of appropriate capacity to the banks and credit staff on the operation and performance of the agriculture enterprises, consumer patterns and market dynamics.

v.   Microfinance provision – development of the microfinance policy and Microfinance Funding Agency (MFA) to recapitalize illiquid and yet insolvent microfinance providers (MFPs) and intermediaries to increase the current 3% outreach.

vi.   Credit data sharing – to reduce information asymmetry for the financing institutions and reduce over-indebtedness; establish the Swaziland Credit Data Sharing Association to ensure that all credit data are reported with the credit bureau.

vii.   Farmer score – Profile and score passionate and commercial smallholder farmers to make differentiation and segmentation easier.

viii.   Mentoring and coaching – rationalize and establish an effective mentoring and coaching framework to provide both technical and business management capacity to the farmers.

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Contributed paper session 4: Economic valuation of value chains

Value chain analysis of goats in Zambia: Challenges and opportunities of linking smallholders to markets

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Abstract

Livestock is one of the fastest growing subsectors in the agricultural sector in most developing countries and has been undergoing what has been termed a 'livestock revolution' (Swanepoel, Stroebel and Moyo 2010). Rapid population growth and urbanization coupled with emerging evidence of income growth in developing countries, especially in Africa, have resulted in a rapid increase in demand for livestock products which is expected to continue in the future. According to Bennett's law, people tend to move away from consumption of starchy foods towards animal proteins as income increases. These broad demographic and economic trends are creating new and expanding market opportunities for smallholder livestock producers to invest in. Therefore, tapping into these opportunities in ways that are beneficial to rural producers is a critical policy and developmental challenge. However, inappropriate policies and misallocation of investment resources could skew the distribution of the benefits and opportunities away from the smallholders who would potentially gain the most from these market opportunities (Holloway and Ehui 2002).

Studies have shown that the majority of the world's rural poor keep and use livestock in a variety of ways that extend far beyond income generation. Therefore, understanding, among other things, the producers' ownership patterns and marketing behaviour is critical in establishing interventions that are necessary for improving the livestock sector. Using a value chain analysis approach, this study looks at the value chain for goats in Zambia, assessing the opportunities and challenges in linking smallholder livestock producers to markets.

Keywords: livestock production, small ruminants, market participation, opportunities and challenges

Introduction

Zambia's livestock sector plays a pivotal role in the socio-economic development of both the rural and urban population. Smallholder farmers, for the most part, dominate the sector. At the household level, livestock serves as a valuable wealth asset accounting for 20% of the productive assets (Lubungu and Mofya-Mukuka 2012). Smallholder livestock production

contributes to income generation and features prominently in cultural transactions such as dowry payments, and settlement of disputes, as well as payment of school fees and other necessities. Its role goes beyond providing food and nutrition in people's diet to acting as a risk buffer by providing a means of reducing the risks associated with crop failure and a diversification strategy for resource-poor farmers (Swanepoel, Stroebel and Moyo 2010).

Goats are the second most popularly owned livestock by most smallholder farmers in Zambia (after village chicken). Given the prevailing farm structures and increasing land constraints in Zambia, small livestock rearing may be well suited for very small farms. Further, the study by Hichaambwa and Jayne (2014) has shown that 64% of rural farm households own less than 2 ha of land; therefore, under these conditions, opportunities for income generation from traditional field crops are limited and declining. Therefore, finding ways to support farmers to be able to leverage their existing investments in livestock to take advantage of emerging opportunities is a potentially valuable development approach. Besides the emerging market opportunities for livestock, the ability of goats to utilize a broad range of feed resources and adapt to marginal conditions further presents an opportunity for resource-poor rural households to engage in goat production. Small livestock rearing is, therefore, suited to the rural farm households to invest in and take advantage of the rapid increase in income and population growth.

However, despite the significant roles that livestock plays and its potential to contribute to poverty alleviation and job creation, Zambia's livestock sector is still underdeveloped and over the past decade has received less funding than crop production (Kuteya et al. 2016). The limited investments made in the livestock sector are mostly directed to cattle production. The sector is characterized by poor husbandry methods, limited disease control, and high mortality rates and low productivity, coupled with a serious knowledge gap. Further, the small livestock sector is characterized by the limited supply of goat meat in the formal markets such as well-established supermarkets and butcheries.

There is a dearth of information on small livestock production such as goats particularly focusing on the key opportunities and challenges in linking smallholder livestock producers to markets. Given the high percentage of rural households which own goats, the small livestock subsector provides a useful case study for assessing the challenges and opportunities of utilizing livestock market to link smallholder farmers to markets. Zambia's gross domestic product (GDP)[1] per capita significantly increased from USD 377 per annum in 2001 to around USD 1,725 per annum by 2014 (World Bank 2015). This increased income level, coupled with rapid urbanization in Zambia and changes in consumption patterns, has contributed directly to the growing demand for livestock-related products (Hichaambwa 2012). However, despite the high production of goats among smallholder farmers, marketing is highly concentrated in informal markets, and the percentage of households that are selling goats has remained low[2]. Studies have shown that the majority of the world's rural poor keep and use livestock in a variety of ways that extend far beyond income generation. Livestock acts as a store of wealth and a risk management tool and, as such, income needs rather than price changes drive the marketing (Rich et al. 2011). Therefore, understanding, among other things, the producers' ownership patterns and marketing behaviour is critical in establishing interventions that are necessary for improving the small livestock sector.

Using a value chain analysis approach, this study looks at the value chain for goats in Zambia, assessing the opportunities and challenges in linking smallholder livestock producers to markets. The study investigates the factors that influence the marketing behaviour of small livestock producers and gains an understanding of the factors restricting them to the use of formal marketing channels to market their goats. This study addressed the following research questions:

i.   What factors influence producers' choice on whether to use formal or informal marketing channels for goats, and what factors influence their marketing behaviour?

ii.   What socio-economic characteristics affect the herd size of small livestock among smallholder farmers, and how can they improve it?

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1   http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=ZM
2   Refer to the full paper http://www.iapri.org.zm/images/WorkingPapers/wp116.pdf

Data and methods

The study utilized qualitative data that were supplemented with quantitative data from the household surveys for various years. The qualitative data were drawn from the focus group discussions (FGDs) which were conducted in eight districts: Mongu, Senanga, Kalomo, Choma, Mumbwa, Chipata, Petauke and Siavonga. The selected districts help us gain an understanding of why some areas are low-producing when goats are believed to thrive in any condition. The FGDs were held with mostly producers (smallholder farmers, and each group had approximately 5 to 15 participants comprising of both male and female farmers). A total of 112 farmers participated in the discussions from all the eight districts. Key informant interviews were also conducted with provincial veterinary officers, district veterinary officers, veterinary assistants, traders, processors and input suppliers. The criteria for selecting the participants were based on households owning or raising goats. Through the discussions with the farmers and key informants, we were able to identify some input suppliers and local butcheries as well as processors.

For the quantitative data, the study used data from the Rural Agricultural Livelihoods Survey (RALS) and Supplemental Survey (SS) for 2004, 2008, 2012 and 2015 as well as the Post-Harvest Survey data (PHS) for 2013/14. RALS and SS were conducted by the Indaba Agricultural Policy Research Institute (IAPRI) and the Food security research project (FSRP) in collaboration with the Central Statistics Office (CSO) and the Ministry of Agriculture, respectively. The PHS was conducted by the Ministry of Agriculture and the CSO. All the data sets used are nationally representative of rural farm households cultivating less than 20 ha of land for farming and livestock production purposes.

The study used descriptive analysis and econometric methods such as linear regression model and probit model to analyse the factors influencing herd size and the choice of marketing channel, respectively. The use of both qualitative and quantitative methods of data analysis gives a comprehensive picture of small livestock production based on the nationally representative survey results and field visits.

Value chain mapping for goats in Zambia

This section describes the value chain map for goats in Zambia. The value chain map provides an understanding of the different actors involved in each segment and the processes involved in moving goats from the producer to the final consumers. Analysing the role that each actor plays along the goat value chain helps us to identify both the challenges and opportunities in linking smallholder farmers to markets. Figure 1 below shows the various stages in the goat value chain. Based on Figure 1, five critical stages have been identified in the value chain: input/service supply, production, marketing/processing/retailing and consumption.

Figure 1. Goat value chain map
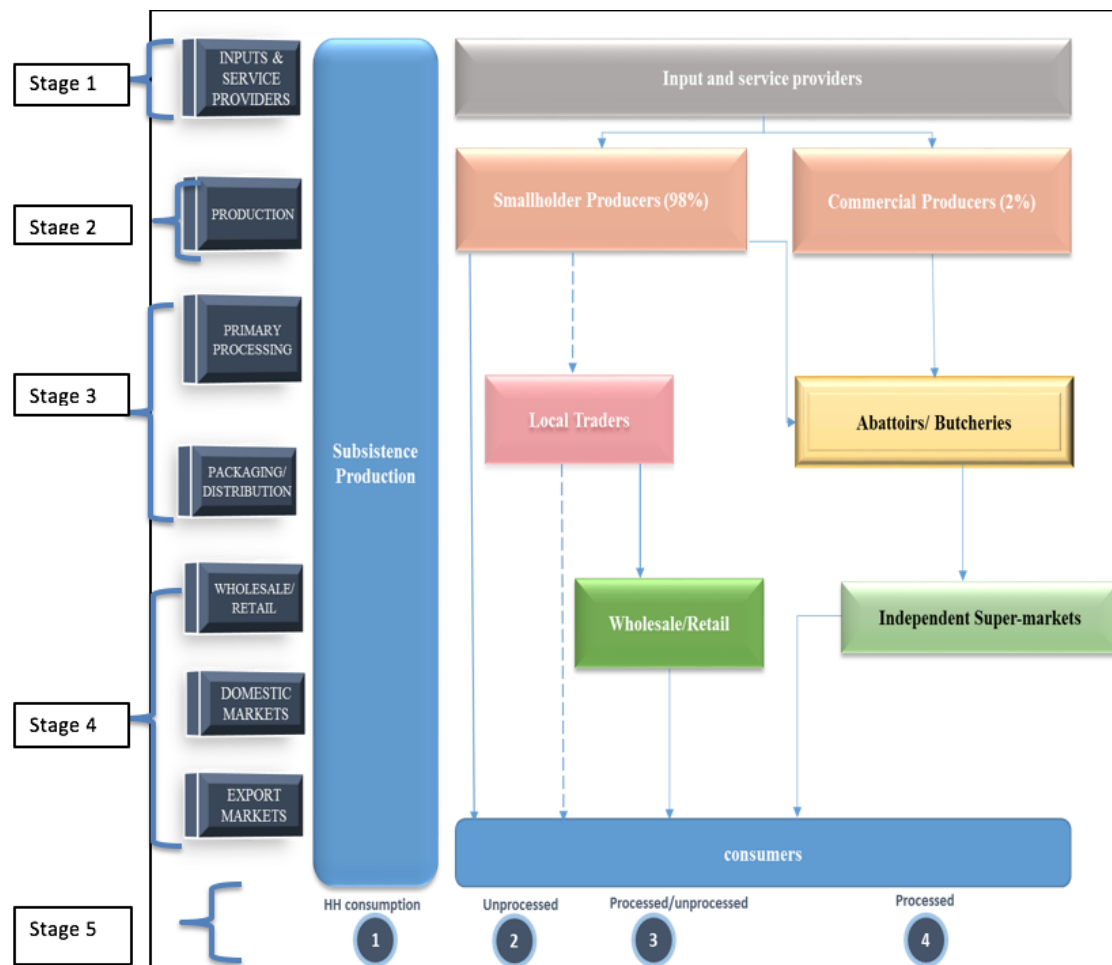
Source: Authors' field notes

Following the value chain map highlighted in Figure 1 for goat production, this section describes some of the stages in the production and marketing of goats. Under inputs, the primary inputs for small livestock production include feed, water and health services (veterinary services).

Feed: Goat rearing in Zambia by smallholder farmers is mostly carried out under the semi-intensive system whereby animals are confined in night shelters and, during the day, left to graze freely in and around the farmland or on nearby communal land. Small ruminant production by smallholder farmers is largely dependent on natural pastures and crop residues for most of the year, and animals rarely receive supplements. As such, nutrition has been documented as one of the limiting factors in traditional livestock production (Simbaya 2002). Further, Simbaya (2002) highlights that during the rainy season young grasses have a very high concentration of essential nutrients that are capable of supporting animal growth but, as the rainy season advances, the protein and other nutrients tend to reduce due to a rapid increase in fibre. The situation worsens in the dry season as the levels of nutrients drastically reduce, thus limiting the nutritional quality of feed available for the animals to meet their protein, energy and mineral requirements.

Nutrition, therefore, tends to affect total lifetime productivity by influencing overall growth and mature size, leading to lower herd replacement rates and an increased period necessary to reach marketable size. However, despite these known facts, results from the nationally representative household survey on grazing patterns for goats remain the same throughout the year (Figure 2). Communal pastures are the most commonly used source of pasture for goats among smallholder livestock farmers. For example, more than 60% of households used common pastures for grazing in the hot, dry season while their own or neighbours' crop fields were the second most common grazing area for goats during the hot and cold, dry seasons. These results are in line with what was obtained from the FGDs with the

farmers. The general perception among smallholder farmers is that goats are self-managed and more tolerant of many diseases than other livestock. This has resulted in very low adoption of sustainable pasture management techniques that can enable them to supply the necessary feed required for their animals, especially in the dry season when the nutrient levels are very low.

Figure 2. Goats' grazing areas by season
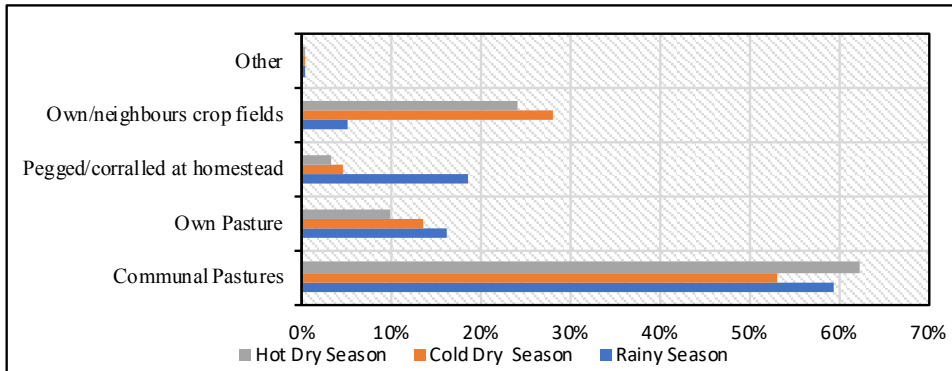
Source: CSO/MAL/IAPRI 2015

Water: Water provision is a crucial input for livestock productivity and goats have unique characteristics that enable them to withstand heat stress and prolonged water deprivation compared to other ruminant animals. However, goat production is often constrained by water and feed shortages (Al-Khaza'leh et al. 2015). Further, a study in Saudi Arabia on the effect of water restriction in lactating goats during the dry season showed that feed intake (dry matter) decreased and milk production reduced from 20% to 18% when water restriction was at 50% and 25%, respectively (Leal De Araujo et al. 2010).

Health services: Despite their desirable characteristics, goats also suffer from disease outbreaks such as mange, diarrhea, heartwater and contagious ecthyma[3] (orf disease also know as Contagious pustular dermatitis) which are among the major constraints to goat keeping. Figure 3 shows the methods of disease control that smallholder livestock farmers used, based on the household survey data collected in 2012 and 2015. The figure reveals that nearly 50% of the households that reported disease incidences in goats did not treat their animals. Similarly, over 40% of the households used veterinary drugs to treat disease in their animals. There has been a slight increase in the percentage of households treating animals with veterinary drugs as well as those that did not treat their animals between 2012 and 2015. Traditional methods are those least used by smallholder households, with fewer than 10% of the households indicating having used this method. The results further show a decrease in the percentage of households using traditional methods. The results presented in Figure 3 align with the general perception among smallholder farmers in rural areas that goats do not require any vaccines for preventing diseases or drugs to treat the diseases, as they are self-treated.

Figure 3. Disease control methods in goats
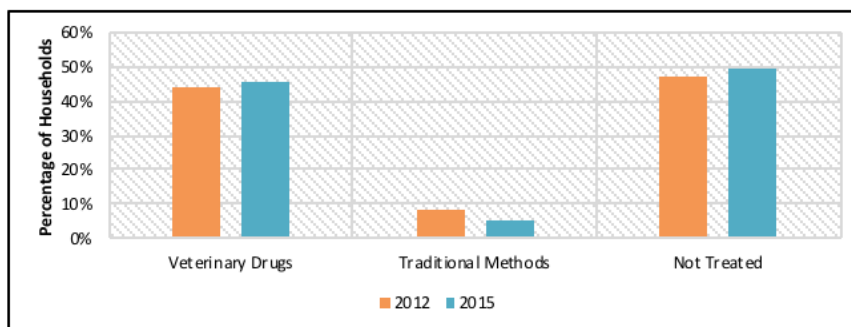
Source: CSO/MAL/IAPRI 2012 and 2015 Survey Data.

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3   A viral infectious skin disease of goats and sheep affecting the lips, especially of young animals.

Goat production by smallholder farmers

Goats are produced in almost all the parts of the country and currently, about 35.1% of the smallholder farmers in Zambia own goats (Chapoto and Zulu-Mbata 2015). Though goats are found in all parts of the country, a huge population of goats is located in Southern province, which has over 50% of households raising goats. Table 1 shows the changes that occurred between 2001 and 2015 in goat population and the proportion of households that own and sell goats. The national population of goats doubled over the years, but the average household herd size had a minimal increase over the same period. The increased population of goats over the years was mostly due to the increased number of households owning goats as opposed to increases in herd size. The percentage of households owning goats increased by over 100%. However, this increase has not translated into a significant increase in the percentage of households participating in markets. Similarly, there is a reduction in the average number of goats sold by the households participating in livestock markets.

Table 1. Changes in goat production over time

Variable	2001	2012	2015	% Change (2001 to 2015)
National herd size of goats	1,098,453	2,151,890	2,908,466	165%
Average herd size	6	7	7	17%
% of Households owning	15.12	30.68	35.1	132%
% of Households selling goats	33.67	38.42	34.26	2%
Average number of goats sold	3	4	2	-33.33%

Source: Author's field notes

Goat marketing

The study by Negassa and Jabbar (2008) shows that many smallholder farmers do not participate in the livestock market and for those who do participate, the size of the transaction (sale or purchase of cattle, sheep or goats) has been found to be very small. They further indicate that for both cattle and small ruminants, birth is more important than purchase from the market in building and maintaining herd size and flocks. Therefore, despite the reasonably high share of cash income coming from livestock as a source of smallholder livelihood, the production system is not adequately market-oriented. McPeak (2004) also observes that, though livestock sales may increase current cash income and thus consumption, sales come at the cost of decreased future income and consumption and, as such, farmers try to maximize herd size and limit marketed animals to raise cash to meet immediate expenditure requirements. Herd size and dependence on livestock have an influence on household livestock marketing behaviour. Barrett, Bellemare and Osterloh (2006) highlight that most households participate in livestock marketing more actively as sellers rather than buyers when prompted by environmental stress. They also noted that low livestock market participation was prevalent among households with an alternative source of livelihoods and those with low herd sizes.

Goats are assets that are easy to sell for cash and, as such, many of the sales are triggered by the need to support family expenses rather than as a business initiative. It was observed that a majority of the households that participate in the marketing of goats are those with a bigger flock. Since goats are productive assets that generate future income, livestock marketing by smallholder households responds mainly to demands for cash needs rather than short-term profit-making. Building and maintaining the herd size is, therefore, of great importance to the smallholder farmers and affects their marketing decisions.

Figure 4. Marketing channels for goats by smallholders
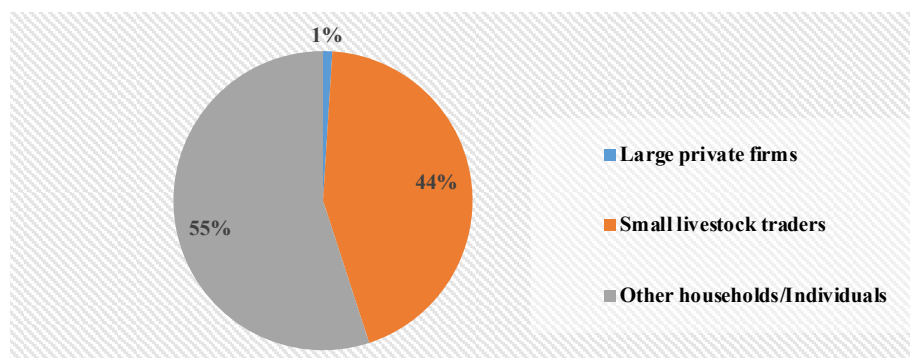
Source: Authors' calculation from RALS 2015

Figure 4 shows that over 90% of smallholder farmers sell their goats through informal markets, which affects the prices that they receive. There is no standardized pricing in informal markets—in most cases, the size of the goat determines the prices. The choice of the marketing channel used by the farmer has a bearing on the price they receive and their gross margins.

To understand the factors affecting the choice of the market channel to use for goats, we turn to the results from the econometrics analysis in Table 2. The results indicate that herd size, and the gender of the household head and decision-maker[4] affect the choice of the market channel to use. For instance, households with big herd sizes are more likely to sell to traders as opposed to selling to individual households. Since traders typically buy quite a large quantity of goats in each transaction, farmers with a large flock of goats will prefer selling to traders compared to selling one or two goats to individual households. The study by Bruyn et al. (2001) also shows that herd sizes of the animals had an influence on the marketing channel used by the farmers. However, it was observed that with increased herd size, transportation cost also increased, which is another factor that influences the choice of marketing channel. Further, farmers in female-headed households are more likely to sell their goats to traders than their male counterparts. However, when we control for the gender of the decision-maker, females were more likely to sell to other households than to small-scale traders. One of the concerns that farmers raised during the FGDs was the issue of feeling exploited by the small traders. Small traders always want to buy at very low prices; hence, female farmers may prefer to sell to individual households rather than to traders to avoid low prices. Also, females are more likely to sell a very small number of goats than their male counterparts, hence selling to individual households fits best for female farmers.

Other studies have found that marketing costs such as transport costs, council fees and animal health certification do significantly affect household marketing behaviour. In particular, high transaction costs discourage market participation and also affect the choice of marketing channel (Bellemare and Barrett 2006; Musemwa et al. 2007). Further, the study by Shiimi et al. (2012) on factors influencing the decision to market cattle via formal or informal markets shows that access to market-related information and improved productivity significantly affects the farmer's decision of whether or not to sell through formal markets. Our results show that households which had access to commodity price information were more likely to sell to traders than to individual households. Disease prevalence also limits farmers from accessing the formal market channels as the perceived standards of the formal markets may disadvantage most farmers (Togarepi et al. 2016). These factors, therefore, limit the farmers' ability to invest in and expand their livestock production

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4 The correlation between gender of the household head and decision-maker is 0.72, hence the two variables are not highly correlated.

5 Decision to sell or not sell

Table 2. Probit results factors affecting choice of market

Variables	Selling to small scale traders	Selling to individual households
Herd size of goats	0.0028*	-0.0033*
	(0.0017)	(0.0017)
Female head (=1)	0.1430*	-0.1257*
	(0.0764)	(0.0762)
Female decision-maker[5] (=1)	-0.1946***	0.1863***
	(0.0634)	(0.0632)
Age of decision-maker	-0.0002	-0.0001
	(0.0014)	(0.0014)
Education level	0.0020	-0.0019
	(0.0053)	(0.0053)
Household size	0.0033	-0.0027
	(0.0063)	(0.0063)
Distance to the district town centre	-0.0000	0.0001
	(0.0007)	(0.0007)
Distance to the markets	-0.0009	0.0010
	(0.0007)	(0.0007)
HH access to price information (=1)	0.057	-0.0604
	(0.0456)	(0.0455)
Disease incidence (=1)	-0.0254	0.0293
	(0.0425)	(0.0426)
Animals vaccinated (=1)	0.0729	-0.0672
	(0.0477)	(0.0478)
Observations	726	726

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Further, we look at the household characteristics that influence the herd size of goats from the OLS results[6]. Since the flock size can be affected by numerous factors that were not included in our regression analysis, we limit the discussion of our results to correlation rather than causality. The results show a positive and significant correlation between age of household head and herd size of goats. This implies that older household heads are more likely to have a big herd size than younger household heads. Results also show that the average age of farmers keeping goats is 48. Since asset accumulation takes time, it is likely that older farmers who have been keeping livestock for a long time will have big herd sizes. Further, older farmers are more apt to keep small ruminants as a strategy of farm diversification and managing risks associated with crop failure (Dossa et al. 2008).

In addition, off-farm income can facilitate the acquisition of more goats by smallholder farmers; hence the positive correlation between the herd size and the value of off-farm income. Barrett et al. (2006) also highlight that households with an alternative source of livelihoods away from livestock are less likely to participate in markets as sellers, thereby maintaining the herd sizes of their animals. Management practices such as vaccination and deworming also have a positive influence on the herd size in the sense that they affect productivity levels of goats. In our results, though deworming has a positive sign on the coefficient, it is not statistically significant. Disease incidences were cited as one of the challenges that farmers face in keeping goats and, therefore, management practices such as deworming and vaccinations play a critical role in reducing mortality rates, thereby maintaining the herd sizes (Jaitner et al. 2001).

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6   Full regression results are available from the authors upon request

Further, households that participate in goat markets own more goats than non-participants. Market participation is likely to facilitate the restocking of new animals as income generated from the sales can be used to purchase more animals with better breeds. Results also show that female-headedness is not associated with herd size. This result

is surprising because other studies have shown that women are more likely to own small livestock, such as goats, than cattle. However, since female-headed households are faced with more financial constraints than their male counterparts, they are likely to sell their goats more often to meet family expenses.

Conclusion and policy implications

The consensus from the field visits and past studies is that households sell their small livestock primarily to meet their immediate needs for cash. The livestock marketing behaviour of smallholder farmers is driven more by income needs than demand or price movements (Shiimi et al. 2012; Barrett et al. 2006). Goat marketing is very liquid, with many buyers and sellers. In the absence of formal financial markets for rural households, keeping livestock represents a means of finance and self-insurance and small ruminants being a liquid asset that can easily be converted into cash is, therefore, a risk-coping strategy of rural households (Barrett et al. 2001; Dercon 1998). However, under the current conditions, formalization of the goat market is difficult because the herd size of goats for the majority of the farmers is still very small. Thus, linking most producers to the markets may require horizontal arrangements, such as selling as a group, which are difficult to achieve when most farmers use their livestock to meet cash needs.

Therefore, moving towards a formal system would, firstly, require farmers to increase their overall herd sizes so that individual farmers are more capable of selling directly to processors. This will require adopting management practices that reduce disease incidence and mortality rates. The government should introduce sanitary mandates. Sanitary mandates entail contractual arrangements whereby the state contracts the private sector to implement certain animal health services that are carried out in the national interest, usually at a cost to the state. This can be revised to mean assistance from other stakeholders in the development of the livestock value chain. These mandates could establish an income base enabling the establishment of private practising in the areas of extensive husbandry systems, which would not typically support such an enterprise.

Secondly, there is a need to have a group of farmers which can supply processors and which have a smaller chance of defaulting on the supply arrangements with the processors. Musemwa et al. (2007) also highlight that the formation of small farmer groups and associations have the potential to increase the participation of small-scale livestock farmers in formal markets. Marketing groups can help lower transaction costs and improve access to information, and farmers can achieve greater economies of scale.

Thirdly, the government, through related agencies, must partner with private firms/institutions in the facilitation of the development of facilities currently deemed expensive and unattractive to the entrepreneur in remote areas to lure individuals to participate in the markets. These should be established in selected districts with production potential.

Fourthly, there is need to establish more breeding centres for small livestock to help increase herd sizes and encourage farmers to participate in the marketing of goats. Grants must be made available to selected individuals or institutions to create and manage breeding centres and programs on behalf of the people or government.

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Value chain analysis of beef in Swaziland

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Abstract

This paper presents the results of value chain analyses for the beef sub-sector in Swaziland. The objective of reviewing the beef value chain was to establish if it is beneficial to the farmers and to derive insights that can contribute to the rapid and sustainable integration of small-scale farmers into the beef cattle value chain in Swaziland, thereby facilitating the process of commercialization of smallholder beef cattle farmers. With 80% of Swazis owning cattle, integrating them into the commercial beef value chain will require substantial assistance. The analyses were based on subsector data regarding the structure and function of the beef value chains. The data were gathered through interviews with farmers and various value chain players and stakeholders. The study identified that beef profitability is being constrained by low productivity at subsistence farmers' level, low investment in technology, poor linkage between smallholder cattle producers and other value chain actors and lack of land and rangeland. The study further concludes that productivity and competitiveness increase when fattening is adopted, and identifies that strategic interventions along the value chain could address the specific constraints that affect the overall performance of the value chain.

Keywords: value chain analysis, beef industry, Swaziland

Introduction

Overview of Swaziland's agricultural sector

Swaziland's agriculture sector is highly dualistic; it entails a traditional subsector and a commercial subsector. This dualism portrays fundamental disparities in land ownership. The traditional subsector is established on communal land tenure on Swazi Nation Land (SNL) and the commercial subsector is based on Title Deed Land (TDL). SNL, which comprises 60% of the country's land area, is used mainly for subsistence farming, while TDL, which occupies the remaining 40%, is employed in commercial agriculture, characterized by relatively high capital intensive cash-crop production (mostly sugar cane), irrigation and corporate ownership.

The dualistic nature of Swaziland's agriculture is also reflected in the contributions made to export by the two subsectors. Agricultural exports are heavily concentrated in a small number of cash crops produced on TDL, while beef exports come from SNL. In contrast, the subsistence-oriented crop production practised on SNL generates few

exports. This means that even though agriculture makes a significant contribution to exports, these exports contribute very little to improved incomes for the vast majority of rural households, whose livelihoods depend on smallholder agriculture. Moreover, some of the traditional export sectors (sugar, textiles) are facing new challenges in export markets, suggesting the need for diversification.

Importance of livestock in Swaziland

Possession of livestock is widespread in Swaziland, involving a large percentage of households. Eighty percent of rural households own cattle in Swaziland (Central Statistics Office (CSO) 2012 unpublished). Livestock, and in particular cattle, plays a vital role, both economically and culturally. Most cattle are managed in extensive systems on common grazing land, and there is substantial potential to increase the economic contribution of what remains a very unproductive system. Co-existing alongside the subsistence system is a small but very well developed commercial cattle industry encompassing production of both beef and dairy products. The beef cattle value chain, therefore, benefits from regional and international export opportunities, and from significant private and public sector investments in Swaziland.

Aim and objectives of the study

The objectives of this value chain analysis are:

- To identify opportunities, constraints, actors and other factors that need to be tackled along the entire chain.

- To encourage transition from subsistence to commercial beef cattle rearing.

- To establish key action areas that can contribute to the rapid and sustainable integration of small-scale farmers into the livestock value chain through

    - Identification of limiting factors that contribute to poor performance in the value chain.

    - Assessing technological options that could improve productivity.

    - Identification of priority areas for future government interventions.

Methodology and data

The research methodology and procedures included some time spent reviewing existing material through desk research; and conducting interviews with key players, including not only Ministry of Agriculture (MoA) officials but also input suppliers, representatives of wholesale and retail produce marketing organizations, members of the catering industry, non-governmental organizations (NGOs), and commercial producers and exporters of beef, SNL livestock producers and feedlotters. Interpretations were petitioned from each group concerning the constraints that need to be overcome and the interventions that are needed to allow small-scale producers in Swaziland to enter into commercial livestock production.

Results and discussion

Subsector Review

Livestock production plays a role in Swaziland, both economically and culturally. Confirmation of this comes from the large numbers of livestock found throughout the country. Among the different livestock species that are kept in Swaziland, cattle are of paramount importance. This is evidenced both by the large number of rural households that own cattle and by the existence throughout the country of relatively organized markets for cattle. Public and private

investments in the livestock sector are predominantly targeting the beef value chain, with the goal of tapping into the large and growing domestic, regional and international markets for beef.

Table 1. Livestock distribution by agro-ecological zone

Year	Beef cattle	Dairy cows	Pigs	Chickens	Goats	Sheep
Hhohho	124733	1810	11140	520757	79685	4118
Manzini	174904	293	5778	199517	130419	2318
Lubombo	172789	1897	10778	1612696	123686	4855
Shiselweni	142687	919	12112	213373	107347	5196
Totals	615113	4919	39808	2546343	441137	16487
Ratio	1.0	1.2	0.1		0.2	0.2
Livestock units	615113	5903	4976		73523	3297
Percentage (%)	87.5%	0.8%	0.7%		10.5%	0.5%

Source: Annual report DVLS 2014, MoA

Livestock holding in Swaziland takes place within three broad land tenure systems: (i) communally held SNL; (ii) privately held TDL; and (iii) publicly held government ranches. The most recent livestock census (carried out in 2014) revealed that the distribution of animals across these three categories varied by species. Across all species, generally speaking, productivity on TDL farms was found to be higher than on SNL because of better animal husbandry and improved disease control.

Table 2. Livestock distribution by landholding type

Landholding type	Livestock distribution (herd)			
	Cattle	Dairy cows	Sheep	Goats
SNL	528,846	2,530	13,426	423,806
TDL	76,267	1,243	3,061	8,493
Government ranch	10,000	1,146	---	8,838
Total	615,113	4,919	16,487	441,137

Source: DVLS Annual Report 2014, MoA

Production costs and marketing margins

Farm level analysis

Smallholder farm production costs on SNL for cattle are highly subsidized in Swaziland. Until 2010, smallholder farmers who kept their cattle on a government ranch for grazing paid only SWL 6 per animal per month for fattening. As a result, production costs made up a small proportion of the final retail selling price (Table 3). Beginning in 2011, the fattening fee was increased to SZL 30 per animal per month. It is hoped that the higher out-of-pocket cost will induce farmers to become more business-oriented and will influence them to adopt more commercial (and hopefully more efficient) production practices.

Table 3. Distribution of costs and margins, beef value chain (SNL) chain level

Livestock source	Market		
	SNL	Feedlot (full ration)	Feedlot (mixed ration)
Average buying price	0	5,000	5,000
Costs*	0	3,423	1,610
Average selling price**	5,500	8,491	8,491
Margin	5,500	68	1,610
Margin %	100.0%	0.8%	22.2%

* Does not include opportunity cost of herding and communal grazing

** Average selling price per kilogram carcass weight of SZL 38 across the market

Although the beef value chain in Swaziland is well established, obtaining information on market prices from abattoirs and processors proved very difficult as they are reluctant to share information. The figures used in computation of margins are based on information collected from abattoirs, farmers and retailers. Most SNL farmers keep cattle for status and as their 'capital wealth' and will only sell when they need to raise finances for specific needs, such as paying school fees. This means that they do not buy cattle with the intention of programed resale. These animals feed on SNL grazing land and are looked after by family members and therefore incur no financial costs associated with buying cattle for resale, feed or labour. Medical costs are minimal as dipping chemicals are subsidized by government and treatment of diseases is only in response to disease outbreaks (reactive). These cattle will be sold at three years or older due to the type of grazing and the fact that there is no supplementary feeding, especially in winter.

In the commercial sector (TDL), cattle take less time to mature due to the availability of grazing land and supplemented feeding during drought and winter months. These farmers can achieve maximum margins of 22.2%. Being business-oriented allows them to operate professionally, such that they incur production (labour and medical) costs. Disease treatment is therefore prophylactic for them.

Feedlots operate on both SNL and TDL farms. The feedlotters buy weaners from SNL and TDL and dairy bull calves at an average price of SZL 5,000 per head with an average weight live of 150 kg. They are ready for sale at a live weight of 450 kg, yielding a carcass average weight of 200 kg, and they incur feed, medical and labour costs. The highest cost contributor is feed. The cattle are either fed a full concentrate ration or a mixed concentrate ration. The mixed concentrate ration is formulated by the farmers, using locally available inputs in order to reduce the feed costs. Feed costs account for 91% of total costs for those on full concentrate ration and 75.5% of the total costs for those on a mixed concentrate ration.

Therefore, the cattle value chain is not an attractive enterprise for farmers who want to venture into the feedlotting business, except for those commercial farmers who also run abattoirs and butcheries (practising vertical integration within the value chain). Feedlotting farmers on full ration have a margin of 8% while those on mixed ration have a

maximum of 22%. The SNL farmers who are still in business either practise mixed ration feeding to minimize costs or have such poor records that they cannot determine whether they are making a profit or loss and are happy to maintain a capital reserve.

Key challenges and constraints

The beef value chain is generally well developed and is functioning relatively well. Nevertheless, opportunities to strengthen the value chain were identified, particularly at the stages of production and procurement. Four key challenges and constraints merit attention: (i) limited investment in technological and/or management innovations, especially with regard to nutrition needed to improve productivity in smallholder cattle farm production; (ii) poor transactional relationships between smallholder cattle producers on SNL and other value chain actors; (iii) inadequate and poorly coordinated public and private investments; and iv) non-availability of a rangeland grazing management policy.

i.   Limited investment in community-based technological innovations

Smallholder systems operating on SNL have seen very little innovation. Animals continue to be range-grazed at very high stocking rates on overexploited communal land, with little effort made to improve nutrition. This form of management has the advantage of keeping production costs very low but productivity is very low also. Opportunities therefore exist to introduce innovative management strategies that could significantly improve nutrition and eventually productivity, for example the production of fodder/hay for storage into the dry seasons, improvement of forage quantity and quality through the creation of grazing blocks and the use of rotations, and supplementation of grazing with manufactured feed and nutritional supplements.

ii.   Poor transactional relationships between smallholder cattle producers on SNL and other value chain actors

The beef value chain in Swaziland suffers from a major bottleneck at the farm marketing level. The main buyers of beef cattle, including SMI, other commercial butchers and feedlots, face serious problems in ensuring adequate supplies of high-quality animals. Although many transactions take place around dip tanks, dip tanks were not intended to be marketplaces and sellers do not take cattle to dip tanks primarily for sales. Because competition among buyers is often limited around dip tanks, sellers typically have few options, which limits their bargaining power and often forces them to become price takers. Transparent behaviour by the different operators is constrained by the absence of market price information mechanisms.

iii.   Inadequate and poorly coordinated public and private investments

The government of Swaziland has attempted to create incentives to make the livestock sector in general, and the beef subsector in particular, attractive to commercial investors. It is providing many goods and services needed by participants all along the value chain. Despite these incentives, producers have not responded by adopting a more commercial orientation to beef production and making the complementary investments needed to drive productivity and production to higher levels. The main reason for this seems to be a lack of coordination among the government's investments, which means that progress made in one area (e.g. herd genetics) is immediately undermined by continuing bottlenecks in other areas (e.g. overstocking of communal lands leading to poor animal nutrition).

iv.   Rangeland grazing management policy

Livestock rearing in SNL is greatly affected by the non-availability of a National Land Policy (NLP). The draft policy, apart from addressing equal opportunities for land allocation to women and men, proposes a strengthened mechanism to allocate fields for growing crops and grazing land. This is currently being executed by the chiefs, among whom awareness of the NLP needs to be raised. In the absence of this policy, the problem of overgrazing will remain a big issue.

Intervention options

A number of intervention options can be identified that offer the promise of better integrating smallholder farmers into the beef value chain. These intervention options, which would not necessarily require significant financial resources from the public sector, fall into four broad categories: (i) investing in improved farm production, input and animal supply; (ii) creating and consolidating markets and marketplaces for cattle and other livestock; (iii) increasing and better coordinating investments along the value chain; and iv) conducting case studies to identify specific issues related to the different cattle producers on both SNL and TDL.

i.   Invest in improved production technology and input supply

Smallholder cattle production on SNL will not become a significant driver of growth and poverty reduction unless productivity can be raised, beginning at the farm level. Investments are needed to improve cattle and rangeland productivity, including investments to improve herd genetics by increasing bull supply, investments to improve nutrition by enhancing feedlot production and investments to improve animal health by increasing delivery of veterinary services.

ii.   Create and consolidate market information and marketplaces for cattle and other livestock

Performance of the cattle value chain in Swaziland continues to be impaired by the long production interval required and the high cost of conducting transactions. Investments designed to improve the cattle marketing system, targeting both the 'hard' aspects (e.g. physical marketplaces) and the 'soft' aspects (e.g. market information systems) could contribute to improving vertical coordination, lowering transaction costs, reducing transaction times and greatly improving the efficiency of the value chain.

iii.   Increase and better coordinate investments along the value chain

The government of Swaziland has signalled its commitment to scale up investments in the livestock sector but increased investments are unlikely to deliver the expected benefits unless they are well targeted and appropriately sequenced. Sound public investments need to be combined with complementary private initiatives to capture potential synergies. Moreover, there is a need to ensure that ongoing investments are structured in such a way that they not only lead to increased value addition but also ensure a socially acceptable distribution of benefit shared among value chain participants.

Improved access to agricultural finance

Many livestock farmers in Swaziland face difficulties in attempting to access loans from commercial lenders. Livestock production is viewed as a high-risk activity so it attracts high interest rates and daunting collateral requirements that most smallholder farmers cannot meet. The lack of insurance products adapted to the needs of livestock producers means that the vast majority operate without credit, which limits their ability to intensify production methods and/ or expand the size of their operation. Financial institutions may require assistance from the government in developing and introducing instruments that can be used by livestock producers to access finance. The work of the Microfinance Unit (MFU) under the Ministry of Finance (MoF) has established a way forward. Initiatives with regard to agricultural finance should be channelled through the MFU.

Regulation of beef cattle industry: The MoA, through the department of Department of Veterinary and Livestock Services (DVLS), needs to find a way to regulate the beef value chain so as to allow the beef industry to grow in the country. Carcass grading is carried out by the buyers and farmers are price takers, hence the need to have a regulatory body to look into the issues of grading and carcass pricing. This will ensure fair benefit for the beef cattle farmers.

iv.   Case studies to identify specific issues related to the different cattle producers in both SNL and TDL

Commercial beef cattle producers in both SNL and TDL have similar challenges; however, they have devised strategies to deal with these challenges. The biggest challenges are the feed costs and market prices. The farmers, in mitigating feed costs, are formulating rations as advised by the MoA extension officers. It is worth noting that when it comes to carcass prices, there is no bargaining power as the buyers collude and thus lower prices are paid. Further studies on sample beef cattle farmers need to be conducted to establish the marketing channels and attributes of both SNL and TDL farmers. This could provide specific market information, setting of cattle price, production etc. The farmers could then be categorized according to the number of cattle they own so that proper analysis could be conducted.

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Growing a PPP: The case study of the Ngwane mills–SWADE joint venture

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Abstract

Establishing public-private partnerships is often considered to be a panacea for weak processing and marketing linkages for smallholder farmers. The reality is more challenging. This paper traces the evolution of a proposed abattoir joint venture to an integrated abattoir-feedlot operation in the Lower Usuthu smallholder irrigation project (LUSIP) I command area in the Lowveld of Swaziland. The focus of the paper is on the need to grow a meaningful partnership, not just from a business perspective but also, just as importantly, a robust partnership between the commercial and development philosophies of suppliers of animal feedstuffs and a parastatal development agency. Inclusion of smallholder farming companies as shareholders and suppliers to the feedlots is another key element.

Keywords: PPP, viability, inclusion, marketing

Introduction and background

[1]Possession of livestock is widespread in Swaziland (Ministry of Agriculture (MoA) 2016) and is carried out by a large percentage of households. Cattle, in particular, play an important role, both economically and culturally. Most cattle are managed in wide-ranging systems on communal grazing land (85% of total beef cattle herd) and there is considerable potential to increase the economic contribution of what remains a very unproductive system. Co-existing alongside the traditional system is a minor but very well-built commercial cattle industry including production of both beef and dairy products. Investments have been made to enable the dairy cattle value chain to provide bull calf weaners that can be feeder stock for beef cattle production. In addition, the beef cattle value chain benefits from regional and international export opportunities and from significant private and public sector investments in Swaziland.

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1   Swaziland beef value chain, 2016, MoA-NASTA

After inspecting the performance of the livestock value chain and revising key policies and strategies, four main sets of constraints in the beef value chain have been identified and found to be undermining performance. The four sets of constraints comprise: (i) limited investment in community-based technological innovations needed to improve productivity in smallholder cattle production; (ii) inefficient coordination between smallholder cattle producers on Swazi Nation Land (SNL) and other value chain actors; (iii) inadequate and poorly coordinated public and private investments; and iv) lack of a National Land Policy (NLP) and rangeland policy.

In January 2016, a preliminary meeting between the Ministry of Agriculture (MoA), Ngwane Mills and the Swaziland Water and Agriculture Development Enterprise (SWADE) agreed to investigate the possibility of establishing a joint venture (PPP) between Ngwane Mills (feedmaster) and farming companies supported by SWADE to establish an abattoir and meat processing unit in the LUSIP I project development area (PDA).

Initially, Ngwane Mills outlined its commitment to extending its operations in the beef and pig value chains in Swaziland as part of its vertical integration strategy in the sub-region. SWADE then explained that it had been investigating the possibility of establishing an abattoir based on its promising vegetable pack house model. Ngwane Mills indicated that it wanted to ensure that a transparent operation is established that actively involves all stakeholders. Furthermore, it was indicated that it would be prepared to invest 51% of the start-up capital, including working capital, of which 49% would be invested by SWADE but with the aim of allocating some of their shares to the livestock enterprises over a period of time. Subsequently, the focus was on carrying out market assessments, exploring business models and ensuring that any proposals met MoA veterinary standards.

A beef cattle value chain study carried out by MoA/NASTA (EU funded technical assistance to the National Adaptation Strategy) and a red meat market study (commissioned by Ngwane Mills) provided strong evidence that there is a solid business opportunity for a well-managed livestock processing and marketing operation.

The opportunity for investment in the meat industry—why a PPP?

The meat industry (beef, pork and goats) in Swaziland has the potential to increase the red meat sector output, if tighter quality controls are adhered to and there are fair sale contracts with smallholders.

Historically, goat production has contributed a major proportion to the red meat volume consumed but beef offers a compelling diversification proposition in the agricultural sector, given a well-developed value chain, significant demand that is not being met, preferential quotas for export and the country's (specifically smallholders') endowment of cattle.

The country cannot afford to lose these market opportunities. The process needs to be led by the private sector market and transparent price incentives are required to encourage farmers to increase quality production. International meat hygiene standards and sanitary requirements must be met by slaughter houses, slabs and abattoirs in the country; until this occurs the gap to meet domestic and international demand will remain.

All 'under the tree' slaughters are considered bad hygiene practices. As home consumption is high (over 50% of meat consumption is domestic (Nganwe Mills 2016)), this gap needs to be addressed.

Lastly, the passage of information from producers to wholesalers to retailers is very challenging, with little accurate information available. Basic data are a challenge to acquire, and sharing of any information is limited. This can be seen as a low hanging fruit and a possible quick win; if transparency is established, it will attract investors. Timely and accurate reporting on the market needs to be established, which could be developed by the Department of Statistics' cost of living surveys. Unfortunately, transferring data between retailers and vendors currently requires considerable manual labour. Apart from the cost of collecting, managing and transmitting the data, the manual approach has also meant that the communication is very slow moving

Making the case and making it work

Establishment of the market case

The Ngwane Mills-funded Red Meat Market study (2016) reported that:

i.   The composition of the red meat sector in Swaziland's market is frequently changing due to opportunistic livestock practices, new processing methods and varied product delivery methods.

ii.   The red meat supply sector contributed approximately SZL 400 million (Swaziland lilangeni) to the Swazi economy's food and beverage sector, or 2.86% of the country's gross domestic product (GDP) and, through its production and distribution linkages, impacts close to 60 retailers, 251 butcheries, hotels, restaurants and individuals countrywide.

iii.   The livestock industry is an important subsector of the national economy. The agrarian sector contributes about 70–74% of the total domestic export earnings, of which livestock account for 18–23%. About 98–99% of this contribution could be attributed to cattle and the rest to the poultry subsector. Goats, like sheep, do not contribute to export earnings, and the import of meats cost the country SZL 183 million in 2015.

iv.   Under the Lomé Agreement, Swaziland had a quota of 10,000 tonnes of beef to export to the European Union (EU) market with a levy of 8%. This was then reduced to 3,800 tonnes, and the country still has not reached the target.

v.   In 2015, the country exported beef to the value of SZL 81 million but only exported 1,1141 metric tonnes of beef. This still proved insufficient as the delivery targets were not met.

vi.   Swaziland only produced 12,650 metric tonnes of beef in 20152. Needless to say, the current supply infrastructure is not set to keep up with the expected demand.

vii   .MoA DVLS reports (2016) indicate that the cattle herd is estimated at 615,113 animals, there are 39,808 pigs and 15,983 sheep, while goats number an estimated 441,1373.

viii. The study accounted for some 47 retail outlets in Swaziland

Establishment of trust

'Success depends on building trust between the two sectors, and often, a change in mindsets. For the public sector, it means being a facilitator of projects providing public benefits. For the private sector, it means being a collaborator negotiating profitable projects with public' (Krueger 2016).

Intuitively, our working group recognized that we needed to develop an understanding of each other – our perspectives, our motivations and approaches to farmers operating on SNL. This relationship has grown to the extent we stand together with our business model and feasibility study and have shared these with the Mkendi community and will shortly do so with our respective boards. This has not been a given but all parties have worked to 'work together'. It is an indication (how do you measure trust?) that, as new people join the working group, we have had to bring them up to speed on our joint mission and processes.

Establishment of the business case–feasibility, sharing of costs

The first aspect, having satisfied the working group that market potential was available, was to assess the supply side of the red meat industry. We show here the calculations for the beef sector. A similar assessment was made for pork. Whilst provision has been made for a possible goat processing module, further work is needed to understand and quantify the goat sector. We focused on the potential for younger male stock to enter the feedlot for finishing. The

indicated share of possible off-take is considered reasonable, especially when the potential for dairy male calves is taken into account.

Table 1. Estimation of potential supply for proposed JV Abattoir- Beef require 5000 head of 400 kg liveweight animals to keep abattoir operating at 80% capacity

National Breeding herd

	Unit	Hh	Lu	Man	Shine	Total			
Cows	No	44,344	66,699	63,661	56,626	231,330			
Females 2 – 3 yrs	No	14,800	23,450	21,913	8,893	69,056			
Breeding Herd	No	59,144	90,149	85,574	65,519	300,386	90,116	45,058	5,000

Source DVLS Annual livestock census- August 2014

11%

Catchment Zone			Supply					
		Lubombo	Shiselwe	Abbatoir Zone	Calves (i) 30% S t W	Male Calves		
Cows	No	66,699	56,626	123,325				
Females 2- 3 yrs	No	23,450	8,893	32,343				
Breeding herd	No	90,149	65,519	155,668	46,700	23,350	4,000	17%
Catchment Zone Others							5,000	21%
Dairy Male Calves	No			3,000	3,000	1,500		
					Say	1,000	1,000	
Imports from SA	No							
Annual Requirement	No						5,000	
Annual liveweight Supply	Kg	400					2,000,000	
Annual Carcase weight	Kg	212					1,060,000	

Source- derived from Table 1 and wokring group calculations

Calves (i)		30% survival to sale on SNL - based on last four years DVLS Annual Report
Liveweight to Abattoir	Kg	400
Dress out percent		0.53

The business model and the case for the PPP

Objective

The objective of the project is support the commercialization of the beef, pig and goat industry in Swaziland through establishing an integrated financially profitable and sustainable livestock product processing operation that is based on active participation of the involved parties (farmers, chiefdom, SWADE and Ngwane Mills). The business is to operate and be managed on a commercial basis and will comply with international health and environmental standards.

Target Outcomes

a. Establishment of a meat abattoir (capacity 25 beef per day and 50 small animals per day with the potential for added capacity)

b. Establishment of two cattle feedlots (1,000 heads per unit), one to cater for EU exports (EU regulations) and one to cater for local consumption (South African and Swazi regulations)

c.   Establishment of transparent and viable animal procurement procedures to ensure a continuous supply of all animal requirements

d   Creation of employment opportunities for young local men and women

How will the success of the project be measured?

The joint venture will be considered successful when it has reached positive financial returns (within three years) and demonstrated a 15% return on capital invested. The analysis is based on 70% throughput of the initial design capacity.

Table 2. Abbattoir Capacity

Type	No.
Beef/day	25
Goat/day	10
Pork/day	40
Slaughter days/month	20.4

The financial assessment indicates the following viability parameters:

Table 3. Financial Viability Indicators

Indicator unit	Investment costs	Working capital	FRR%	Pay back period (yrs)
Abattoir	20,645,000	6,000,000	16	5
Feedlot	3,500,000	3,000,000	15	5
Combines	24,145,000	9,000,000	15.75	5

As expected, the viability of the operation is extremely sensitive to the buying and selling price of animals and their products whilst purchased feed is the key cost parameter for the feedlot. Based on these positive indicators, the working group is proceeding to finalize the detailed feasibility study for submission to our respective boards.

Output(s)

Phase I –

a.   comprehensive feasibility study that is climatically, environmentally, economically and socially valid to be submitted to the respective boards on 1 March 2017

b.   associated agreements established between the community of Mkhweli Chiefdom, SWADE and Ngwane Mills – achieved in principle

c.   land made available under the khonta process supported by an enhanced chief's letter—final negotiations with chief and his inner council

d.   establishment of the potential animal supply of cattle, pigs and goats in the region—assessed June 2016.

Phase II –

a.   Establishment and initial operations of the feedlot–June 2017

b.   Establishment and initial operations of abattoir–September 2017

c.   Secure the supply of cattle, pigs and goats–ongoing

d.   Monthly financial and operations reports indicating targets being met–ongoing

Governance

The joint venture will be operated as a limited liability company registered in Swaziland and operating under the laws of Swaziland. It will be governed by a seven-person board with an independent chair, three directors nominated by Ngwane Mills, two directors nominated by SWADE and one director nominated by the traditional authority. After two years, one of the SWADE directors will be drawn from farmer company shareholders. Ngwane Mills will provide the commercial management for the enterprise. SWADE will actively engage in farmer awareness and farming system support whilst the Mkhweli will provide community leadership focussing on farmer awareness, responsible management and project security. Furthermore, the Mkhweli Trust is ready to enter into a contract to supply a minimum of 20 cattle, 100 pigs or 100 goats per month. Livestock suppliers (farmer companies) would earn the right to acquire shares (1%) from the lot held by SWADE on their behalf based on the following criteria:

- An established record of supplying on typically 20 cattle, 100 pigs or 100 goats per month over a two-year period;

- Willingness to enter into a supply contract with the company; and

- Valid board of directors and clean and up-to-date audit record.

The initial shareholding will be:

Table 4. Proposed shareholding of NMSAF Company

	Percent	Contributed as	No.
Total Shares			100,000
Ngwane Mills	51%	Financing from Ngwane Mills	51,000
SWADE	48%	Financing from GoS	48,000
Permanent	1%		1,000
On behalf of supplying farmers	47%		47,000
Condition for transfer to be			
Mkhweli Community Trust	1%	Community leadership	1,000

Securing land

Land tenure in Swaziland is divided mainly into two types:

Title Deed Land (TDL): This is land in respect of which a person can have a title, and which can be sold and bonded; and

SNL: This is land that is held in trust by the Ingwenyama (His Majesty the King) on behalf of the Swazi nation. Section 211 of the Swaziland constitution provides that 'All land (including any existing concession) in Swaziland, save as privately held title deed land, shall continue to vest in Ingwenyama in trust for the Swazi Nation…'. This is land that is mainly found in the rural areas where the majority of Swazis live.

Administration of land in Swaziland:

SNL is administered by chiefs, on behalf of His Majesty the King. The Swaziland constitution, s.212, establishes the Land Management Board (LMB) responsible for the overall management and for the regulation of any right or interest in land, whether urban or rural or vested in Ingwenyama, in trust for the Swazi nation. According to the constitution, in performing its functions, the board shall be accountable to the Ingwenyama.

Acquisition of land under SNL

Swazis access land through the khonta ('be given land') system. The process followed under this custom is that, once a person has been accepted by the Inner Council (Bandlancane) to be allocated land in the community, they are required to pay a cow as a token of appreciation. The Inner Council representatives walk the boundary and tie a knot (kubopha lifindvo). Members of the community near the new site are also informed so that they can witness the allocation.

The Mkhweli Inner Council has been requested to consider providing around 15 ha of unencumbered land under the khonta system. The Inner Council has moved the case to the chief with positive support. The site will require access to:

a. Good-quality sealed road(s)

b. Reliable electricity

c. A guaranteed supply of around 120,000 litres of water per day.

The way forward

Eight main lessons for agri-PPPs have been identified (Rankin et al. 2016). Our assessment of where we stand is as follows.

1. To be successful, agri-business partnerships need to align the partners' disparate interests and visions and reach consensus, particularly on public sector objectives and priorities for promoting PPPs.

A key factor in the process of developing this PPP has been the time invested in 'getting to know each other' through focused discussions, joint field (learning) visits and full participation in the working group.

2. The role of each partner should be clearly defined according to the unique skills and expertise that each can bring to the agri-PPP, with appropriate incentives designed to reward these roles.

It has been clear that SWADE brings potential engagement with farmers on SNL whilst commercial management is the vital attribute of Ngwane Mills.

3. Effective agri-PPPs share risks fairly among partners and include risk management mechanisms to protect the most vulnerable.

Structuring the shareholding reflects the balance of risk assumed, with the role of SWADE holding shares in trust for farming enterprises considered a key risk mitigation for SNL farmer enterprises.

4. There is ample scope for the involvement of financial institutions as an additional core partner in agri-PPPs.

Initially, the investment capital will be provided by Ngwane Mills (51%) and the Government of Swaziland (GoS) through SWADE (49%) – working capital will be sourced from the domestic finance industry in Swaziland.

5. While agri-PPPs can promote the inclusion of smallholders and Small and Medium Agricultural Enterprises (SMAEs), they are unlikely to have an impact on the poorest of the poor.

This is a fair assessment as some 20% of homesteads (Government of Swaziland 2012) on SNL do not own livestock.

6. Collective action is an essential feature of all agri-PPPs and helps both to promote inclusion and to reduce transaction costs. Fostering collective action and capacity building increases the participation of smallholders in modern value chains while reducing the transaction costs for lead private partners.

As noted earlier, both parties have been actively engaged in developing the business model; for instance, the reconnection that feedlots needed to mitigate the risk of erratic supply to the abattoir was jointly arrived at.

7. Sound institutional and regulatory frameworks are essential factors in the design of well performing PPPs. A judicious land governance system and transparent decision-making and budgetary processes for selecting PPP projects and private partners are critical factors that must be considered in the governance of agri- PPPs

In Swaziland the experience of SWADE through the Komati and LUSIP projects has provided a sound basis of understanding the challenges of working with commercial (business and taxation) and traditional (SNL) systems. It is hoped that the Commercialization of SNL Bill, when enacted, will provide a clearer playing field.

8. There is a pressing need to improve the monitoring and evaluation (M&E) of agri-PPPs.

The nature of this PPP – finishing animals and processing them––provides a well-structured reporting format for monitoring the commercial viability of the venture

Reporting Requirements:

a.   Weekly and monthly reports on physical and financial progress

b.   Annual reports

c.   Audit reports.

Provision will need to be made to assess the impact on the overall meat and livestock feed industries

The next steps are for us are to obtain:

-    Approval of the feasibility study by the respective boards

-    Registration of company

-    Environmental approval

-    Approval of company and registration as an approved export/local abattoir

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Smallholders' and livestock value chain actors' access to credit in Tanzania

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Abstract

A study was conducted in the lake zone in Tanzania to assess the access to credit of value chain actors in the beef supply chain with a focus on beef cattle fattening. Challenges and opportunities were also identified. Data were collected from various actors and stakeholders in the chain through focus group discussion (FGD) and use of structured questionnaire which covered 401 pastoralists and agro-pastoralists, 90 cattle fattening operators and 10 key informants in the Shinyanga and Mwanza regions. Eight districts were involved: five districts (Kahama, Kishapu, Meatu, Bariadi and Maswa) in the Shinyanga region and three districts (Nyamagana, Sengerema and Magu) in the Mwanza region. Data were analysed using descriptive and gross margins analysis.

The findings show that access to formal sources of finance in the country is difficult and scarce for most of the supply chain actors. Most operate their businesses from their own funding sources (95.6%), a situation which limits expansion of optimal profitable ventures, while only 1.1% had credit from formal sources of finance and 3.3% received assistance from their families in the form of physical animals. The challenges along the beef cattle supply chain for producers (pastoralists and agro-pastoralists) were different from those of beef cattle fattening operators, being mainly lack of fattening skills (22.6%), lack of credit (20.4%), high cost of fattening (17%) and limited availability of animal feeds (14.2%). On the other hand, beef cattle fattening operators complained of high prices of feeds for fattening (27.7%) due to alternative outlets for cotton husks and cotton seed cake, shortage of credit (16.6%) due to lack of collateral, difficulties in securing areas for conducting fattening (16.2%) and limited availability of feeds (22.6%). The opportunities for beef cattle fattening included the establishment of an Agricultural Bank in the country which can now set favourable conditions for collateral, high market access and prices for fattened beef cattle, availability of feeder cattle (55.1%) and the level of beef cattle fattening awareness (95.5%) among agro-pastoralists and pastoralists.

Keywords: actors, agro-pastoralist, pastoralist, supply chain, access to credit

Introduction

This paper presents an overview of smallholder and livestock value chain actors' access to credit in Tanzania with a focus on beef cattle fattening in the Mwanza and Shinyanga regions. Tanzania is among the African countries known for their huge livestock resource base. It ranks first in the Southern African Development Community (SADC) and East African Community (EAC) by having the largest population of livestock, and ranks third in Africa after Sudan and

Ethiopia in livestock population (National Bureau of Statistics (NBS) 2012). The country accounts for about 1.4% of the global cattle population and 11% of the African cattle population (Food and Agriculture Organization of the United Nations (FAO) 2014). Based on the 2016/2017 Ministry of Agriculture Livestock and Fisheries Budget Speech, there are 25.8 million head of cattle, 17.1 million head of goats, 9.2 million head of sheep, 2.67 million head of pigs and 76.5 million chickens, of which 42 million are local chickens and 34.5 million are improved chickens.

Despite the large number of cattle available in the country, the livestock industry's contribution to the national economy is low. In 2010, for example, the industry contributed only 16% and 3.8% to the agricultural gross domestic product (GDP) and national GDP, respectively, and the sector grew by only 3.4%, compared to 4.4% for the crop sector (United Republic of Tanzania (URT) Economic Survey 2010). This is mainly due to low livestock growth rates, high mortality rates, low production and reproductive rates and poor quality of the final products from the industry (Ministry of Livestock and Fisheries Development (MLFD) 2010).

Recently, there has been great emphasis in the country on commercializing beef cattle production for the sector to contribute more effectively to household income, food security and nutrition as well as to the nation's economy (Ministry of Livestock Development (MLD) 2006). Beef cattle fattening has been earmarked as one among several means to improve beef cattle production through value addition. In the Shinyanga and Mwanza regions, value was added to cattle purchased from pastoralists and agro-pastoralists by increasing productivity and improving the quality of beef cattle through supplementary feeding using concentrates. In this case, animals of lower grades were bought from producers at the primary livestock markets by traders at lower prices and fed cotton seed cakes and cotton husks or maize bran for three to four months before being sold again at premium or higher prices to other traders or slaughterhouses.

The study aimed at establishing the structure of the beef subsector in the Mwanza and Shinyanga regions of Tanzania, where fattening of cattle is becoming increasingly important. Specifically, the objectives of the study were to: (i) identify primary actors in the supply chain and point out their roles and interrelationships; (ii) assess livestock value chain actors' access to credit for their business; and (iii) identify associated challenges and opportunities for improving the supply chain.

Methodology

The study involved collecting primary and secondary data from various actors and stakeholders in the chain through FGD and use of structured questionnaires, which covered 401 pastoralists and agro-pastoralists, 90 cattle fattening entrepreneurs and 10 key informants in the Shinyanga and Mwanza regions. The study covered five districts in Shinyanga region, Kahama, Kishapu, Meatu, Bariadi and Maswa; and three districts in the Mwanza region, Nyamagana/Ilemela, Sengerema and Magu, as shown in Figure 1 below. The preliminary survey was conducted from April to June, 2010 and was followed by the detailed survey which was conducted from July to September, 2011. Data were analysed using descriptive methods to obtain information on frequencies, means and percentages gross margins analysis.

Figure 1. Location of the study area
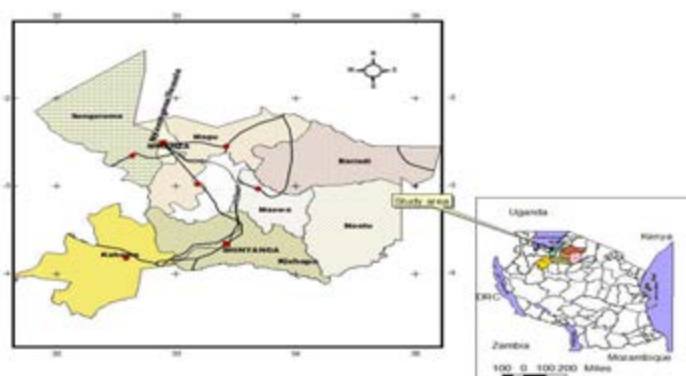
Results and discussion

Livestock marketing in the study area

The study revealed that there were 14 and 16 operating livestock markets in the Shinyanga and Mwanza regions, respectively. Of these, Kishapu and Nyamhongolo were the largest and the only secondary markets, handling about 10,000 cattle per month on average and up to 15,000 cattle during the peak marketing season of September to December. The secondary market in Kishapu operated once per week while the Nyamhongolo secondary market operated six days per week.

Livestock marketing channels

There existed two supply channels for terminal domestic beef cattle markets in the study area. The first involved a direct channel whereby traders bought beef cattle from producers (pastoralists and agro-pastoralists) at primary markets and sold at profit to butcher operators. The second involved some value addition whereby beef cattle fattening operators bought cattle from producers or cattle traders at primary and secondary markets. In either case, the cattle were kept in feedlots for about three months, as reported by 93.4% of the respondents, and thereafter sold to live animal exporters or to local butcher operators through livestock markets after the animals had gained weight or reconditioned. Livestock processing industries were found to be not well developed, as is the case for the whole country (MLD 2006; MLFD 2010). Analysis of data for this study shows that 58.9% of the livestock marketed in the Mwanza and Shinyanga regions were sold to the Pugu secondary market in Dar es Salaam, as shown in Table 1 below.

Table 1. Markets for fattened beef cattle (N=90)

S/N	Name of the market	Number of respondents	Percentage
1	Pugu	53	58.9
2	Muhunze	11	12.2
3	Nyamhongolo	3	3.3
4	Kasamwa	4	4.4
5	Sengerema	3	3.3
6	Shanwa	2	2.2
7	Sale at fattening area	14	15.6
	Total	90	100

Source: Survey data, 2010/2011

Primary actors in the supply chain and their roles

The primary actors in the beef cattle supply chain were observed to include beef cattle producers (pastoralists and agro-pastoralists), traders, including beef cattle fattening operators, middlemen, butcheries, retailers and consumers. All these actors play different roles, interacting with each other to supply beef to the final consumers.

Beef cattle producers (pastoralists and agro-pastoralists)

Beef cattle producers included both pastoralists and agro-pastoralists, who kept about 97.3% of the cattle found in the country (National Sample Census of Agriculture (NSCA) 2007/2008). The remaining 2.7% was for improved dairy (2.4%) and beef breeds (0.3%) kept by government and private commercial ranches. The beef cattle producers played a vital role in the beef subsector as they played the primary function of raising beef cattle up to the point where they were sold and taken to the next level of the supply chain. The producers invested in animal health, nutrition and reproduction. According to the NSCA's 2007/2008 reports, there were 261,875 and 145,461 beef cattle producers in the Shinyanga and Mwanza regions, respectively.

Traders

Traders in the beef cattle supply chain in the Shinyanga and Mwanza regions were involved in purchasing cattle from pastoralists and/or agro-pastoralists through the primary markets (97.6%) or directly from cattle producers with the purpose of reselling in other auctions at higher prices or selling to the butcheries (2.4%). Two types of traders were identified in the study area. The first type were traders who bought healthy and heavy animals from producers and re-sold to other cattle buyers, including butcher operators at secondary markets or other niche markets. The second category of traders, termed fattening entrepreneurs, specifically bought weak animals or semi-finished animals from the markets for the purpose of fattening (adding value) or finishing for at least three months, as reported by 93.4% of the respondents, before reselling to the livestock markets for local consumption or export. Animals for fattening were normally purchased at lower prices, ranging from TZS 279,190 (Tanzanian shillings) to TZS 433,096 (USD 1 = TZS 1,600) for uncastrated bulls, which were later sold at TZS 553,012 to TZS 740,000 per piece after fattening.

Butchers and consumers

The category of butcher operators involved all actors who bought animals from the primary or secondary markets for immediate slaughter. They played an important role in the livestock subsector as they link producers and consumers through livestock traders. There were about 207 and 229 butcheries in the Shinyanga and Mwanza regions, respectively.

Retailers and middlemen

Retailers were involved in buying carcasses from slaughterhouses or butcheries and distributing them to supermarkets and other meat shops. On the other hand, middlemen were involved in buying and selling animals at the same location, taking advantage of time and the ignorance of sellers as they could buy an animal from one seller and immediately sell it to another trader at a profit. Retailers and middlemen were not found to be prominent in the study area.

Service providers

Service providers in the study area included the stockists who supplied drugs and acaricides like super dips, ginners who own ginneries that produced animal feed ingredients such as cotton seed cake and cotton husks, and government institutions that provided extension services. Financial service providers were found to be inactive as agricultural activities are reported to be risky undertakings, although the business required capital in order to run a viable enterprise. It was evident during field visits for this study that coordination and collaboration among these actors was not well developed.

Beef cattle traders

Livestock trading provides liquidity to pastoralists as well as serving as livestock outlets. Livestock traders incur several costs in the process. These include market fees, trekking costs (herders' wages, food and transport), livestock movement permits, feeds, treatment and transport to secondary markets.

Livestock value chain actors' access to credit

It was revealed that most of the livestock value chain actors in the study area could not access credit for their business as the banks in the study area, i.e. the National Microfinance Bank and Community Rural Development Bank, found livestock business to be too risky to finance and also farmers had no collateral. Most livestock value chain actors therefore operated their businesses from their own funding sources (95.6%), a situation which limits the expansion of optimal profitable ventures, while only 1.1% had credit from formal sources of finance and 3.3% received assistance from their families in the form of physical animals, as shown in Table 2 below.

Table 2. Livestock traders' access to financial credit (N=90)

S/N	Sources of credit	No. of respondents	Percent
1	Formal financial institution	1	1.1
2	Family	3	3.3
3	Own	86	95.6
	Total	90	100

Source: Survey Data 2010/11

Challenges and opportunities along the beef cattle supply chain

The performance and effectiveness of the beef supply chain depended on the various factors that affected the supply chain actors through different channels. These factors may impose constraints or establish opportunities that have bearings on the performance of the livestock supply chain. The survey results, on the one hand, as reported by beef cattle fattening operators, indicated that high prices of fattening feeds was the leading challenge (27.7%), followed by availability of credit to expand fattening enterprises (16.6%), area for conducting fattening (16.2%) and availability of feed stuff (22.6%). The results in the present study support findings by Alemayehu (2011), Petrus et al. (2011) and Moreki et al. (2011), who found high prices and availability of feeds to be the most serious challenges faced by beef cattle fattening enterprises. Although Umar et al. (2008) reported that the economic viability of cattle fattening enterprises was not in doubt because raw materials needed for fattening could be sourced at ease, the availability of credit was the challenge facing smallholder producers when fattening. On the other hand, the results reported by agro-pastoralists and pastoralists indicated that lack of fattening skills or low level of education to start a fattening business was the leading challenge (22.6%), followed by other challenges, as reported by beef cattle fatteners, such as availability of credit (20.4%), high costs of fattening (17%), availability of feed (14.2%) and area for fattening (12.4%). Other challenges were insignificant, accounting for less than 5%, as shown in Table 3.

Table 3. Challenges to beef cattle fattening

	Beef cattle fattening operators (N=90)		Agro-pastoralists/pastoralists (N=401)	
S/N	Challenge	%	Challenge	%
1	High prices of feed staff	27.7	Have no fattening skills	22.6
2	Credit provision	16.6	Credit provision	20.4
3	Fattening area	16.2	High fattening costs	17
4	Availability of feed staff	22.6	Availability of feed staff	14.2
5	Availability of water for feeder cattle	4.7	Fattening area	12.4
6	Transportation of beef cattle (means and costs)	3.8	Long distance from sources of feed staff	3.1
7	Reliable markets for fattened beef cattle	3.4	High feeds transportation costs	2.8
8	High costs of treatment	2.1	Not aware about fattening	2.8
9	Animal diseases during fattening	2.1	High treatment costs	1.6
10	Availability of feeder cattle	0.4	Shortage of extension officers	0.8
11	Availability of casual labourers	0.4	Animal diseases	0.8
12			Tedious activity	0.8
13			Lack of foot-and-mouth disease vaccination	0.5
14			Unreliable market	0.2

Source: Survey data 2010/11

The opportunities for beef cattle fattening included availability of market outlets for fattened beef cattle, as indicated by demand and high gross margins (20.2%). Agro-pastoralists' and pastoralists' awareness of beef cattle fattening (95.5%) (Table 4) was an opportunity to expand beef cattle fattening enterprises in the study area and later in the

country for economic growth. The results in Table 4 indicate that 82.5% of the agro-pastoralist and pastoralist respondents were willing to start fattening and 14.5% had already started a beef cattle fattening business.

Table 4. Opportunities for beef cattle fattening (N=401)

District	Awareness of fattening	Aware of and would like to fatten	Aware of and have started fattening
Kahama	51	41	9
Kishapu	47	37	11
Meatu	50	38	11
Bariadi	41	40	3
Nyamagana/ Ilemela	47	44	4
Magu	50	46	4
Sengerema	48	47	3
Maswa	49	38	14
Total	383	331	59
% of total	95.5	82.5	14.7
Source: Survey data 2010/11			

Source: Survey data 2010/11

Conclusion

There were challenges impacting the beef cattle supply chain in the study area, of which limited availability of credit to expand fattening enterprises ranked high, as well as lack of improved fattening skills/education, poor linkages and low collaboration among and between the actors in the chain. Despite all these shortcomings, there are also opportunities to expand and improve the beef cattle supply chain and foster economic growth both at local and national level. Among others these include the newly established Tanzania Agricultural Bank (TADB) which may now set favourable conditions for collaterals leading to the expansion of the businesses, high market access and prices for fattened beef cattle, availability of feeder cattle (55.1%) and the level of beef cattle fattening awareness (95.5%) among agro-pastoralists and pastoralists (Table 4). These can be used to expand and improve the precursor beef cattle fattening enterprises, pioneered by a few enterprising innovative traders into a vibrant value chain that makes a meaningful contribution to improving the cash income of many households who depend on livestock keeping for their livelihoods.

Recommendations

• Financial institutions should reconsider their risk assessment practices to be able to increase lending to the beef cattle fattening businesses.

• Farmers' skills should be improved through training so that they are creditworthy and able to produce higher volumes and more consistent quality of beef that is better suited to the market requirements.

• The beef cattle supply chain should be upgraded to a vibrant value chain by supporting the evolution of collaboration and binding linkages.

• The enabling environment should be improved. Policies and regulations related to beef cattle fattening should be improved and put into use.

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Economic valuation of cattle value chain in Oyo State

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Abstract

The livestock industry is an important component of Nigeria's agricultural sector and a key contributor to economic growth but it lacks effective financing. This study was carried out in Ogbomoso town, Oyo State to examine the economic value of the cattle value chain with the aim of identifying nodes needing financial support. Purposive sampling technique was used in selecting 30 pastoralists/ producers, 30 marketers and 30 processors. Data were analysed using descriptive statistics and policy analysis matrix (PAM). Results of the analysis show that three primary actors participated, namely producers/Fulani farmers, marketers of live cattle and processors. Findings revealed that the processors were also responsible for marketing live cattle. Analysis of the PAM revealed that positive private profit of NGN 62 (Nigerian Naira), NGN 077.3/head, NGN 3, 833.3/head and NGN 17,166.7/head were recorded for the producers, marketers and processors, respectively. Social profits of NGN 60,493.33/head were obtained by the producers, indicating that the activity can contribute to national income development. Social profits for markers and processors were negative, at -NGN 19120.83/head and -NGN15,654.17/head, respectively, indicating that the system cannot survive without assistance from the government. Results of the nominal protection coefficient on output (NPCO) at 1.52, 1.35 and 1.56 were recorded for the producers, marketers and processors, respectively. The effective protection coefficient (EPC) and profitability coefficient (PC) of cattle producers were 1.24 and 1.03, respectively, indicating protection of the output; the EPC and PC of cattle marketers and processors were -3.42 and – 0.20,- 8.66 and -1.10, respectively, indicating that output was not protected for these actors while inputs were taxed as indicated by the result of the nominal protection coefficient on input (NPCI) at 3.94, 1.03 and 1.13 for the producers, marketers and processors, respectively. Finally, it is recommended that major constraints should be dealt with, especially in the area of infrastructure, to attract external investors. Producers, marketers and processors should have more access to credit to boost their production and transactions as the case may be and government should provide a safety net for marketers and processors to be able to meet international market requirements.

Keywords: cattle, value chain, policy analysis matrix, comparative advantage

Introduction

Nigeria is a major hub of animal product consumption in West Africa. It is also one of the largest livestock raising countries in the region, as recorded by Bonnet et al. (2010). The country's cattle herds are estimated at over 16

million head, far ahead of Niger (8.7 million), Mali (8.2 million) and Chad (7 million). The livestock industry is an important component of general agriculture and a key contributor to economic growth and development. In addition, it has the capacity to earn revenue for the government. It provides employment, food, farm energy, manure, fuel and transport (Nuru 1986). Fakoya (2007) stated that livestock, especially ruminant production, is the most efficient user of uncultivated land and evidently contributes to crop production. Efficient crop-livestock integration systems have the tendency of allowing nutrients to be recycled more effectively on the farm, thereby enhancing crop yield. Under such a system livestock can be fed on crop residues, like straw, damaged fruits and grains, as well as other products that would have posed a major waste disposal problem (Fakoya 2007).

It is estimated that annual domestic and imported slaughtering accounts for around 7.5 million cattle with a livestock value of about NGN 525 million. Many cattle are marketed well into the rainy season (May–June) when prices are low, by much as 20% below market prices. The prices peak from October to January, by as much as 30% above market prices. Bonnet et al. (2010) and Tewe (1997) stated that cattle are the most predominant and highly valued livestock in Nigeria. Notwithstanding its acclaimed relevance, the subsector tends to play a decreasing role in national development in view of its contribution to the country's agricultural gross domestic product (GDP). Livestock as a percentage of agricultural GDP was as high as 19% in 1983 and 1984. However, the share has dropped over time, to 10% in 1998 and 6% in 2004 and 2005. Similar trends were recorded in the subsector's percentage contribution to the country's non-oil GDP and total GDP, where the recorded shares were 4% and 2%, respectively, as at 2005 (Ojiako and Olayode 2008).

The cattle value chain tends to solve problems of unemployment and wealth creation. It has been utilized in development and research to capture the interactions of increasingly dynamic (and complex) markets in developing countries and to examine the inter-relationships between diverse actors involved at all stages of the marketing channel (Kaplinsky 2000; Dolan and Humphrey 2000; Fitter and Kaplinsky 2001; Ponte 2001; Schmitz and Knorringa 2000; Giulani et al. 2005; Bair and Peters 2006; Pietrobelli and Saliola 2008). Moreover, by going beyond firm- or activity-specific analysis, value chain analysis allows for an assessment of the linkages between and amongst productive activities. Karl et al. (2009) noted that the approach provides a framework to analyse the nature and determinants of competitiveness in value chains in which small farmers can participate. It also provides the basic understanding needed for designing and implementing appropriate development programs and policies to support market participation according to Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (German Organisation for Technical Cooperation (GTZ) (2007).

Livestock systems are characterized by long marketing chains featuring great distances, numerous phases of weight gain and feeding regimes, many levels of traders and transactions, a multitude of steps and stages of processing, and a variety of employment-creating services and inputs. On the consumer side, the delivery of livestock products through informal markets tends to serve poor consumers, creating an even tighter focus on the poor (Pica-Ciamarra 2005). Also it appears that government intervention in the sector is low and the effect poorly understood. It is on this basis that the study assessed the cattle value chain in Oyo State.

Methodology

Ogbomoso town is located in Oyo state. Its population is 1.1 million. It has five local governments, namely Ogbomoso north, Ogbomoso south, Ogo Oluwa, Oriire and Surulere. It is one of the major areas of cattle production in Oyo state. Ogbomoso people are of the Yoruba ethnic group, the largest single ethnic group in Nigeria. Both primary and secondary data were used in the study. Primary data were collected using structured questionnaires, informal interviews and focus group discussions (FGD). Secondary data were sourced from the Ministry of Agriculture and Federal Department of Livestock and Pest Control, Abuja. Ogbomoso is one of three agricultural zones in Oyo state: Ogbomoso north, south and Oriire local governments were purposively selected. Forty respondents were randomly selected for four actors in three local governments within the study area, making a total of 120 respondents.

Figure 1. Flow chart of sampling procedure
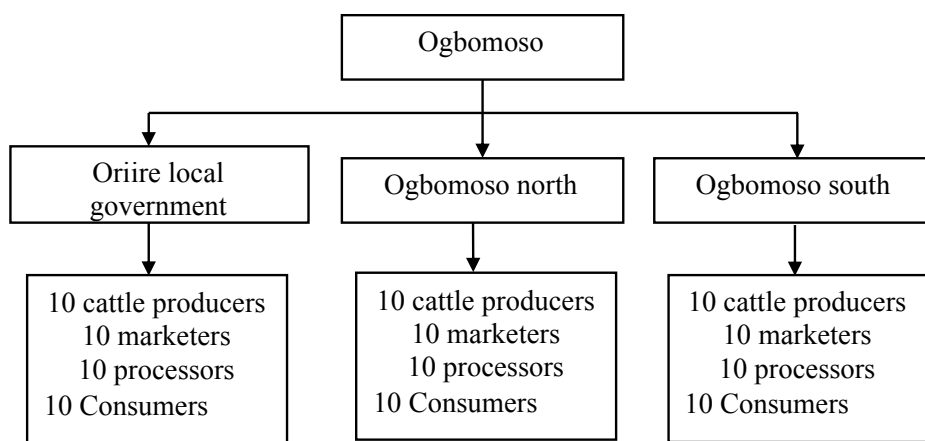
Analytical tools

Policy analysis matrix

The three principal purposes of the PAM methodology are to provide information and analysis in policymaking in these three central areas of agricultural policy. The construction of a PAM for an agricultural system allows one to calculate private profitability—a measure of the competitiveness of the system at actual market prices. A second purpose of the PAM approach is to estimate the agricultural system's social profitability—the result if products produced and inputs used are valued in efficiency prices (social opportunity costs). The third purpose of PAM analysis is to measure the transfer effects of policies.

Policy analysis matrix table

	Revenues	Costs		Profits
		Tradable inputs domestic factors		
Private prices	A	B	C	D
Social prices	E	F	G	H
Divergence and efficient policy	I	J	K	L

Note to the table

Private profits, $D = A – B – C$, measures competitiveness in actual market prices.

Social profits, $H = E - F – G$, measures efficiency (comparative advantage) in efficiency prices.

Output transfers, $I = A – E$, measures divergences in revenues (caused by distortions in output prices)

Input transfers, $J = B – F$, stands for divergences in tradable input costs (caused by distortions in tradable input prices)

Factor transfers, $K = C – G$, represents divergences in domestic factor costs (caused by distortions in domestic factor prices)

Net transfers, $L = D – H$, is the net transfer effect (arising from the total impact of all divergences)

Profitability coefficient (PC) $= (A - B - C)/ (E - F - G)$ or D/H, measures the incentive effects of all polices affecting the production of the selected products

NSP = H

Private cost ratio (PCR): C/ (A-B), is the quotient between the cost of the domestic factors, valued at private prices, and the value added, which is also calculated at private prices. The system will be competitive if the quotient is lower than or equal to unity

Domestic resource cost ratio (DRCR): G/ (E-F), is the quotient between domestic factor costs valued at social prices and the value added, also computed at social prices

Subsidy Ratio to Producer (SRP): L/E or D-H/E, ratio measures the net transfer to the farming system as a proportion of the total social income generated; it allows the analyst to discover to what extent economic policy is subsidizing the system. A high SRP points to a lack of competitiveness, as the system's financial viability tends to depend on political decisions

Social benefit-cost ratio (SBCR) for each system and then comparing these ratios across all the systems. The SBCR is equal to the ratio of social revenues to social costs, or SBCR = E/ (F + G)

Nominal protection coefficient on tradable outputs (NPCO) = A/E, showed how much domestic prices differ from social prices

Nominal protection coefficient on tradable inputs (NPCI) = B/F, showed how much domestic prices of tradable inputs differ from their social prices

Effective protection coefficient (EPC) = (A – B)/ (E – F), compares valued added in domestic prices (A – B) with value added in world prices (E – F). The purpose of the EPC is to show the joint effect of policy transfers affecting both tradable outputs and tradable inputs

The EPC is a variant of the Effective Rate of Protection (ERP), a common measure of trade distortions. ERP = (EPC – 1) x 100%

Results

Budget for producers

The cattle producer budget shows a cost of calves at private prices at NGN 30,000 against a social price of NGN 7,200, indicating that the cost of calves at private value was high compared to the international price. Also, there is a wide difference between private labour costs and social labour costs, at NGN 17,550, as presented in Table 1 below. There was little difference between the private and social value of capital (Table 1).

Table 1. Farm budget for cattle producers per head)

Item	Unit of measurement	Private price	Social price
Cost of calf	Naira/head	30,000	7,200
Capital	Interest	333.33	200
Labour	per man day	36,000	18,450
Transport	per trip per cow	1016.67	1,016.67
Drugs	mg per head	3906	640
Total cost		71,256	32,306.67
Revenue	Naira per head	133,333.3	88,000
Profit margin	Naira per head	42,076.6	550,533

Drugs used in deworming are an input used in cattle production. The private value of de-wormer was NGN 3,904 to raise a cow to saleable weight, while its social value was NGN 640. The total input cost at private value was NGN 71,256 against a social value of NGN 32,306.67 per cow. The private output value per cow was NGN 133,333.33 of 300kg per cow while its social value was NGN 88,000 of 300 kg per cow. The rrofit margin presented at private value was NGN 42,076.6 against a social value of NGN 55,0533. The budget showed that producing at social price was better than producing at private price.

PAM for producers

The data entries in the first row of Table 2 show the observed revenue and cost, reflecting what price farmers actually pay or receive. Private profitability was positive and estimated at NGN 62,077.3 per cattle head. This shows the profitability of cattle producers in the area and provides a stimulus for existing firms to increase output and for other firms to enter the business. Social profitability was also positive and estimated at NGN 60,493.33, meaning that the cattle producer gained NGN 60,493.33 for every cow produced and the system had comparative advantage. This is an incentive for the expansion of the activities. The third row shows the divergences or differences between the first row, private valuation, and the second row, social valuation. A positive output transfer of NGN 45,333.3 was obtained, indicating that private revenue exceeded social revenue—a good indication that government subsidizes output prices. However, it also implies that consumers are purchasing the commodity at prices greater than international market prices, thereby encouraging the import of beef products.

Input transfer was positive, and estimated at NGN 26,066, indicating that private cost of tradable inputs is higher than their social cost; that is, government taxes tradable inputs and local prices were higher than those prevailing in the international markets. Factor transfer was positive and estimated at NGN 17,683.33, showing that the social value of the domestic factor is lower than its private value, an indication that government taxed the domestic factor of production. The net effect of policy was positive and estimated at NGN 15,83.97. This indicated that the overall effect of policies was in favour of cattle producers in the short run.

Table 2. PAM table (cattle producers)

	Revenue (₦)	Cost of tradable inputs (₦)	Cost of domestic factor (₦)	Profit (₦)
Private values	133,333.3	34,922.67	36,333.33	62,077.3
Social values	88,000	8,856.67	18,650	60,493.33
Divergences	45,333.3	26,066	17,683.33	1,583.97

Indicator ratio of cattle producers

The private cost ratio (PCR) of 0.34 indicates that the production system is competitive and producers could enter the system. The domestic resource cost ratio (DRC) of 0.46 indicates that the country has a comparative advantage in producing cattle and making efficient use of domestic resources. The NPCO of 1.52 shows the presence of subsidy in cattle production. The NPCI of 3.92 indicates the effect of distortions in cattle production as a result of the presence of subsidy on inputs. The EPC of 1.24 shows a positive effect of policy support in the production process. The profitability coefficient was greater than indicated (1.03) and measured the incentive effects of all polices affecting the production of cattle. A Subsidy Ratio to Producer (SRP) of 0.02 is an indication that the system is taxed, thereby reducing the ability of producers to export (Table 3).

Table 3. Indicator ratios for producers

Indicator ratio	PCR	DRCR	NPCI	NPCO	EPC	PC	NSP	SRP
Value	0.34	0.46	3.92	1.52	1.24	1.03	60,493.3	0.02

Budget for marketers

The cattle marketer budget presented below shows that the cost of a cow at private price was NGN 90,500 against its social price of NGN 88,000, indicating a higher private value. Private labour cost was NGN 5,100 and social labour cost was NGN 3,187.5. The private value of capital, NGN 12,533.33, also shows higher value than its social value of NGN 9,600. There was no difference in private transportation cost and social transportation cost. The private cost of dues and levies was NGN 200 while there was no levy on the product internationally. The total input cost at private value was NGN 712,56 against its social value of NGN 32,306.67 per cow. The private output value per cow was NGN 114,666.66 of 300kg per cow while its social value was NGN 88,000 of 300kg per cow. The profit margin

presented at private value was NGN 3,833.34 against its social value of -N 1,912,083. The profit margin at social value was negative, indicating that marketers would be at a loss if trading internationally. The budget generally shows that it would be better for marketers to trade domestically (Table 4).

Table 4. Farm budget for cattle marketers (per head)

Item	Unit of measurement	Private price	Social price
Cost of cow	Naira/head	90,500	88,000
Capital	Interest	12,533.33	9,600
Labour	Per man day	5,100	3,187.5
Transport	Per trip per cow	6,333.33	6,333.33
Levy	Naira/head	200	0
Total cost		114,666.66	107,120.83
Revenue	Naira/head	118,500	88,000
Profit margin		3,833.34	-1,912,083

PAM for marketers

The data entries in the first row of Table 4 show the observed revenue and cost, reflecting what price farmers actually pay or receive. The private profitability was positive, estimated at NGN 3,833.3 per cattle head. This shows the profitability of cattle marketers in the area and provides stimulus for existing firms to increase output and for other firms to enter the business. Social profitability was negative, estimated at -N 19,120.8, meaning that marketers lose NGN 19,120.8 for every cow marketed and the system has a comparative disadvantage; as such, expansion under the present system should not be considered. The divergence calculation shows that a positive output transfer of NGN 30,500 was obtained, indicating that private revenue exceeded social revenue—a good indication that government subsidizes output prices but also implying that consumers are purchasing the commodity at prices higher than international market prices; as such, importation of the product is encouraged.

Input transfer was positive and estimated at NGN 2,500, which indicated that the private cost of tradable inputs is higher than the social cost. This indicates that government taxes tradable input; efficiency could be achieved through an increase in use of these inputs. The factor transfer was positive and was estimated at NGN 5,045.87. This showed that the social value of the domestic factor is lower than the private value, an indication that government taxes domestic factors of the production. The net effect of policy was positive and estimated at NGN 22,954.13. This indicates that the overall effect of policies was in favour of marketers in the short run (Table 5).

Table 5. PAM—marketers

	Revenue (NGN)	Cost of tradable input (NGN)	Cost of domestic factor (NGN)	Profit (NGN)
Private values	118,500	96,833.33	17,833.37	3,833.3
Social values	88,000	94,333.33	12,787.5	-19,120.8
Divergences	30,500	2,500	5,045.87	22,954.13

Indicator ratios—marketers

The private cost ratio (PCR) of 0.82 indicates that the system is competitive and more marketers could enter the system domestically. The domestic resource cost ratio (DRC) was negative, estimated at -2.0. This indicates that the country has a comparative advantage in exporting cattle and the cost of domestic resources used in the system was less than the contribution of its value added at social prices. The NPCO of 1.35 shows the presence of subsidy on cattle production. The NPCI of 1.03 indicates the effect of distortions in cattle production as a result of presence subsidy on inputs. The EPC of -3.42 shows the negative effect of government and its intervention in the sector. The profitability coefficient was less than one, as indicated by -0.2, showing that payments were transferred out of the

system. The subsidy ratio to producer (SRP) of 0.26 was an indication that the system was taxed, which affected the marketers negatively in the international market (Table 6).

Table 6. Indicator ratio (cattle marketers)

Indicator ratio	PCR	DRCR	NPCI	NPCO	EPC	PC	NSP	SRP
Value	0.82	-2.01	1.03	1.35	-3.42	-0.2	-19121	0.26

Budget—processors

The cattle processors' budget shows that the private price was NGN 100,000 against its social price of NGN 88,000, indicating a higher private value. The private value of capital was NGN 12,533.33 and its social value was NGN 9,600. The private labour cost was NGN 3,500 while social labour cost was NGN 2,187.5 (Table 6). There was no difference in private transportation cost and social transportation cost. The private cost of dues and levies was NGN 300 while there was no levy on the product internationally. Government has to certify the meat through veterinary services and NGN 350 was paid per head of cattle for the service at private value, while NGN 50 was paid at social value. The total input cost at private value was NGN 120,500 against its social value of NGN 103,654.17 per cow. The private output value per cow was NGN 137,666.7 of 300 kg per cow while its social value was NGN 88,000 of 300 kg per cow. The profit margin presented at private value was NGN 17,166.7 against its social value of NGN 15,654.17. The profit margin at social value was negative, indicating processors would be at a loss if traded internationally.

Table 7. Farm budget—processors (per head)

Item	Unit of measurement	Private price	Social price
Cost of cow	Naira/head	100,000	88,000
Capital	Interest	12,533.33	9,600
Labour	Per person day	3,500	2,187.5
Transport	Per trip per cow	3,816.67	3,816.67
Veterinary services	Naira/head	350	50
Levy		300	0
Total cost		120,500	103,654.17
Revenue	Naira/head	137,666.7	88,000
Profit margin	Naira/head	17,166.7	-15,654.17

PAM—processors

The data entries in Table 8 show the observed revenue and cost, reflecting what price farmers actually pay or receive. Private profit was positive and estimated at NGN 17,166.7 per cattle head. This provides stimulus for existing firms to increase output and for other firms to enter the business. Social profitability was negative, estimated at NGN 15,654.2, meaning that processors were losing NGN 15,654.2 for each processed cow; the system had a comparative disadvantage and should not be expanded as it is. The differences show a positive output transfer of NGN 49,666.7, indicating that private revenue exceeds social revenue, which is a good indication of government subsidy. It also implies that consumers are purchasing the commodity at prices greater than international market prices which encourages importation of the product.

Input transfer was positive and estimated at NGN 12,300, indicating that the private cost of tradable input is higher than the social cost. Factor transfer was positive and estimated at NGN 4,545.83, showing that the social value of the domestic factor is lower its private, which shows that government taxes the domestic factor of the production. The net effect of policy was positive and estimated at NGN 32,820.87. This shows that the overall effect of policies was in favour of processors in the short run.

Table 8. PAM—processors

	Revenue (NGN)	Cost of tradable input (NGN)	Cost of domestic factor (NGN)	Profit (NGN)
Private values	137,666.7	104,166.67	16,333.33	17166.7
Social values	88,000	91,866.67	11,787.5	-15654.2
Divergences	49,666.7	12,300	4,545.83	32820.87

Indicator ratios—processors

The private cost ratio of 0.49 indicates that the system is competitive and more processors could enter the system. The domestic resource cost ratio (DRC) was negative and estimated at -3.05, showing that the country has a comparative advantage in processing cattle; also, the cost of domestic resources used in the system was less than the contribution of its value added at social prices. The NPCO of 11.56 shows the presence of subsidy on cattle production. The NPCI of 1.13 shows the effect of distortions in cattle production as a result of the subsidy on inputs. The EPC of -8.66 indicates a negative effect of government and its intervention in the sector. The Profitability Coefficient was less than one as indicated by -1.1, showing that payments were transferred out of the system. The SRP of 0.02 is an indication that the system is taxed, which affected the processors negatively (Table 9).

Table 9. Indicator ratio (cattle processors)

Indicator ratio	PCR	DRCR	NPCI	NPCO	EPC	PC	NSP	SRP
Value	0.49	-3.05	1.13	1.56	-8.66	-1.1	-15,654	0.02

Conclusion

The cattle value chain in Nigeria is a viable economic sector that is capable of contributing to national development through employment creation. Cattle producers are the best protected of all; the Nigerian government is making good progress in terms of the availability of domestic input in the sector and the system is safe for investors. Nevertheless, marketers and processors should be assisted by the government to be able to stay in the system. Marketers need to be financed and trained to raise the standard of processing to international levels. Domestic factors used by marketers and processors were taxed; government needs to subsidize these factors.

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Contributed papers session 5: Livestock production, efficiency and marketing

Beef cattle fattening using fodder-based ration

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Abstract

The vast majority of Swaziland's 1.2 million people depend on subsistence farming for their livelihoods, which has been drastically handicapped by a struggling economy and recent droughts linked to climate change. SMI, which is the only abattoir licensed to export to the international market, is struggling to get enough fattened animals from local feedlots and the country also imports a lot beef from the Republic of South Africa (RSA) to meet local demand. High cost of complete mixed ration (CMR) has been identified to negatively reduce the profitability of fattening cattle. Results of trials conducted at the Lower Usutu small scale irrigation project (LUSIP) and the Komati downstream development project (KDDP), fattening using fodder crops (yellow maize, Napier, mucuna, lucerne), agro-by products (molasses, maize stover and chicken litter) indicate that significant weight gains can be achieved within three to four months at a low cost compared to using the standard CMR. From this study, it can be concluded that fattening beef cattle on fodder-based diets is a viable practice and the results show that the animals gained acceptable weights daily; thus, they were ready for the market within a reasonable period of time.

Keywords: fodder crops; smallholder; feedlotting; beef cattle

Introduction

Feedlotting involves the feeding of beef cattle with a protein-balanced, high-energy diet for a period of 70 to 120 days under confinement to increase live weights and improve degree of finish and thus obtain better grades at the abattoir. Demand for beef remains strong in Africa, despite most producers looking to grow exports into the European Union (EU) and other international markets. Agro-industrial by-products, fodder crops and crop residues represent a vast animal feed resource, which is as yet largely unexploited. The livestock industry is an important subsector of Swaziland's national economy. The agrarian sector contributes about 70–74% of the total domestic export earnings, of which livestock accounts for 18–23%. About 98–99% of this contribution could be attributed to cattle and the rest to the poultry subsector.

Ration formulation is the process of combining an assortment of feed ingredients into a ration that will meet the nutrient requirements of animals for the intended purpose of production. A balanced ration is one that provides all the required nutrients in proportions and amounts that will properly nourish a given animal for 24 hours. The goal of any feeding program is to provide the correct amount and balance of nutrients to animals at the proper time to

achieve the desired level of performance and profitability. In order to formulate rations and predict performance of animals fed a given ration, it is necessary to predict intake, which is usually about 2–3% of body weight on a dry matter basis. Rations are nutritionally balanced and formulated to meet the nutrient requirements of animals both for maintenance and production. In the case of feedlot animals, production refers to body weight gain and changes in body condition. Thus, feedlot animals require nutrients for maintenance and body weight gain. The ration must be balanced in such a way that it provides, amongst others:

•   Sufficient quantity of energy yielding nutrients.

•   Sufficient quantity and adequate quality of proteins.

•   Sufficient bulk or roughage for normal rumen function.

The basic objective of this study was to examine the growth response of local cattle breeds finished on fodder-based rations other than using the commercial beef fattening from weight of entry to weight at marketing; and to identify constraints so that improvement strategies might be formulated. The research has been, and is being, carried out on the potential of these by-products, fodder crops and crop residues and to exploit their use on feedlot animals' nutrition.

Materials and methods

Site description

The research was conducted at three farmer companies under the Swaziland water and agricultural development enterprise (SWADE), one feedlot at KDDP and two at LUSIP 1.

Sourcing of feeder cattle

Animals were sourced from individual local farmers at an agreed price per kilogram. Local breeds of cattle were used. The animals were weighed, dewormed and vaccinated on entry into the feedlot.

Housing and subject selection

The kraals were well aerated, which is good for easy flow of air in and out of them. The animals were grouped and some were in individual pens. The feedlot kraals have a slightly sloping floor which made it easy to clean, i.e. remove excess manure.

Feeding regimes

The groups of feeder cattle were assigned to a dietary treatment and fed at 3% of their body weight. The dietary treatments were lucerne, cowpeas, yellow maize and stalks, chicken litter and molasses.

Table 1. Nutritional content of feeds

Feed	Protein	Energy	Inclusion in the diet
Lucerne	18.3	18.0	15%
Cowpeas	18.1	18.1	15%
Yellow maize and stalks	9.4	18.7	54%
Chicken litter	24.2	16.8	15%
Molasses	5.5	14.7	1%

Weighing procedure

All the animals were weighed once a week in each farmer company.

Results and discussions

The table below shows all the results of the three feedlots, namely the demo centres, Singeni and Nxutsamlo. These show the averages per animal in each of the feedlots. The initial weight averages ranged from 202.3 kg to 304 kg. The average days spent in the feedlots ranged from 88 to 137.7 and daily weight gains ranged from an average of 0.38 kg to 0.75 kg. The selling prices are also shown as ranging from SZL 5,401.3 (Swaziland lilangeni) to SZL 5,933.9. The feed expenses ranged from SZL 934.2 to SZL 1,681.6. The feed expenses were based on SZL 12.2, which was the cost per day at SZL 1.4 per kilogram in a feed ration of 8.6 kg per day. The labour costs were based on a labour cost of SZL 38.5 per day per feedlot where one labourer was hired per feedlot. These costs were spread over the days spent on average by each animal and also by the number of animals in the feedlots. Demo centre, Singeni and Nxutsalmo had 16, 15 and 3 animals, respectively. The labour cost was highest at Nxutsamlo due to there being few animals and therefore the fixed labour cost was spread over few animals. The most profitable feedlot was the demo centre, with a profit of SZL 460 per animal, while Singeni had a SZL 71 per animal profit. Nxutsamlo incurred a loss of SZL 1,414.1.

Table 2. Production and profitability analysis: actuals and projections

Average per animal			Actuals		Projections	
Demo centre		Singeni	Nxutsamlo	Proj. FBR	Proj. CMR	
Production	Initial weight (kg)	304.0	265.8	202.3	300.0	300.0
	Final weight (kg)	337.00	308.0	305.30	384.00	399.0
	Days on feedlot	88.0	76.5	137.7	120.0	90.0
	Daily weight gain (kg)	0.38	0.55	0.75	0.70	1.10
Profitability	Selling price (SZL)	5,933.9	5,452.8	5,401.3	8,448.0	8,778.0
	Purchase price (SZL)	4,187.5	4,251.3	3,366.7	4,500.0	4,500.0
	Feed expenses (SZL)	1,074.7	934.2	1,681.6	1,465.4	3,483.0
	Labour cost (SZL)	211.8	196.4	1,767.2	231.00	173.3
	Profit/animal (SZL)	460.0	71.0	(1,414.1)	2,251.6	621.8

Two projection scenarios were created to explore the differences between FBR- and CMR-run feedlots. The initial weights were set at 300 kg for both feedlots. The days on feedlot per animal were set at 120 for the FBR and 90 for the CMR and daily weight gains of 0.70 kg and 1.1 kg, respectively. The selling prices were based on SZL 20 per kg for both and purchase prices were set at SZL 15 per kg. The feed expenses were based on a daily ration of 8.6 kg per animal for both scenarios and the feed for FBR was SZL 12.2 and CMR was SZL 38.7 per ration. Labour is costed at SZL 38.5 per day through the average days spent by each animal in the feedlot under each feed regime. The profit per animal for FBR was more than 300% more than for the CMR feeding regime scenario. The projections show that FBR is more viable and better than the CMR feeding regime.

Table 3. Feed cost comparison: FBR vs CMR

Average per animal	FBR	CMR
Weight of feed (kg)	8.6	8.6
Cost per kg (SZL)	1.4	4.5
Cost per day (SZL)	12.2	38.7

Figure1. Weights (initial and final) for actuals and projections

Initial and final weights (kg) for beef animals: actuals and projections
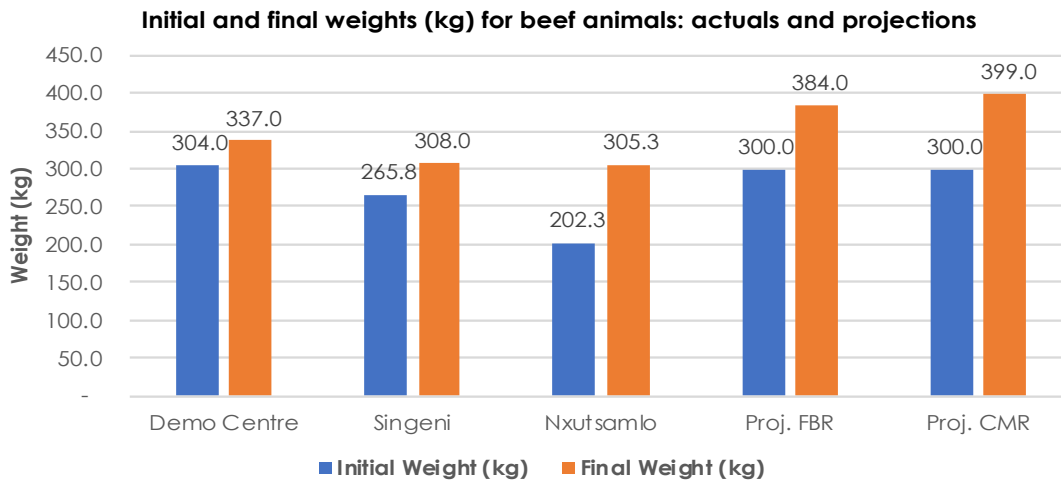
Figure 2. Daily weight gain for actuals vs projections

Daily weight gain
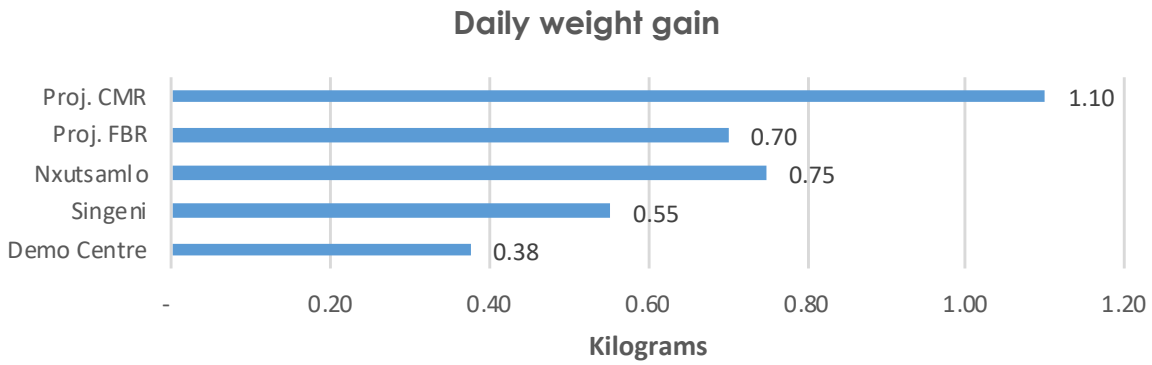
Figure 3. Cost per day: CMR vs FBR

Cost per day: CMR vs FBR
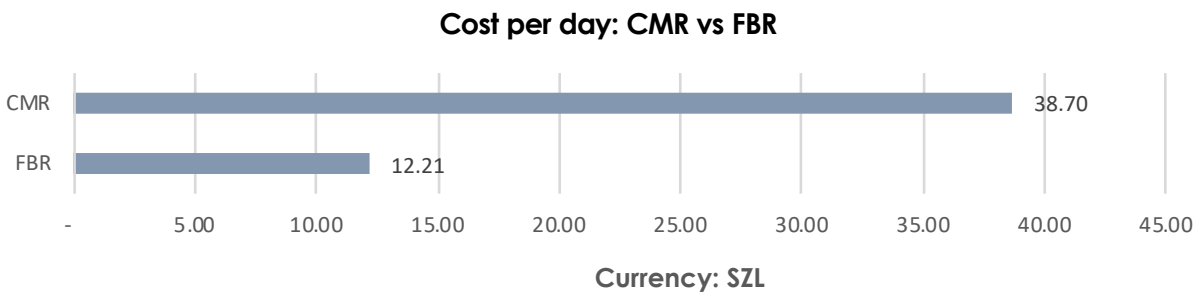
Figure 4. Profit per animal, actuals and projections
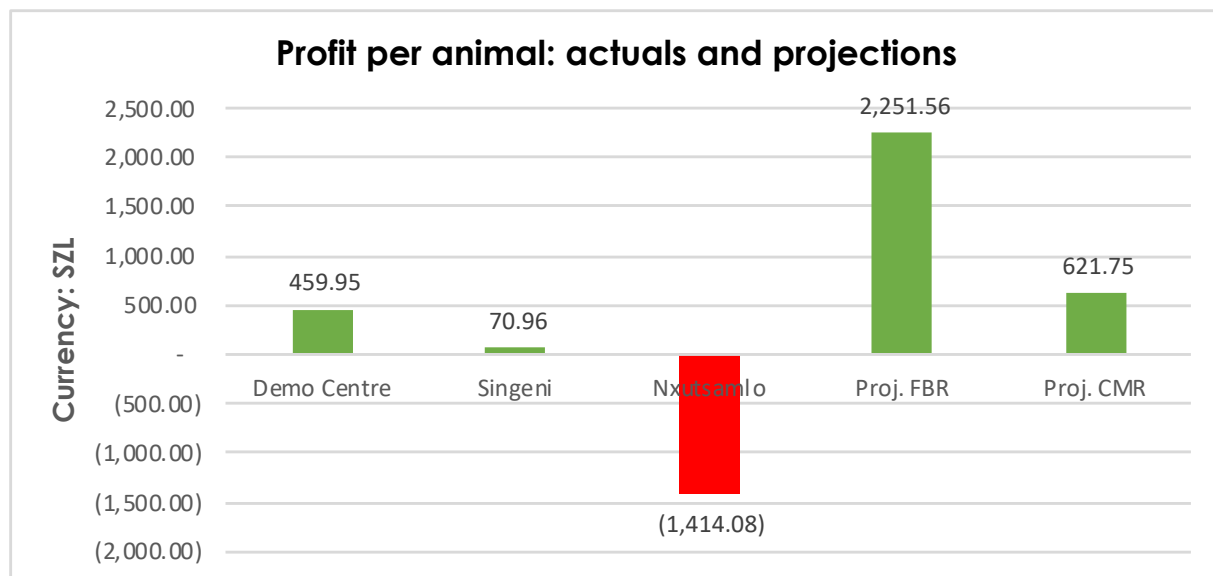
Conclusion

Optimal utilization of fodder crops, even though the animals take longer to be ready for market and the weight gain per day is lower than with commercial feed, considerably increases animal production, helps to reduce the acknowledged animal protein deficit and lowers the cost of feed production, resulting in improved net profits.

Recommendations

• The feedlots must be stocked with at least 20 animals of about 300 kg.

• Each animal must be bought at at least SZL 15/ live kg and sold at about SZL 20/live kg as per the projections.

• One labourer must be hired to run each feedlot.

• Feeding must be done at the same time each day.

Measuring impact of access to livestock services on the technical efficiency of small ruminant production in rural Ethiopia

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Abstract

The productivity of the livestock sector in Ethiopia is constrained by several factors, including low accessibility of services and inputs and lack of a well-organized marketing system. Farm households' access to key agricultural services is expected to improve the performance of the sector. Focusing on small ruminants, this research addresses two related questions: is there any considerable difference in terms of technical efficiency between those who have no access to key services and those who have access to one or more of the services? And is there any causality between these differences in the technical efficiency of small ruminant production and access to services? The services considered in this study are agricultural extension, rural credit and market information for sheep and goats. This research was undertaken in seven sites of different production systems covering nine districts. A sample of 1,108 farm households were interviewed to generate primary data. The study employed stochastic frontier analysis to estimate technical efficiency and multi-valued treatment effects modelling to estimate the effect of access to agricultural services on the technical efficiency of small ruminant production. The results of the analyses could not establish any relationship with the three key services (i.e. agricultural extension on sheep and goats, rural credit for sheep and goats and market information on sheep and goats) and the technical efficiency of sheep and goat production. Two key questions emanate from the analysis: are the services properly designed? And are they being delivered the right way? Ethiopia needs to look into these questions carefully and responsibly.

Keywords: multi-valued treatment effect, small ruminants, stochastic frontier analysis, technical efficiency

Introduction

Small ruminants (sheep and goats) have peculiar economic importance in rural Ethiopia. They provide 46% of the national meat consumption and 58% of the value of hide and skin production (Awgichew et al. 1991). Sheep and goats have many advantages over large ruminants for most smallholder farmers, including lower feed costs, quicker turnover, easy management and appropriate size at slaughter (Abegaz et al. 2002; Donkin 2005; Wilson and Morrical 1991). They also have greater tolerance to less favourable conditions, suffering less mortality during periods of drought than large ruminants (Desta et al. 2013; Galal 1983). In addition, subsistence farmers prefer sheep and goats as the risk of losing large ruminants is often very high (Awgichew et al. 1991).

However, the performance of the livestock sector has been reported to be very low (Befekadu and Berhanu 2000). The sector is dominated by extensive production systems, where indigenous breeds are kept under low-input/low-output husbandry practices. The constraints that limit the productivity of the sector are poor genetics that result in low production and low reproductive performance; poor quality and varying seasonal availability of feed; high disease incidence and parasite challenges; low accessibility of services and inputs; and lack of a well-organized marketing system, as currently informal marketing dominates (Beyi 2016).

In particular, the productivity of Ethiopian sheep and goats is low; they grow slowly and kid mortality is high. There is an urgent need to increase the productivity of sheep and goats to improve household income and nutrition, and to meet the demands of the growing human population and foreign markets Developing efficient input delivery systems, knowledge-based animal husbandry (including feeding, breeding, housing and healthcare), cost-effective marketing and efficient and equitable supply chains have all been identified as important interventions.

A recent national study has revealed – based on comprehensive data – that small ruminants are kept essentially as liquid assets to be quickly converted to cash at times of need. Sheep and goats of smallholder farmers are supplied to the market live (Kassie et al. 2016). These live animals are channelled through both formal and informal marketing systems, with the latter system dominant (Beyi 2016). There are three channels in the domestic market: consumers buy live animals from a market and slaughter themselves, or consumers purchase meat from a market, or at butchers' shops. The actors in the live animal trade are producers, local traders, middle- or larger scale traders, butchers and consumers Alemayehu 2011). The main animal collection points for most export abattoirs and live animal exporters are purchasing agents assigned in major marketing areas, small- and large-scale traders and livestock trading cooperatives (Asegede et al. 2015; Legese et al. 2008).

It is well documented that market infrastructure, such as live animal transportation facilities, improved abattoirs, sheds, grading systems and quarantine facilities, are among the most important constraints on livestock marketing in Ethiopia (Eshetu and Abraham 2010; Pavanello 2010). Due to the absence of all-weather roads and transportation services, farmers usually trek their animals over long distances. Coupled with the absence of other infrastructure, such as feeding and watering troughs, this would result in live weight loss, physical injury, meat quality loss and sometimes the death of animals (Leta et al. 2014; Yami 2010). Another key challenge of livestock marketing in Ethiopia is lack of market information and poor market services (Beyi 2016). Producers lack market information. Producers also fail to respond to price changes (Alemayehu 2011; Anteneh et al. 2010). Poor market infrastructure limits the efficiency of livestock marketing. In Ethiopia, about 120 market centres are recognized by the government but are not well organized to provide watering, feeding, resting and quarantine facilities; the situation is worse in pastoral areas (Anteneh et al. 2010).

In addition, lack of market services significantly undermines the market margins farmers generate from their agricultural products and elevate the prices they pay for agricultural products when involved as buyers. The transaction costs of markets in general and livestock markets in particular are quite high due to, among other issues, lack of transport facilities that force marketers to trek their animals; lack of feed and watering services in and around the markets; lack of veterinary services around markets; lack of handling facilities; and lack of market information. High transaction costs and information problems present challenges in the coordination of supply chains, which often leads

to underinvestment in storage and handling facilities, undersupply of finance, and large intra- and inter-seasonal price fluctuations which undermine market participation and competitiveness.

Access to appropriate market information is one of the major constraints on small ruminant marketing identified by different empirical studies in Ethiopia (Abebe et al. 2013; Kocho et al. 2011). At national level, using data collected from selected markets, the Central Statistical Agency (CSA) has put in place a mechanism to disseminate monthly average livestock producers' livestock prices, including the price of sheep and goats, for different secondary and terminal markets of the country. However, these price data are mainly collected from major town markets to which farmers from remote rural areas might have limited access and hence little use is made of the data. LINKS (Livestock Information Network and Knowledge System), a sub-project in the Global livestock collaborative research support programme, also provides market information on request using SMS, radio and other media. Moreover, a study conducted by LINKS, which was part of the first attempt to establish a national livestock market information system, shows the presence of many organizations which collect livestock information but also the presence of overlaps and unusable information (MacOpiyo et al. 2008). Despite the above limited efforts, in Ethiopia there is no documented evidence on market information services to smallholder small ruminant farmers.

Similarly, animal health service in Ethiopia is considered as extremely low, and the majority of the services are provided by governmental institutions (Kebede et al. 2014; Filmer and Pritchett 2001; Dubale and Mariam 2007; Desta 2015). In 2011, there were four federal and fourteen regional laboratories, 1,675 district and sub-district level clinics and 1,163 animal health posts (Ministry of Agriculture (MoA) 2011) According to a 2012 survey estimate, the government veterinary service satisfied only 30% of the veterinary service needed (MoA/EU 2013). The private sector also has limited participation in the animal health service delivery system but is mainly involved in the selling of drugs and offering veterinary clinics Jibat et al. 2015). For example, in 2011 there were only 676 district and subdistrict level private clinics and 613 private drugstores MoA 2011.

Compared to the type and total number of livestock in the country, the quality and extent of animal health services provided, measured by available service provided and extent of health information transfer, is still minimal. In 2012/2013, for instance, the total coverage of small ruminant vaccination was 16.8% and 16.9% for sheep and goats, respectively (Central Statistics Agency (CSA) 2013). Similarly, the proportion of sheep and goats that were afflicted and treated for various diseases was 36.5% and 29.9%, respectively whereas the average disease reporting rate from 2007 to 2010 was 40%, which is really very low (MoA 2012).

Livestock extension services in Ethiopia is also a neglected area of intervention and hence inadequate to the country's livestock population (Kassa 2003; Kassa 2005). For instance, the total number of livestock holders participating in livestock extension packages in 2012/2013 was less than 1%, and of these about 70% were even involved in dairy, poultry and honey and wax development packages CSA 2015). This implicitly indicates the availability of limited extension packages for small ruminants. Other empirical studies also show that agricultural extension services provided for small ruminant production are minimal Umeta et al. 2015. Training can build the capacity of farmers to take technologies and adopt them easily (Dubeufa and Sayadi 2014). Although various project-based efforts were made to train smallholder producers, broadly speaking, capacity-building efforts in small ruminant production are inadequate in the country. Moreover, available small ruminant agricultural extension services in the country mainly focus on the provision of inputs such as improved breeds, improved feed and animal health services.

Access to financial services has a significant contribution to improving production and productivity of livestock in developing countries. In Ethiopia, financial services are mainly provided by formal institutions like microfinance institutions (MFIs), commercial banks and insurance companies. Semi-formal institutions like saving and credit associations and other informal local institutions including *iddir, equb* and individual moneylenders are also available. Relatively, among the available formal and semi-formal financial institutions smallholder farmers have mainly access to MFIs and saving and credit cooperatives (SACCOs). The limited access of smallholder farmers to formal financial institutions may be explained by different reasons, including their collateral demand availability in rural areas. However, strategies that help poor household farmers to access financial services have been developed by the National Bank of Ethiopia together with non-governmental organizations (NGOs) since late 2005 (Wiedmaier-Pfister

et al. 2008). Moreover, the government of Ethiopia, together with other NGOs, has also been implementing different rural finance intermediation programs to improve access to financial services by poor rural households (International Fund for Agricultural Development (IFAD) & Federal Democratic Republic of Ethiopia (FDRE) 2014). Compared to inputs for crop production like fertilizer and improved seed, credit access for livestock production is very scanty and limited (Tadesse et al. 2015).

There is a general consensus that rural services should be made accessible to farm households to improve their livelihoods. Although this is a trivial recommendation to make, there is rarely empirical evidence as to whether the services available to rural communities are contributing to the betterment of the societies. The case of small ruminant keepers in Ethiopia is a case in point. Much research has suggested the provision of timely and affordable delivery of services to small ruminant keepers in Ethiopia (Bernard & Spielman 2009; Ogato et al. 2009; Berhanu & Poulton 2014; Mogues 2013). However, there has never been any effort, to the best of our knowledge, to investigate whether the services available for small ruminant keepers are affecting their productivity or technical efficiency. This study therefore aims at assessing the impact of access to key services on the technical efficiency of small ruminant keepers in rural communities of Ethiopia, using nationally representative data.

Methodology

Multivalued treatment effects modelling

The main question we are trying to answer here is whether there are any considerable differences in terms of technical efficiency between small ruminant keepers who have access to key livestock services and those who have not. The small ruminant services considered in this study are agricultural extension, rural credit and market information. In treatment effects language, those who have access to the services are considered treated and those who have not are called the control group. The analytical framework to estimate the individual and combined effects of the access to the different rural services is laid out below, using the potential outcomes framework following (Cattaneo et al. 2013; Imbens 2000; Lechner 2001; Linden et al. 2016; Uysal 2015).

Following the seminal papers by Rubin (1974) and Rosenbaum and Rubin (1983), numerous scientific efforts have been made and extensions of the treatment effect framework for the binary treatment case have been developed (Imbens 2000; Rosenbaum & Rubin 1983; Imbens & Rubin 2015; Imbens & Wooldridge 2009). Not all treatments are dichotomous; hence, this framework was expanded for modelling the effects of multivalued treatments (Imbens 2000; Lechner 2001). Multivalued treatments refer to cases in which each subject could receive one of several different treatments or not receive treatment at all (Imbens 2000; Wooldridge 2007, 2010).

We denote the potential outcome that household 'i' would obtain if given treatment level 't' as Y_{ti}, where Y_{ti} is the realization of the random variable Y_t. Let Ti be our multivalued treatment variable, which takes the integer values between 0 and K, and Xi represents the vector of pre-treatment covariates. For each individual i, i = 1,…,N in the sample, Y_i, T_i, and X_i are observed. The indicator of receiving the treatment t for individual i is denoted by dit(T_i) and takes the alues '0' or '1' as:

$$d_{it} = \begin{cases} 1, & \text{if } T_i = t \text{ where } t \in \zeta = \{0,...,k\} \\ 0, & \text{otherwise.} \end{cases} \qquad (1)$$

For each individual, there is a set of potential outcomes ($Y_{i0},…, Y_{iK}$). Yit denotes the potential outcome for each individual i, for which T_i = t. Only one of the potential outcomes is observed, depending on the treatment status. Adopting the potential outcomes framework of Rubin (1974), the observed outcome, Y_i, can be written in terms of treatment indicator, dit(T_i), and the potential outcomes, Y_i

$$Y_i = \sum_{t=0}^{K} d_{it}(T_i)Y_{it}. \qquad (2)$$

Several pairwise treatment effects were defined by Lechner [43]. The first is the average effect of treatment 'm' relative to treatment 'l'. Let μk and μk|l denote the unconditional mean, $E[Y_{ik}]$, and the conditional mean, $E[Y_{ik}|T_i=l]$ for k, l = [0,…,K], respectively. Using the notation, we can define the average treatment effect (ATE) over the entire population – which is the average effect of giving each household treatment m relative to treatment l over the entire population as:

$$ATE = \Delta_{ml} = E[Y_{im} - T_{il}] = \mu_m - \mu_l.$$ (3)

Similarly, the average effect on the treated (ATT) – which is the expected effect for a household randomly drawn from the population of participants who receive treatment m – is given as:

$$ATT = \Gamma_{ml|m} = E[Y_{im} - T_{il} \mid T_i = m] = \mu_{m|m} - \mu_{l|m}.$$ (4)

There are different ways of estimating these parameters depending on the data generation process. When the data are generated from randomized experiments, ATE can be estimated using the sample means of observed outcomes. However, when data are generated through observational studies, estimation of ATE requires additional conditioning on Xi, which is assumed to contain all confounders associated with both the treatment assignment mechanism and potential outcomes (Uysal 2015; Imbens 2015). Conditioning on Xi is based on two assumptions. The first is the conditional independence assumption (CIA) or weak unconfoundedness, which requires that all determinants of treatment level and of the outcome variable are observed [44, 45, 48]. CIA is specified as:

$$Y_{it} \perp d_{it}(T_i) \mid X_i, \forall t \in \zeta$$ (5)

The second assumption is the overlap or common support assumption. In the binary treatment case, this implies that treated and control households need to have overlapping propensity score or likelihood of accessing the services, all else being constant (Caliendo & Kopeinig 2008; Guo & Fraser 2015). For multivalued treatment effect estimation, Imbens [42] has formulated the generalized propensity score (GPS) as the conditional probability of receiving a particular level of treatment given the pre-treatment variables. The GPS is estimated as:

$$r(t,x) \equiv \Pr[T_i = t \mid X_i = x] = E[d_{it}(T_i) \mid X_i = x]$$ (6)

Imposing the generalized version of the overlap assumption [54], the strict overlap or common support assumption is specified as (Uysal 2015):

$$0 < \in < \Pr(T_i = t \mid X_i = x), \text{ for some } \in > 0, \forall t \in \zeta \text{ and } \forall x \text{ in the support of } X$$ (7)

Rosenbaum and Rubin (1983) refer to the combination of unconfoundedness and overlap as strong ignorability. Hence, under these assumptions, the conditional expectation of potential outcome for treatment level t identified by conditional expectation of observed outcomes of households receiving treatment t is given as (Imbens & Wooldridge 2009):

$$E[Y_{it} \mid X_i] = E[Y_{it} \mid d_{it}(T_i), X_i] = E[Y_i \mid d_{it}(T_i), X_i]$$
$$= E[Y_i \mid T_i, X_i].$$ (8)

The unconditional means can therefore be estimated by averaging these conditional means, meaning,
$$\mu_t \equiv E[Y_{it}] = E[E[Y_{it}|X_i]].$$

The models

There are various econometric formulations to estimate the parameters of interest in the treatment effects framework; i.e. potential outcomes, ATE and ATT. The approaches can be clustered as adjustment using covariates or

weights and matching. We focus on estimation of ATE and ATT of multivalued treatments. Each of the models used in the study area is specified below.

Regression adjustment (RA)

With the assumption of ignorability, one of the most common ways to adjust for confounding variables and reduce bias is through the use of multiple regression models that regress the outcome on a set of covariates separately for each treatment level, after which the predicted outcomes for each subject and treatment level are computed using data only from the individuals receiving the relevant treatment level (Wooldridge 2010). The average of these predicted values estimates the potential outcome means, which can then be contrasted to estimate average treatment effects (Linden et al. 2016; Uysal 2015; Rosenbaum & Rubin 1983). The simplest multiple regression model for this analysis is an additive model, which includes the main effects for treatment and other covariates but excludes potential interactions between treatment and other covariates (Lin 2011). Following this approach, we can define the conditional mean functions of the potential outcomes as follows:

$$m_t(X_i) = E[Y_{it} \mid X_i] = E[Y_i \mid T_i = t, X_i] = \beta_{0t} + X_i'\beta_{1t}, \ \forall_t \in \zeta \tag{9}$$

where $\beta_t = [\beta_{0t} \ \beta_{1t}]$ is the vector of unknown parameters and β_{1t} has the same dimension as X_i. After estimating the parameter vector β_t, the average treatment effect (Δml) and average treatment effect on the treated ($\Gamma ml|m$) can be estimated by contrasting estimated potential outcome means between any two treatment levels (say 'l' and 'm'):

$$\hat{\Delta}_{ml}^{RA} = (\hat{\beta}_{0m} - \hat{\beta}_{0l}) + \frac{1}{N}\sum_{i=1}^{N} X_i'(\hat{\beta}_{1m} - \hat{\beta}_{1l}) \tag{10}$$

$$\tag{11}$$

$$\hat{\Gamma}_{ml|m} = (\hat{\beta}_{0m} - \hat{\beta}_{0l}) + \frac{1}{N_m}\sum_{i:d_{im}(T_i)=1} X_i'(\hat{\beta}_{1m} - \hat{\beta}_{1l})$$

Inverse probability weighting (IPW)

IPW is one the four common ways of using the propensity score (PS) to reduce or minimize the effects of confounding when estimating the effects of treatments on outcomes (i.e. matching on the PS, stratification on the PS, covariate adjustment using the PS and inverse probability of treatment weighting (IPTW) using the PS) (Austin 2013). Given the multivalued treatment in this case, we use GPS and as shown by Imbens (2000) in the binary treatment case, we can identify the unconditional means of the potential outcomes by weighting observed outcomes by the conditional probability of the received treatment:

$$E\left[\frac{Y_i d_{it}(T_i)}{r(t, X_i)}\right] = E[Y_{it}]. \tag{12}$$

The treatment effect parameters can therefore be given as:

$$\tag{13}$$

$$\hat{\Delta}_{ml}^{IPW} = \frac{1}{N}\sum_{i=1}^{N} \frac{Y_i d_{im}(T_i)}{\hat{r}(m, X_i)} - \frac{1}{N}\sum_{i=1}^{N} \frac{Y_i d_{il}(T_i)}{\hat{r}(l, X_i)}$$

$$\tag{14}$$

$$\hat{\Gamma}_{ml|m}^{IPW} = \frac{1}{N_m}\sum_{i=1}^{N} Y_i d_{im}(T_i) - \frac{1}{N_m}\sum_{i=1}^{N} Y_i d_{il}(T_i)\frac{\hat{r}(m, X_i)}{\hat{r}(l, X_i)}$$

Doubly robust treatment effects models

In this group, we have estimated augmented inverse probability weighting (AIPW) and augmented inverse probability with regression adjustment (IPWRA). To get doubly robust estimators for the treatment effect parameters, Uysal (2015) and Linden et al. (2016) used a weighted regression method with the weights related to the weighting identification. Hirano and Imbens (2001) use the same approach to estimate binary treatment effects. Following the generalizations for multivalued treatments developed by Uysal (2015) , the double robustness for the proposed estimation method implies that if the weights are estimated based on a correct GPS specification, or if the potential outcomes are correctly specified, the resulting estimator will be consistent. The doubly robust estimator of Δ_{ml} can be derived by estimating the regression model that estimates the unconditional means as

$$Y_i = \sum_{t=0}^{K} \mu_t d_{it}(T_i) + \sum_{t=0}^{K} d_{it}(T_i)\left(X_i - X_m\right)' \alpha_t + \varepsilon_i \tag{15}$$

by a weighted least squares regression with the following minimization problem:

$$\min_{\widetilde{\mu}_t, \widetilde{\alpha}_t} \frac{1}{N} \sum_{i=1}^{N} \left(\sum_{t=0}^{K} \frac{d_{it}(T_i)}{\hat{r}(t, X_i)} \right) \left(Y_i - \sum_{t=0}^{K} \widetilde{\mu}_t d_{it}(T_i) - \sum_{t=0}^{K} d_{it}(T_i)(X_i - \overline{X})' \widetilde{\alpha}_t \right)^2 \tag{16}$$

The resulting estimators, $\hat{\mu}_i^{dr}$ are consistent for $\hat{\mu}_i$ if (a) the conditional mean of t_{it} is correctly specified; (b) the conditional mean of $d_{it}(T_i)$ is correctly specified; or (c) both. By using μ_m^{dr} and μ_l^{dr} , the average treatment effect $\hat{\Delta}_{ml}$ is estimated doubly robustly as:

$$\hat{\Delta}_{ml}^{dr} = \hat{\mu}_m^{dr} - \hat{\mu}_l^{dr} \tag{17}$$

For doubly robust estimation of the average treatment effect on the treated (Γml|m) the unconditional means model for the treated group given as:

$$Y_i = \sum_{t=0}^{K} \mu_{t|m} d_{it}(T_i) + \sum_{t=0}^{K} d_{it}(T_i)\left(X_i - X_m\right)' \alpha_{t|m} + \varepsilon_i \tag{18}$$

needs to be weighted by:

$$\sum_{t=0}^{K} d_{it}(T_i) \frac{\hat{r}(m, X_i)}{\hat{r}(t, X_i)}. \tag{19}$$

Accordingly, the weighted estimated regression estimators of μt|m and αt|m solve the following minimization problem:

$$\min_{\widetilde{\mu}_{t|m}, \widetilde{\alpha}_{t|m}} \frac{1}{N} \sum_{i=1}^{N} \left(\sum_{t=0}^{K} d_{it}(T_i) \frac{\hat{r}(m, X_i)}{\hat{r}(t, X_i)} \right) \left(Y_i - \sum_{t=0}^{K} \widetilde{\mu}_{t|m} d_{it}(T_i) - \sum_{t=0}^{K} d_{it}(T_i)(X_i - \overline{X})' \widetilde{\alpha}_{t|m} \right)^2 \tag{20}$$

Therefore, $\hat{\mu}_{m|m}^{dr}$ and $\hat{\mu}_{l|m}^{dr}$ are used to estimate ml|m doubly robustly as:

$$\hat{\Gamma}_{ml|m}^{dr} = \hat{\mu}_{m|m}^{dr} - \hat{\mu}_{l|m}^{dr} \tag{21}$$

Sampling

This study used a combination of purposive and random sampling. The study sites and hence the districts were selected with the purpose of developing benchmarks for the interventions of the global research initiative on small ruminant value chain development of which Ethiopia is part. Firstly, the intervention villages/kebeles and control villages/kebeles were identified. The ratio of number of intervention to number of control village/kebeles was decided to be 1:2 or, if not possible, 1:1. Then, the control villages/kebeles were randomly selected among the set of all neighbouring villages/kebeles. The list of households in the sample (intervention + control) villages/kebeles was developed from a health service roster or that of tax collectors.

Based on the total number of households in each village/kebele, we determined proportionally the number of households to be included in the sample of 150 households. Then, we identified the households using the lottery method with replacement. In total, the study covered seven sites in nine districts where 1,108 households were visited in 28 kebeles. Of the 1,108 sample producers, 98.2% were represented in the interview by either the household head or the spouse of the household head. About 15% of the sample households were female-headed, 0.4% were jointly-headed and the rest were male-headed. This sample can be considered as representative of the smallholder producers in the country. The districts are Abergelle (Wag), Astbi Wemberta, Doyo Gena, Horro, Menz Gera, Menz Gera, Shinille and Yabello

Figure1. a–Sheep density and the study sites; b–Goat density and the study sites
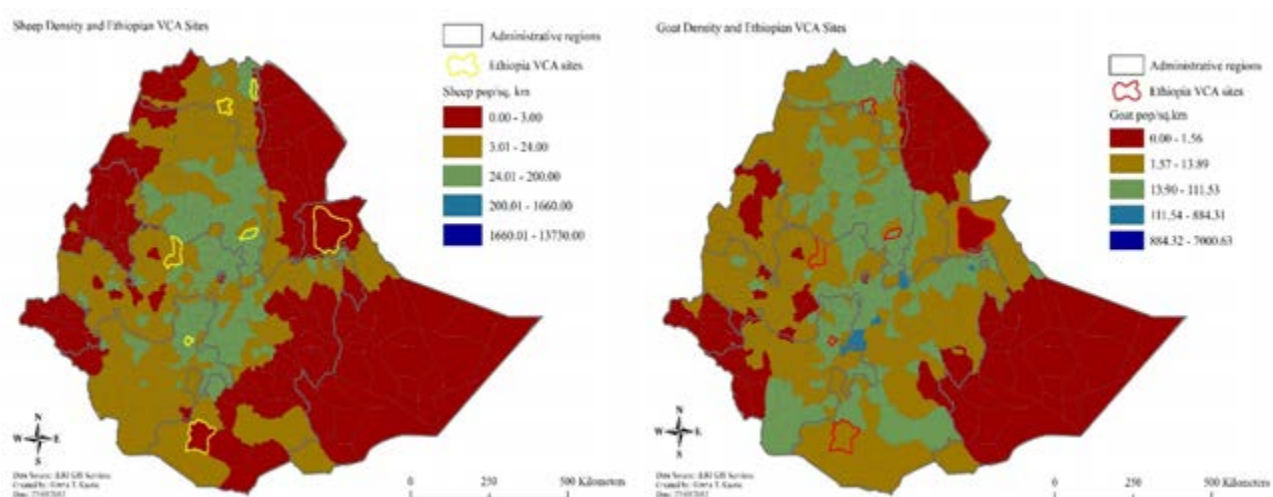
Results and discussion

Characteristics of the sample households

The regional distribution of our total sample (N=1108) shows that the Amhara and Oromia regions constituted 28.52% each, 14.62% were from Tigray, 13.72% were from southern Ethiopia and 14.62% were drawn from the Somali region. The average household size was about six persons per family [ranging from 1 to 20] and the labour dependence ratio was computed to be 39% [ranging from 0 to 500]. Smallest and highest average family sizes were observed in the Atsbi (5.1) and Doyogena (7.3) districts, respectively. Smallest and highest average labour dependency ratios were observed in the Menz Mama (20%) and Shinille (64%) districts, respectively. Female-headed households have fewer dependents, except in the Shinille district (Somali region). Literacy at household level varies from district to district. More than 30% of the household members were found to be illiterate in Abergele (Wag Zone, Amhara region), Ziquala (Wag Zone, Amhara region), Yabello (Oromia region) and Shinille. Particularly in Yabello, half the sample population is illiterate. Interestingly, in almost all regions, female-headed households have a lower proportion of illiterate members. Generally, the evidence shows that the dry lowlands appear to be lagging behind in terms of literacy.

Averages of reported land holding range from 0.51 ha per household (Shinille) to 3.1 ha per household (Abergelle). The figures might need to be seen from the perspective that crop production is not so common among the agro-pastoralists of Shinille and the topography and quality of the farmland in Abergelle undermines the potential benefit of the larger mean size of holdings. For the entire sample, the average number of plots and the total land owned by a given household were 2.1 and 1.5 ha, respectively. Management of the farmland holding is an important aspect of farm management in rural Ethiopia. In the study areas, household head and spouse of the household head own and/or manage almost all the plots owned. Expectedly, most of the land owned by the households is allocated for crop production. In relative terms, farmers in Menz Gera and Menz Mama (highlands of alpine climate in central Ethiopia) allocate a considerable size of land for their livestock feeding (feed production and grazing).

In all districts, the importance of small ruminants for the rural communities is quite evident. On average, a sample household keeps nine sheep and eight goats. This is much higher than the average holding of cattle (four per household) and poultry (three per household). In the highland areas, households keep more sheep than any other livestock whereas in the lowlands goats are frequent. In the midlands, such as Abergelle, both sheep and goats are common. The median herd size for sheep-keeping households is quite considerable in Menz gera, Menz mama and Abergelle. Comparatively, the median herd size for goat-keeping households is quite high in Abergelle, Ziquala, Yabello and Shinille.

Small ruminants are mainly kept for cash-generating purposes. In absolute figures, all households are net sellers of sheep and goats except those in Doyogena, where goat transaction seems not to be happening. Markets are more of an outlet than an inlet for goat production, except in Doyogena (albeit small N), where sample farmers use it as an inlet only. Markets are serving both as inlets and outlets for sheep even more than for goats, yet markets are more important for outflows of sheep than inflows. Farmers employ temporally different marketing patterns for different age and sex groups of sheep and goats. Farmers have limited selling options making the sheep and goat buyers' market. The decision on what sheep and goat to sell and how to spend the proceeds is predominantly taken jointly by the household head and the spouse. Farmers trek their animals to and from markets for hours (the average trek ranging from 6.5 to 20 km).

Access to rural services for human beings and livestock was explored in this study. Wells and natural springs are the two most important sources of potable water – followed by rivers and ponds – throughout the year for the sample households. For livestock, rivers are the most important source of drinking water, followed by wells and springs. Obviously, there is heavy dependence on natural sources of water, implying high vulnerability of the livestock production system to drought risk.

Econometric analysis

Efficiency measures

Stochastic frontier models were estimated to calculate the technical efficiency of small ruminant production at household level. We estimated a Cobb-Douglas production function to regress total gross revenue (in Ethiopian birr (ETB)) from sheep and goats on land size owned by the household in hectares, hired labour for small ruminant production in human days per annum, total cost of veterinary services for sheep and goat in ETB per annum, and total cost of produced fodder in ETB per annum. The inefficiency term in the stochastic frontier model can have different distributional forms. The most common of these are half normal distribution (Aigner et al. 1977), exponential (Meeusen and van den Broeck 1977), truncated normal (Stevenson 1980) and gamma distribution (Greene 2003). Once the parameters of the Cobb-Douglas function are estimated, inefficiency parameters are generated using different approaches. The two most common post-estimation procedures used to estimate (in) efficiency terms are those of Jondrow et al. (1982) and Battese and Coelli (1988). In this study, exponential and truncated normal distribution of the inefficiency term were assumed and both Jondrow et al. (1982) and Battese and Coelli (1988) procedures were used to estimate the efficiency term. Therefore, we have four models to estimate the efficiency term. As expected, the efficiency estimates were not different between the two approaches of calculation.

Accordingly, we will be reporting only results associated with Battese and Coelli (1988) procedures for the sake of brevity.

The production function shows that farmers are spending much more than they should on feed and fodder production.

The result of the stochastic frontier model shows that the gross revenue from small ruminant production is negatively related to the cost being incurred by the households. Otherwise, there is still the possibility of increasing revenue from small ruminant production if farmers employ more labour and land, and make a higher investment in veterinary services.

Table 1. Stochastic frontier model estimates

Variable	Model 1 (tnormal)	Model 2 (exponential)
Logarithm (ln) of total farm land owned	0.424‡ (5.81)	0.424‡ (5.81)
Ln of total labour used in shoat production	0.114‡ (2.96)	0.114‡ (2.96)
Ln of total cost of feed and fodder	-0.085‡ (-3.29)	-0.085‡ (-3.29)
Ln of total cost of medication	0.069‡ (4.16)	0.069‡ (4.16)
Constant	8.858‡ (72.02)	8.858‡ (71.76)
$\_\mu$	-567.27 (-12.84)	
σu	5.45 (16.82)	-1.798 (-3.56)
σv	-0.019 (-0.18)	-0.019 (-0.18)
Statistics		
N	1069	1069
LL	-1591.41	-1591.38
AIC	3198.83	3196.77
BIC	3238.62	3231.59

Note: *, +, and ‡ denote statistical significance of the coefficient estimate at 10%, 5% and 1% levels of statistical error. LL: log likelihood; AIC: Akaike information criterion; BIC: Bayesian information criterion.

The estimations show that the average technical efficiency of small ruminant production is 71% and it ranges from 2% to 89% (Table 2).

The mean technical efficiency does not show any meaningful difference among the households when we vary access to the different services [treatment levels]. The left side of the distribution of the technical efficiency is very low among households with no access to any of the services (28.6% of the total sample) and among those with access to agricultural extension and market information services (21.6% of the total sample).

Table 2. Technical efficiency estimates of households given their access to services

Treatment level	Services	Distr. of efficiency term	Mean	Min	Max
0	No service	Normal/truncated normal	0.72	0.16	0.88
		Exponential	0.72	0.16	0.88
1	Agricultural extension	Normal/truncated normal	0.71	0.34	0.89
		Exponential	0.71	0.34	0.89
2	Market information on small ruminants	Normal/truncated normal	0.70	0.38	0.86
		Exponential	0.70	0.38	0.86
3	Credit for shoat	Normal/truncated normal	0.71	0.47	0.84
		Exponential	0.72	0.47	0.84
4	Extension and market information	Normal/truncated normal	0.71	0.02	0.86
		Exponential	0.71	0.02	0.86
5	Extension and credit	Normal/truncated normal	0.71	0.52	0.86
		Exponential	0.71	0.52	0.86
6	Market information and credit	Normal/truncated normal	0.72	0.57	0.81
		Exponential	0.72	0.57	0.81
7	All services	Normal/truncated normal	0.70	0.27	0.81
		Exponential	0.71	0.27	0.81
	Total	Normal/truncated normal	0.71	0.02	0.89
		Exponential	0.71	0.02	0.89

Figure 2 shows the kernel density estimation of the distribution of the efficiency terms based on specified with inefficiency term distributed truncated normally and technical efficiency estimated using the Battese and Coelli (1988) method among households in treatment levels 0, 1, 2, 3 and 7. Kernel estimates reveal a similar distribution between the two groups of households at each treatment level except the peak points where those with access to the services depict higher technical .

Figure 2. Kernel density estimates of the technical efficiency of small ruminant production I
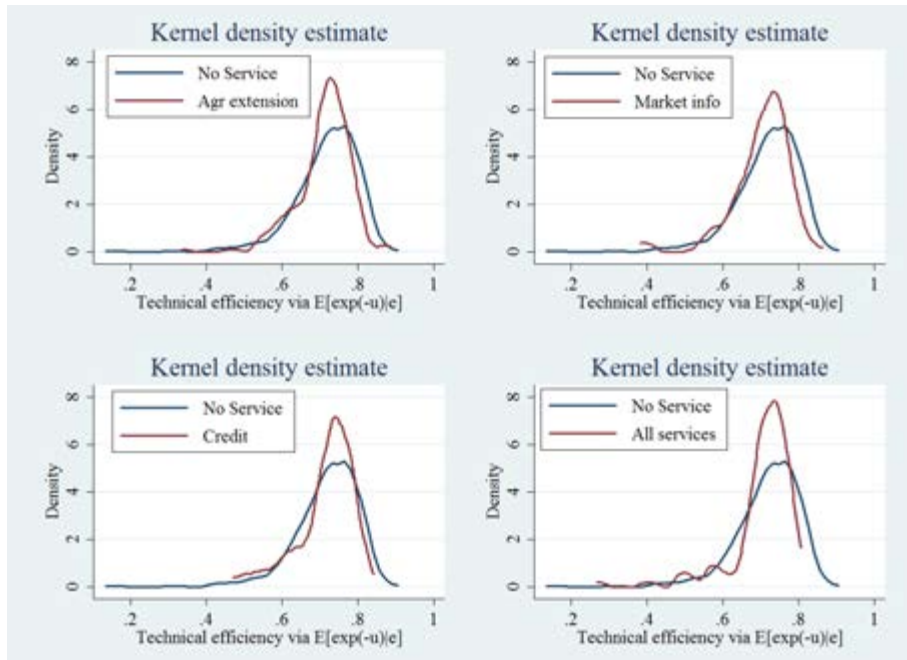
Figure 3 shows the kernel density estimation of the distribution of the efficiency terms estimated based on a frontier model with exponentially distributed inefficiency term and technical efficiency estimated using the Battese and Coelli (1988) method among households in treatment levels 0, 4, 5, 6 and 7. The kernel estimate of the distributions that compare households with no access with those which are accessing extension and credit and with households accessing market information and credit services show lower maxima compared to other groups

Figure 3. Kernel density estimates of the technical efficiency of small ruminant production II
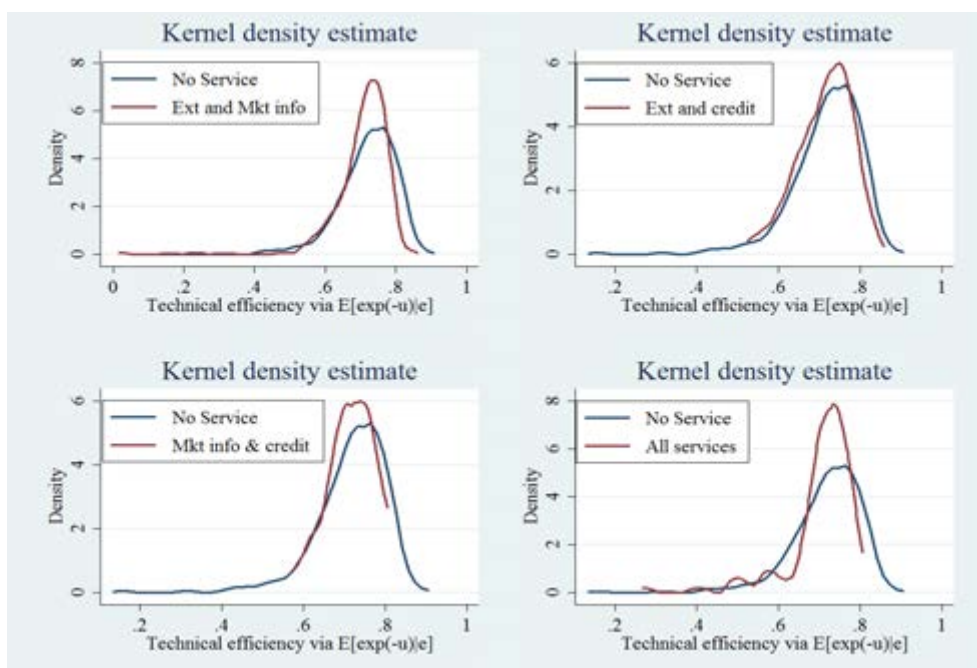
Impact of access to services on technical efficiency

The general tendency in assessing the impact of agricultural technologies (including institutions) focuses on developing a cause and effect framework between the technologies and indicators of impact at the far end of the impact pathway. Many published works show significant impact of use or adoption of improved production technologies on farm income (Kabunga et al. 2014; Khonje et al. 2015), food security (Kabunga et al. 2014; Kassie et al. 2014; Mangisoni 2008; Shiferaw et al. 2014), poverty (Mangisoni 2008; Becerril and Abdulai 2010; Kassie et al. 2011; Mendola 2007; Minten and Barrett 2008) and other ultimate impacts on the livelihoods of beneficiaries (Alene et al. 2009; Bezu et al. 2014). Although the causality is plausible, it is always necessary to see whether intermediate impacts are being observed and, if they are, to see whether a cause and effect can be established between treatments and these outcomes. We believe that before impacting household level income/expenditure or food security, a given agricultural technology should enhance productivity or increase efficiency of production. Accordingly, we examined whether there is any cause and effect relationship between access to the different services that are provided to small ruminant keepers and their technical efficiency.

Nearly a third of the sample households did not have access to any of these three services and only 8.8% of the households reported having been able to access all three. Although there is a blanket agricultural service almost throughout the country, only 17.41% received extension services meant for small ruminants. Similarly, only 6.24% and 9.78% of the households received marketing information and credit targeted for small ruminants, respectively.

Table 3. Access to rural services for small ruminants by sample households

Type of sheep and goat services the household received	Freq.	Percent
No service	307	28.58
Extension on shoat only	187	17.41
Market info on shoat only	67	6.24
Credit for shoat only	105	9.78
Extension and market info on shoat	231	21.51
Extension and credit for shoat	68	6.33
Market info and credit for shoat	15	1.4
All services	94	8.75
Total	1,074	100

The treatment effect models estimated have two components: the treatment assignment and the treatment effect components. The treatment assignment model was estimated using the multinomial logit and the outcome model was estimated using the exponential outcome model. It is clear that the services might have a synergetic effect on the efficiency of farm households and hence all combinations of the services were considered.

Average treatment effect

The results of the regression adjustment model reveal that the ATE—the effect we would have observed had the entire population been accessing all three services—is -0.02, meaning 2% lower technical efficiency of small ruminant production. The result from this model also shows that the baseline technical efficiency would have been 73% had no one been accessing these three services at a time. The ATE estimated using the inverse probability weighting model also shows that when all farmers get access to credit for small ruminants, the average technical efficiency is estimated to be 1.4% less than when no household receives the credit (Table 4).

Table 4. ATE estimates

	RA		IPW		AIPW		IPWRA	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Extension on shoat only vs no service	0.010	0.009	0.001	0.007	0.010	0.006	0.009	0.006
Market information on shoat only vs no service	-0.015	0.013	0.010	0.008	-0.007	0.010	-0.009	0.010
Credit for shoat only vs no service	0.002	0.011	-0.014*	0.008	0.002	0.009	0.002	0.008
Extension and market information vs no service	-0.003	0.009	-0.003	0.007	-0.001	0.007	-0.003	0.007
Extension and credit vs no service	-0.004	0.013	-0.016	0.013	0.003	0.009	0.001	0.009
Market information and credit vs no service	0.018	0.024	-0.010	0.027	-0.011	0.033	0.000	0.021
All services vs no service	-0.020*	0.012	-0.018	0.011	-0.005	0.009	-0.008	0.009
Mean potential outcome								
Services (no service)	0.730‡	0.006	0.715‡	0.004	0.709‡	0.005	0.726‡	0.005

Note: *, +, and ‡ denote statistical significance of the coefficient estimate at 10%, 5% and 1% levels of statistical error.

Average treatment effect on the treated estimates

The ATE estimated using the IPWRA model shows that the technical efficiency of those accessing only agricultural extension services for small ruminants have a technical efficiency higher than 0.015 units above the baseline average of 0.738, which could have been observed if those who accessed the service did not get any of the services. However, both regression adjustment and inverse probability weighting estimators show that the technical efficiency of those accessing all three services is less by 2% and 2.2%, respectively. This is in comparison to the baseline technical efficiency of 73.8% and 71%, respectively (Table 5. The baseline level is the average technical efficiency that would be observed if those who are accessing these services had not done so.

Table 5. Average treatment effect on the treated (ATET) estimates

	RA		IPW		IPWRA	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Extension on shoat only vs no service	0.011	0.009	0.001	0.007	0.015+	0.007
Market information on shoat only vs no service	-0.014	0.013	0.002	0.008	-0.008	0.010
Credit for shoat only vs no service	0.003	0.010	-0.014	0.009	0.007	0.010
Extension and market information vs Nno service	-0.002	0.008	-0.003	0.007	0.006	0.007
Extension and credit vs no service	-0.003	0.013	-0.018	0.013	0.001	0.010
Market information and credit vs no service	0.018	0.025	-0.010	0.029	-0.003	0.022
All services vs no service	-0.020*	0.012	-0.022*	0.012	0.004	0.009
Mean potential outcome						
Services (no service)	0.738‡	0.008	0.710‡	0.005	0.715‡	0.005

Note: *, +, and ‡ denote statistical significance of the coefficient estimate at 10%, 5% and 1% levels of statistical error.

Despite the limited number of statistically significant relationships, it seems that there is no cause and effect relationship between the three services considered and technical efficiency in small ruminant production. This study does not claim that it has captured all sources of variation or that all variables were measured without error. This caveat can, however, hardly undermine the strong message the results reveal.

The design, provision modalities and qualities of rural services in Ethiopia rarely take the interests and capabilities of the targeted communities into consideration (Mogues 2013; Tarozzi et al. 2015). Studies have already reported that rural credit services had no statistically significant impacts on key welfare indicators, including net revenues or livestock ownership (Thangata and Mequaninte 2011).

Agricultural extension services in rural Ethiopia were also reported to have mixed impact at household-level technical efficiency and welfare. For instance, Thangata and Mequaninte (2011) reported that having access to agricultural extensions means no significant difference in productivity changes and technical inefficiencies. Gebrehiwot (2015) also reported that agricultural extension services did not help farmers in diversifying their income. On the other hand, Dercon et al. (2009) and Gebrehiwot (2015) have indicated that access to agricultural extension has a positive and significant relationship with household welfare.

Conclusion

This study presented empirical evidence on the lack of any significant cause and effect relationship between access to three key services and the technical efficiency of small ruminant production in rural Ethiopia. Despite the importance of agricultural extension services, market information and microfinancing, small ruminant keepers do not seem to access these services with the required quality and content. The content and mechanism of delivery of rural services has always been an issue of concern in Ethiopia despite the continuous macro-level effort to enhance farmers' access to such services (Federal Democratic Republic of Ethiopia (FDRE) 2010). As stated in the two national strategy documents; i.e. Growth and transformation plan II (FDRE 2016) and the Ethiopia livestock master plan (Shapiro et al. 2015), within the coming few years, the government has envisioned improving livestock production and productivity through access to improved agricultural services. The plans include improving public agricultural service support programs, capacity building and aspects of market development. For instance, among other issues, improving services on genetic selection, rationalization of public and private sector role in clinical services, promotion of feed efficiency by removing double VAT and promotion of exports by establishing traceability and animal health programs are included (MoA 2015; Shapiro et al. 2015). In addition, using the lesson learned from Agricultural growth programme I, there is a plan to improve the infrastructure of available farmers' training centres (FTC) and the capacity of extension workers (MoA 2015).

Strategies or local level plans can only be as good as the effectiveness of their implementation. So far, at least as seen from this nationally representative sample, there is no evidence that the services on extension, market information and rural credit are helping smallholder small ruminant keepers improve their efficiency. We therefore suggest the following for research and development considerations.

It looks as if extension services in small ruminant production and productivity are almost non-existent. Therefore, in addition to available packages, there is a need to develop possible extension packages from empirical findings that need to be used by smallholder farmers in different contexts. The technology packages developed and provided to farmers need to be comprehensive so that complementary technologies are made available to farmers for enhanced synergy at farm level.

The market incentives dictate farmers' decision to participate in genetic improvement, feeding strategies and health management services. However, the attention given to marketing and market information systems is still inadequate, even in the current five-year Ethiopia livestock master plan. Access to market and market information could be a strong incentive for smallholder farmers to adopt improved technologies and management systems. Therefore, there is a need to design sustainable and effective national and local strategies that improve smallholders' access to market and market information.

The role rural credit plays in empowering rural communities in general and small ruminant keepers in particular can hardly be overemphasized. Despite the rapid growth in terms of coverage, rural credit services usually disappoint

poor farmers because of their rigid repayment schedules, lack of risk allowance and high interest rates. Rural credit services can play a more productive role if the legal framework within which microfinance services are provided are relaxed so that private financial institutions come into the picture and create a competitive environment.

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The various problems associated with financing livestock production in northern Nigeria

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Abstract

Nigerian farmers are finding it difficult to get financial aid that will support the different livestock production chains, which is noted in the areas of production, preservation, transportation, marketing and capital needed in the sourcing for the feed, kick-starting livestock production and the use of advanced technology. Many reasons are adduced for this but the primary reasons are insufficient finance and limited sources from which it can be obtained (Ajobo and Oguntade 1996). Nigerian livestock farmers cannot increase production as a result of the aforementioned challenges. Capital surpluses must thus be transferred from other sectors of the economy to the agriculture sector which can be best facilitated by credit institutions (Ajobo and Oguntade 1996).

This study was conducted to ascertain the problems smallholder livestock farmers are having in accessing credit facilities to boost the actors in the livestock value chain. The findings from the projects that comprise the small-scale farmers in Federal Capital Territory—Abuja, Kaduna and Nassrawa states—that undertake goat production, show that most goat farmers visited and interviewed did not receive any support from the State Government, due to lack of collateral, shortage of funds and unavailability of plans. However, some of the visited poultry farmers were receiving some financial support.

Secondary data were used for this study from the Ajetomobi and Olagunju (2000) report that 54% of farmers obtain credit from esusu (credit) cooperatives, against 3% who obtain the same from commercial banks in southwestern Nigeria. Reasons adduced for this reliance are many, including a dearth of rural banks, distance from loan office, low farm income and time lag between loan application and disbursement from formal sources. Nweze (1994) remarks that the objectives of cooperative associations are to pool capital resources, labour for farm work, provision of financial assistance to members in need and community development. Such involvement would lead to improved agricultural production and rural development. Furthermore, it would lead to higher incomes and better quality of life for the rural population and fattening and finishing livestock activities. This paper suggests that farmers need to form cooperative societies and associations to boost their demands for livestock agricultural loans, explore the agricultural value chain in goat production and increase the capital base of smallholder livestock farmers in northern Nigeria.

Keywords: Livestock, financing, farmers, Nigeria.

Introduction

Too many difficulties are experienced by commercial and peasant livestock farmers in the northern region of Nigeria in accessing funds, as can be seen in the production, preservation, transportation, marketing and capital needed in the sourcing of feed, kick-starting of livestock production and advanced technology needed to expand the livestock businesses.

It also poses a security problem to the country, as herdsmen graze their cattle by moving from one place to another in search of fodder and grasses, which results in the destruction of farmland, frequent clashes between herdsmen and crop farmers, and the livestock being at high risk of being illegally slaughtered by cattle rustlers.

The livestock industry provides a means of livelihood for a significant proportion of rural pastoral families in the sub-humid and semi-arid ecological zones of Nigeria. According to the Food and Agriculture Organization of the United Nations (FAO) (1988), an estimated 183,000 rural households derived some income from the dairy industry in 1986. At present Nigeria has 1.8 million cows (whole, fresh, milk animals -head) (FAOSTAT 2005). It was also noted that it provides a means of employment for the cattle Fulani, whereby an average person in the populace of northern Nigeria will also earn from the sales of meat and the processing of cows' milk. For example, the various activities of the Nigerian northern dairy industry are centred on milk production, importation, processing, marketing and consumption, and these have been going on for over 60 years. These activities are, however, unorganized, except for the relatively few processing firms that produce and market reconstituted milk products from imported powdered milk. This makes it difficult for them to access bank loans.

Despite the unorganized nature of the industry, the dairy industry represents an important component of the agricultural sector of the economy with great economic, nutritional and social implications (Olaloku 1976; FAO 1991; Yahuza 2001). The needs of livestock farmers must be catered for and thus this paper will study and evaluate the different areas in which northern Nigeria's livestock producers need assistant in respect to accessibility of funds, and the various bottlenecks associated with northern livestock farmers' lack of access to credit in Nigeria's agricultural systems.

The different areas in which Nigeria's northern livestock producers will need assistance in respect to livestock farming

Like cattle, small ruminants are found almost everywhere in Nigeria. There are estimated to be a total of more than 51 million head, with goats outnumbering sheep. These animals are kept mostly for their meat and skins (goatskin production was some 23,000 tonnes of fresh skins in 2004). They are slaughtered for meat during festive occasions; and are slaughtered daily to augment the supply of meat in both urban and rural areas. Although some seasonal movement of pastoral sheep does take place, the great majority of small ruminants are sedentary village livestock and their patterns of distribution mirror those of human settlement. The traditional system of feeding goats and sheep in Nigeria is based on the use of kitchen waste and agricultural by-products, and browsing (scavenging).

Figure 1. Distribution of goats and sheep in northern Nigeria
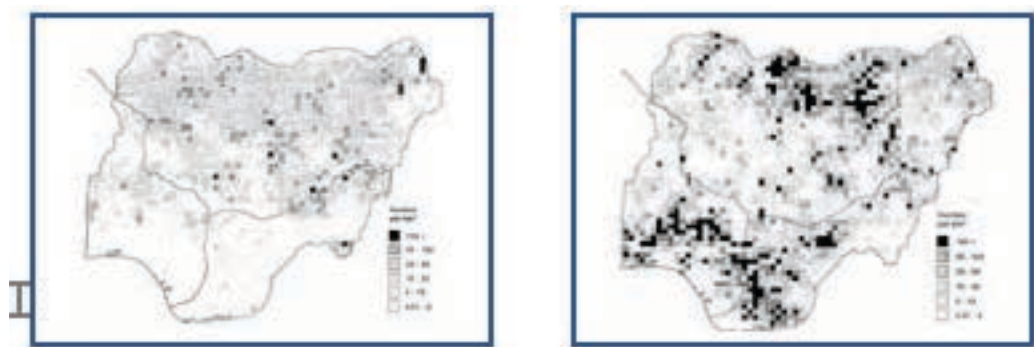
Source: Bourn

Table 1. Data on ruminant livestock population

Livestock species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cattle ('000)	15050	15073	15088	15103	15118	15133	15149	15164	15200	15200
Goats ('000)	25000	25500	25500	26000	26500	26500	27000	27000	28000	28000
Sheep ('000)	14000	19500	20000	20500	21000	21500	22000	22500	23000	23000

Source: FAOSTAT data 2006

The various problems associated with northern livestock farmers in accessing credible loans in Nigeria

Given the high rate of livestock production of ruminant and non-ruminant animals in northern Nigeria, there is an urgent need for the Federal Ministry of Agriculture and Rural Development to begin to establish special funds that will cater for household and commercial livestock farmers. For instance, the data on ruminant livestock population from the years 1996 to 2005 clearly show the number of the cattle, goats, sheep, asses, horses and camels produced during the year.

Without adequately taking into consideration all forms of the process of management and keeping adequate records of the different production stages of the livestock, it will be very difficult for an average farmer to get a suitable bank loan, although some farmers may obtain one for their various livestock chain practices without adequate record keeping. Enough information about availability and the different procedures should be disseminated to the livestock farmers by the government. It was also observed that many livestock farmers are scattered, making it difficult for the Federal Government of Nigeria to provide the necessary information to them on funds available. A database of livestock farmers is needed to evaluate their needs, understand the different livestock chains and study the various problems to help address farmers' problems, namely:

a.   Suitability of the livestock business, risk and uncertainty where there is no evidence or proof of ownership and it is very difficult to prove that money lent will be paid back and well spent on the livestock business.

b.   Lack of collateral for loans to northern Nigerian farmers, and information about how farmers should approach the whole process.

c.   The long procedures which are involved in seeking and repaying loans, which are so tedious that many farmers are discouraged from applying.

d.   The high interest rate being demanded by the banks, which some farmers cannot afford, added to the tedious documentation procedures.

e.   Poor management by those farmers who do not have enough information about the livestock, and farm production, and poor record keeping.

f.   Poor insurance policies for farmers, as most have no insurance policy and the banks will not take any form of risk.

g.   Low or non-availability of credible loans for Nigerian livestock farmers.

h.   The low demand for the different agricultural products in the northern part of the country and the few people undertaking different types of livestock production there.

i.   Uneven and inequitable distribution of wealth resources among average livestock farmers in Nigeria.

Conclusions

The various explanations and issues discussed above have shown that northern Nigeria livestock farmers are experiencing difficulties in accessing the loans needed to support them. This discussion is timely, because the various challenges faced by Nigerian farmers are concurrently faced by Fulani cattle herdsmen, and the consumption of all forms of dairy products from livestock. This paper also stresses the role of cooperative societies and associations in which funds can be disbursed to help the livestock farmers and the need of step-up training on documentation, proactively engaging farmers in record keeping. All these practices will go a long way to encouraging banks to loan money, and the establishment of a special fund for peasant farmers will help address the shortage of funds in livestock rearing.

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Market channel choice decisions in Botswana's cattle markets

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Abstract

The purpose of this study is to analyse the downstream cattle supply chain and cattle farmers' marketing behaviour and decisions in Botswana. The study sheds some light on the existing question of why smallholder cattle farmers in Botswana make relatively little use of the Botswana meat commission livestock markets, the only entity allowed to export beef. A transaction cost approach (TCE) is applied to a survey of livestock farmers from three districts, which represent diverse agro-ecological zones of Botswana. Our analysis confirms the hypothesis that transaction costs in the form of information and search, negotiation and bargaining, and monitoring and enforcement costs play a significant role in influencing the downstream cattle supply chain and marketing behaviour of smallholder cattle farmers in Botswana. The study has potential policy implications that help policy-makers when designing policies that improve agricultural market structures and promote market participation.

Keywords: transaction costs, agricultural marketing, Botswana (JEL classification: D130, D120)

Introduction

Livestock production is the most important agricultural sector in Botswana and plays a significant role among rural livelihoods and the economy, contributing more than 80% to the agricultural gross domestic product (GDP). It is also a significant foreign exchange earner with direct linkages to domestic sectors, ranging from rural supply and urban demand of cattle to finance (Statistics Botswana 2015; van Engelen et al. 2013). Over the years, different stakeholders, including the government of Botswana, have put in place different measures in an attempt to improve the cattle industry: productivity-enhancing measures, infrastructural development and improving markets. Improvement of the livestock sector is viewed as one of the potential ways to increase rural household incomes, create sustainable jobs and investment opportunities for the rural population and drive economic diversification away from a mineral-dependent economy. Despite these policy efforts, there is evidence that beef productivity and profitability have been declining due to mismanagement and the inefficient operations of abattoirs, cattle marketing arrangements and farmers (Bahta and Baker 2015; Bahta and Malope 2014; Temoso et al. 2015). Even worse, despite the fact that Botswana beef

enjoys preferential market access in the European Union (EU), there has been a decline and stagnation in beef exports, to the extent that it has failed to fulfil its EU beef quota[1] (van Engelen et al. 2013).

Therefore, analysis of existing production and marketing structures, the role of transaction costs and existing partners is vital to understand farmers' constraints in cattle production and marketing, and expected to provide useful information on how to improve the system. However, so far most of the attention has focused mainly on the factors constraining production and farm productivity/profitability (e.g. Bahta and Malope 2014; Temoso et al. 2015) and little attempt has been made to investigate the constraints to cattle marketing in Botswana. Past studies that investigated the role of transaction costs in cattle market participation in Botswana include Nkhori (2004) and Mmopelwa and Seleka (2011). The studies found that high transaction costs, such as distance to market, market information and speed of payment, affect cattle marketing decisions (including choice of market outlets) of cattle farmers in Botswana. Producers' minimal level of sales is also associated with prevailing high transaction costs; for example, farmers often complain about inadequate animal transport, delays in issue of animal identification-related permits and slow payments (Bahta et al. 2013). However, the main drawback of such studies is that their analysis embedded transaction cost using only few proxy variables. Furthermore, these studies have neither investigated marketing outlets for cattle farmers nor examined the transaction costs associated in farmers' decision to sell their cattle in a particular marketing outlet.

Transaction costs are considered barriers to efficient participation of resource-poor smallholders in different markets (Randela et al. 2008; Woldie and Nuppenau 2009). Producers will not use a specific marketing channel when the value of using that market channel does not at least compensate the costs of doing so (Musemwa et al. 2008). In Botswana, cattle farmers who participate in the markets tend to sell their animals mainly to butcheries and the Botswana Meat Commission (BMC)[2]. However, in recent times, more and more smallholder farmers are opting to sell to the local market rather than the BMC (Statistics Botswana 2014, 2015). This might reflect dissatisfaction by farmers with prices offered by the BMC (Jefferis 2005), and transaction costs associated with inaccessibility to markets and high costs of transport to the BMC collection points are some of the biggest challenges cattle producers in more remote areas face (Bahta and Malope 2014). The transaction costs that market channels impose on farmers are believed to affect such farmers' decisions in choosing a particular marketing channel (Woldie and Nuppenau 2009). Transaction costs are also expected to differ amongst households due to asymmetries in access to assets, market information, extension services and remunerative markets (Makhura 2001).

Our study seeks to understand what factors influence farmers' decisions to choose a cattle marketing channel. Why is market participation so low in some market channels? What are some of the transaction costs that the smallholder cattle farmers in Botswana face? Specifically, the objective of this study is to investigate the role of transaction costs in determining market participation of smallholder cattle farmers in Botswana. This study provides an empirical basis for identifying options to increase the participation of smallholders in livestock markets in Botswana. Such analysis might help policy-makers when designing policies that promote market participation and hence improve agricultural development. Improvement of markets and market access could play a crucial role in improving agricultural development and reducing poverty and food insecurity (Ouma et al. 2010). According to Barrett (2008), empirical evidence indicates that interventions directed at improving facilitation of smallholder organization, reducing the costs of intermarket trade and improving access of poorer households to improved technologies and assets are crucial to stimulating market participation and reducing poverty among smallholder farmers.

In this study, we employ a transaction cost economics (TCE) approach to a cross sectional farm-level data[3] as the TCE approach allows us to explain the use of two main cattle markets by livestock farmers in Botswana. Many studies (e.g. Alene et al. 2008; Makhura 2001) have used the usual transaction cost analysis, which is tailored to understand only why some farmers are net sellers, net buyers or autarky. Departing from such an approach, the current study is

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1   Under the Economic Partnership Agreement (EPA) the EU has fully opened its market of half a billion people to almost all exports (except arms and ammunition) from SADC EPA partners, free of quotas and duties. For Botswana, this means quota-free export of beef to the EU (EU 2015).
2   The BMC is a government parastatal enterprise that has monopoly rights over the purchase of cattle for export and the sale of exported beef.
3   The Smallholder Livestock Competitiveness Project is an ACIAR-funded project implemented by the International Livestock Research Institute (ILRI) in partnership with the Botswana Ministry of Agriculture's Department of Agricultural Research.

a case of net seller households that face different transaction costs when accessing various market channels. In such a situation, the decision towards selling in a particular market channel is affected by the magnitude of the transaction costs the market outlet imposes on them. It is expected that producers will not use a particular channel when the cost of using that market outweighs the value it can possibly offer. The assertion is that in the absence of institutions that govern formal exchange, opportunistic behaviour of other chain actors is expected to raise transaction costs, which in turn leads to the imperfection of the cattle market: differential market prices. Therefore, measuring transaction costs in such a market is important from a policy perspective as reducing transaction costs means increasing the links between market channel actors, increased bargaining power and improved market access (Woldie and Nuppenau 2009).

The rest of the paper is organized as follows. Section two details the materials and methods that are used to model the transaction costs. A discussion of the results follows in Section three. The paper closes with a summary of the main findings and policy implications in Section 4.

Materials and methods

There is now a vast literature dealing with both the theory and empirical implications of TCE. Both the theoretical and empirical literature acknowledges that transaction costs are detrimental for the operational efficiency of both input and output markets. Transaction costs in the form of information costs, the costs associated with the search for trading partners, physical infrastructure and the ways institutions are formed, which includes enforcement of contracts, are all likely to influence marketing and supply decisions by households.

Studies that endeavoured to measure transaction costs in various markets include, among others, Hobbs (1997), Gong et al. (2006) and Woldie and Nuppenau (2009). For instance, Hobbs (1997) used a Tobit analysis approach to measure the importance of transaction costs and their effect on vertical coordination in the UK cattle industry. He identified the relative importance of transaction costs that affect farmers' decision to sell through live-ring auction and direct to packers. Likewise, Gong et al. (2006) recognized the importance of transaction costs in the market channel choice behaviour of beef farmers in China. Using a similar approach, Woldie and Nuppenau (2009) found that transaction costs in the form of information, negotiation and monitoring and enforcement costs are prevalent and influenced market channel choice of banana farmers in Ethiopia.

Generally, farmers sell all, a proportion or none of their cattle through a particular marketing channel. As mentioned above, this study considers cattle sales to the main cattle marketing channels, the BMC and butcheries, used by livestock farmers in Botswana. The question is how such decisions are made and which factors influence the marketing behaviour of farmers and their choice of a particular cattle marketing channel. The hypothesis is that the farmers' decision of whether to sell to butcheries or the BMC is influenced by the transaction costs and household and farm characteristics. Apart from these two market outlets, other marketing outlets in Botswana include feedlots and traders, which are not considered in this study since their contribution is almost negligible. Some farmers also sell their cattle to individual buyers; however, the place of transaction is unclear as individuals could mean neighbours and the transaction could involve an exchange of animals. Thus, the cattle sold to individuals are not considered in the analysis.

A two-limit Tobit model

To test the above hypothesis, a two limit Tobit model is used as specified in Maddala (1992) and Hobbs (1997). The two limit Tobit model can be presented as:

$$y_i^* = \beta' x_i + \varepsilon_i \tag{1}$$

Where: y_i^*= Latent Variable (unobserved values for values <0 and >1) representing the potential cattle sold through butcheries; X= vector of independent transaction cost and farmer characteristics variables; B = vector of unknown

variables; and ε_i = disturbance term assumed to be independently and normally distributed with zero mean and constant variance and i=1,2,3 …n.

Denoting y_i^* (the proportion of cattle sold through butcheries where the alternative is proportion-sold through BMC) as the observed dependant (censored) variable is:

$$y_i = \begin{cases} 0 \ if \ y_i^* \leq 0 \\ y_i^* \ if \ 0 \leq y_i^* \leq 1 \\ 1 \ if \ y_i^* \geq 1 \end{cases} \qquad (2)$$

In the current study, the dependent variable represents a proportion of cattle sold through butcheries and the alternative is proportion-sold through BMC. The former transactions are mostly directed by price signals at the spot, whilst the latter, despite the possibility of offering higher prices, have various requirements for beef products in terms of weight and quality due to the downstream recipients (i.e. the EU export markets).

Following Hobbs (1997) and Gong et al. (2006), we divide the transaction costs into three categories: information, negotiation and monitoring costs. Information costs are those incurred in the search for information about products, prices, inputs and buyers and sellers by forms and individuals (Gong et al. 2006). Negotiation costs are related to the physical transaction and include negotiating, and writing contracts or paying for the services of an intermediary to the transaction (Gong et al. 2006). The last category of transaction costs arises after an exchange has been negotiated. According to Gong et al. (2006), this could involve monitoring the behaviour of a supplier or buyer to ensure that the terms of the pre-agreement of the transaction are satisfied. We also include household characteristics variables that could potentially satisfy the theoretical expectations in the analysis of beef cattle marketing behaviour.

Data and study area

To address the objective of this study we use a cross-sectional farm-level survey collected in partnership between the International Livestock Research Institute (ILRI), Botswana's Ministry of Agriculture and local authorities under the auspices of the Australian Centre for International Agricultural Research (ACIAR) funded research project Competitive smallholder livestock in Botswana. The survey was carried out among livestock farmers in three districts (Southeast, Chobe and Central) of Botswana, representing diverse agro-ecological zones of the country. A multi-stage cluster (area) sampling approach (Horppila and Peltonen 1992) was used to select a sample from the population. First, the Central district (Botswana's largest district) was divided into four sub-districts to account for the differences in farming system, ecology and soil type, to form six clusters. Then, within a cluster, extension areas[4] were randomly selected from lists of all extension areas, taking into account the general distribution of cattle in the study area. Subsequent stages involved a random selection of crushes[5] or sample of locations, from which a number of farmers were randomly selected. The summary statistics of the data are discussed in Section 4.1 (and more details can be found in Bahta et al. (2013).

Results and discussion

Summary statistics

Table 1 presents a summary of descriptive statistics on the surveyed households. Household heads were elderly (average age is 60.64) with rather low levels of education (mean = 5.45 years of schooling). Household heads are

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4 Extension areas are areas within districts that are classified based on delivery of agricultural extension services.
5 Normally the veterinary district offices keep lists of farmers by crushes. Thus, a list of farmers was provided by crushes for each extension area in the respective district/sub district.

the ones responsible for the coordination of the household activities, hence their age and education level are crucial factors in determining whether the household benefitted from the experience and knowledge of an elder person or has to base its decisions on risk-taking attitudes of younger farmers. About 85.34% of the households were male-headed, implying that female-headed households accounted for about 14.66% of the sample. Consistent with data from Statistics Botswana (2013), households tend to be small with a mean of 4.74 persons per household. Table 1 also indicates the farm households' access to communication and transportation facilities; about 65% and 73.28% of households owned radio and television, respectively. Surprisingly, about 91.38 % of the surveyed households had mobile phones. According to Saunders et al. (1994), some of the benefits accruing from the widespread adoption of information and communication technologies (ICTs) in developing countries include increasing knowledge of market information and improving coordination of transportation. On average, a household had access to about 8.39 ha of crop land and kept 31.84 cattle and a transport equipment worth BWP43 221.55.

Table 1. Socio-economic analysis of the farm households (N=241)

Variables	Mean	Std. Err.
Age of household head (years)	60.67	0.88
Gender (% male farmers)	85.34	0.02
Education of household head (years)	5.45	0.31
Household size	4.74	0.20
Value of transport equipment (pula)	43221.55	5995.92
Households with mobile phone (%)	91.38	0.02
Households with a TV (%)	73.28	0.03
Households with radio (%)	65.09	0.03
Value of beef cattle output (Pula per year)	11366.64	1002.42
Total crop land area (hectares)	8.39	1.32
Herd size (beef cattle equivalent[6])	31.84	2.80

Figure 1 depicts market channels used by the cattle farmers in the surveyed districts. About 56.3 % of the farmers sold their cattle to the butcheries, 24.1% to individual buyers and 15.8% to the BMC abattoirs, whilst the rest were sold to other markets (i.e. traders, feedlots and private slaughter slabs, retailers and supermarkets). These findings are consistent with the Statistics Botswana (2015) analysis, which shows that, compared to the 1980s, farmers in Botswana tend to sell more of their livestock to the local market than the export markets. Figure 2 shows the average cattle prices received from the market channels used by farmers. Despite most of the farmers selling their cattle to butcheries (see Figure 1), on average, the BMC offers relatively high prices (BWP 2,757.5 (Botswana pula) per adult cattle), followed by traders (BWP[7] 2,737.5 per cattle), feedlots (BWP 2,533.33 per cattle) and butcheries (BWP 2,475.45 per cattle), respectively. Individual buyers and other market channels offered the lowest average price (BWP 2,000 per cattle).

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6   Beef cattle equivalents were computed by multiplying the number of cattle of various types by conversion factors. Following insights from discussions with the BMC, the conversion factors were calculated as the ratio of average slaughter weight of different cattle types to the average slaughter weight of a mature beef bull.
7   BWP is the Botswana currency with the rate to USD of BWP 1 = USD 0.1159 (First National Bank of Botswana (FNB) 2013).

Figure 1. Market channels used by cattle farmers in Botswana[8]
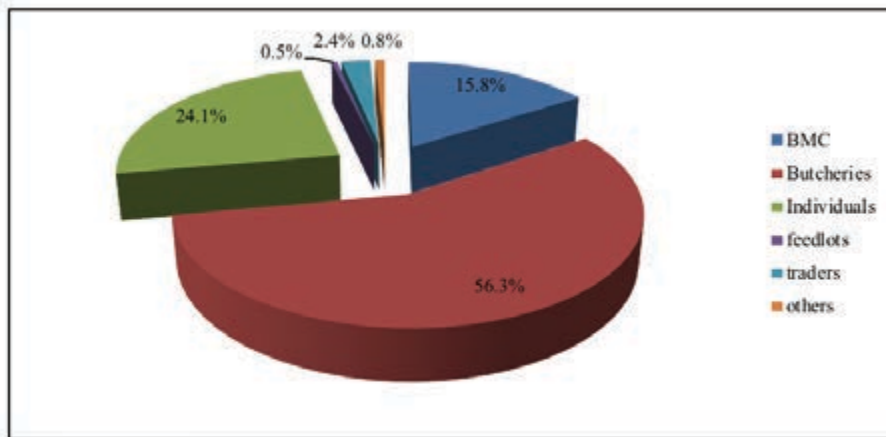
Based on Figures 1 and 2, we would expect a correlation between the price offered and the number of farmers selling to that market. That is, we would expect more farmers to sell their cattle to the BMC and traders than butcheries, since on average they offer better prices. However, inaccessibility to markets and high costs of transport to the BMC collection points are some of the biggest challenges that smallholder beef producers in more remote areas face (Bahta 2013; Bahta and Malope 2014). This means producers will not choose a specific market channel when the value of using that market channel does not at least compensate the costs of using it. This might explain why, despite BMC offering high prices, producers still choose markets such as butcheries (close proximity and lower transport costs, and there is a possibility for price negotiation and immediate payment, as compared to BMC abattoirs). The high transaction costs, such as negotiation costs and transport costs (distance to the market), payment delays and bargaining power that come with selling to the BMC abattoirs discourage farmers from accessing that market channel (Mmopelwa and Seleka 2011). Similarly, Bahta and Bauer (2007) have shown that among smallholder cattle producers in South Africa, distance to the market reduces market participation. Also, in order to sell to the BMC abattoirs, there are certain compliances that animals have to meet such as health status, cold dress mass (CDM), grade and other regulations that have been imposed by the EU countries (the BMC exports the majority of its produce to this market), hence high transaction costs.

Figure 2. Cattle average prices (BWP) by various buyers

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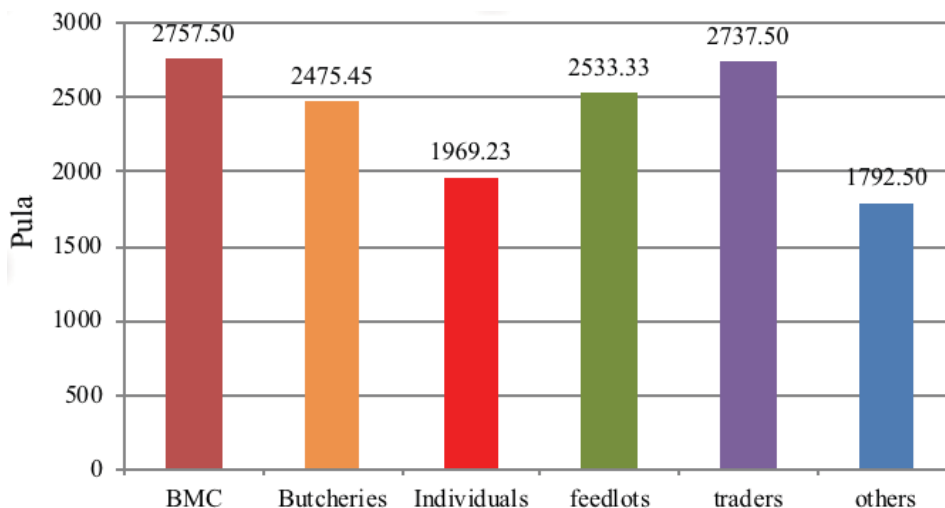
8   Other market channels include private slaughter slabs, retailers and supermarkets.

Table 2 shows the descriptive results of information search or ex ante type of transaction costs. One aspect of information costs is related to search costs in finding market-specific information and potential buyers (Woldie and Nappenau 2009). On average about three fifths (60.58%) of the farmers in the study area had access to market information, a reason likely to be associated with a significant percentage of households having access to televisions and radios which could be their sources of market information. Table 3 also presents the length of time farmers had to wait for veterinary problems and the number of visits they received from a veterinary extension officer. Farmers had to wait for about nine days when they experienced veterinary problems, which is inconsistent with the annual number of visits they had received (average = 0.87) from a veterinary officer. As stated above, it is very common to see extension officers more preoccupied with the issuance of livestock movement permits (part of the livestock identification trading system (LITS). This leaves extension officers with limited time for extension work such as assisting farmers in identifying diseases and curing/attending to sick animals, and introducing new technologies or organizational models for feed production and utilization. The problems of human and physical resources such as vehicles are exacerbated during foot-and-mouth disease (FMD) vaccination campaigns, during which extension officers are required to rotate between regions, leaving the extension offices unmanned.

Table 2. Transaction costs: information and search (*ex ante*) (N=241)

Variables	Mean	Std. Err.
Market information (%)	60.58	0.032
Length of time waiting for help with veterinary problems (days)	9.49	2.271
Number of extension visits (days)	0.87	0.054

To fulfil the EU export requirements and maintain the much-needed EU market access, the major export destination for Botswana's meat, the government of Botswana introduced the LITS that uses rumen bolus, in 1999. This was an attempt to respond to the EU Council Directive as the country could not fulfil the requirement of the Directive using the traditional branding system. The bolus system was a complete departure from the traditional 'hot iron' branding and ear tagging that have little or no deterrence to cattle thieves (van Engelen et al. 2013). The LITS identifies animals using rumen boluses with embedded RFID microchips to trace animals throughout the production chain (Bowling et al. 2008). Furthermore, each rumen bolus is coded with the owner's name, a personal identification number, the brand on the animal, the position of the brand, the sex of the animal and the hide/coat colour of the animal. The location of the animal is uploaded to an extension officers' computer and stored on the central database in Gaborone.

Table 3. Bargaining and negotiation (during transaction)

Variables	Mean	Std. Err.
Time spent looking for buyers (days)	1.50	0.044
Farmer has dedicated buyers (%)	27.39	0.029
Distance to market (km)	58.77	4.271
Membership of organization (%)	19.09	0.025
Time spent on organization of boluses (days)	11.63	3.326
Time spent administering boluses (days)	2.99	1.723
Incidence of misreading boluses (%)	31.54	0.030
Provision of information about animals sold (days)	2.15	0.791

Accordingly, cattle sales permits must be obtained from area veterinary/extension officers to verify the origin and animal health background of cattle for sale. Permits are based on electronically reading each animal's bolus which, as mentioned above, serves as the main identifier under the export traceability aspects of the animal identification system. The findings from Table 3 show that farmers had to spend between 12 and three days organizing a bolus. The long period of time that farmers have to spend organizing boluses for their animals could be due to the unavailability of boluses in the markets and shortages during insertion. This was also a conclusion reached by a study carried by Oladele and Monkhei (2009).

Moreover, farmers had to wait for three days to administer boluses to get the sales permit and about 32% reported they had experienced an incidence of misreading boluses. This is consistent with Bahta et al. (2013), who reported the absence of the veterinary officer or technical problems with bolus-reading machines, which are often a major problem that lead farmers to wait for long periods (several months' delays were reported) to get the permits. The farmers selling to the BMC market had to wait on average about two days to get information on the animals they sold. For sales outside the BMC-mediated export systems, witnessing of sales by a village chief is legally sufficient and sales are based on mutual agreement with the buyer (Bahta et al. 2013). However, this represents a lower-priced sales channel (see Figures 1 and 2) and one subject to speculative purchasing when farmers are keen to sell for climatic reasons, or when household cash flow requires it.

Table 4. Transaction costs: monitoring and enforcement (*ex-post*) (N = 241)

Variables	Mean	Std. Err.
Cattle age as buyer's main quality requirement		
• Never	120	
• Sometimes	55	
• Always	66	
Speed of payment		
• Butchery	4.85	0.566
• BMC	14	1.464
Trust in buyer		
• Non-payment by a buyer is a risk (%)	6.64	0.016
Contract or agreement with a buyer (%)	41.91	0.031

Table 4 shows the variables that reflect transaction costs with regard to monitoring and enforcement (ex-post). Cattle unsold due to age affected the enforcement costs, with an average of about three cattle being unsold due to this factor. For the variable that cattle age was considered to be the main quality requirement by the buyer, it was assessed whether the buyer never considered cattle age or considered it sometimes, or whether the age was always considered as the main quality requirement. Accordingly, from the 241 survey respondents who participated in the market and sold cattle, almost half (120 farmers) said cattle age was not the main quality requirement that buyers look for. Similarly, about an equal proportion, 55 farmers and 66 farmers, responded that buyers look for age of the cattle as the main quality requirement sometimes and always, respectively. Table 4 also shows that only 27.39% of the farmers who participated in cattle markets indicated that they had dedicated buyers. This is consistent with findings in Table 4 that farmers had to spend on average about a day and a half looking for a potential buyer. Farmers had to wait two weeks (about 14 days) to get paid once they had sold their cattle to the BMC. This could be one of the factors that discourage farmers who can sell their cattle to butcheries that pay during the transaction or, as reported in Table 4, with an average of four days.

Some transaction costs are implicit and difficult to observe but also play an important role in determining the method sellers select to market cattle. Such Implicit costs are related to the level of trust between an individual buyer and seller when they complete individual transactions (Bailey and Hunnicutt 2002). The trust variables that are considered for this study are related to availability of a contract or agreement during transaction and the rate or risk of non-payment by a buyer once a transaction has been made. About 41.9% of farmers reported that they had signed a contract or agreement with the buyer when selling their cattle. Consequently, only about 7% viewed non-payment by a buyer as a risk.

Econometric results

Parameter estimates of the Tobit model (equation 1) are found in Table 6 and provide some useful insights on the determinants of choice of cattle market channels. The overall result suggests that the proportion of cattle sold

through butcheries versus those sold to the BMC[9] is influenced by transaction costs related to information and search, bargaining and negotiations, and enforcement and monitoring costs. Although computing marginal effects could give more insight into the magnitude of the effects of the statistically significant transaction cost variables on the proportion of cattle sold through butcheries, this was not possible in this study due to the presence of some zero values of the observed transaction cost and household characteristics variables.

Among the information costs variables, the coefficient of price information was found to have a negative effect on the proportion of cattle sales through the marketing channel of butcheries. It can also be interpreted as having knowledge on price information of alternative markets; thus the BMC, as it commonly disseminates market information to farmers, reduces the proportion of cattle sold through butcheries. This suggests that the greater availability of market information at the butcheries than at the BMC enables farmers to check on the spot prices they receive vis-à-vis the prevailing market prices, hence, the best price that compensates transaction costs incurred. This helps farmers not to receive prices lower than the ones they normally know, as they may decide to seek out alternative market outlets and in the future may negotiate more forcefully or try to improve the quality and presentation of their produce (Woldie and Nuppenau 2011). Information cost can also be estimated by the number of extension visits a farmer received in the past 12 months. Our results show that the variable of extension visits had a positive influence on market participation in butcheries. This implies that farmers in our study may be relying on extension officers to attain timely and reliable market price information which then increases their bargaining power during a transaction. This, with the support of well-developed price-transmission mechanisms such as radio and television which the majority of the farmers (a third of our respondents) have access to, increases their ability to discover market price information.

Table 5. Empirical results (N = 241)

Variables	MLE (Tobit)	Standard error
Farmer have price information	-0.06**	0.0285
Extension visits in the last 12 months	1.06*	0.6559
Time spent transacting: time spent looking for buyers and arranging sales	-0.04	0.5508
Adequate number of buyers	0.97	1.3123
Distance to commonly used market	-0.02***	0.0082
Membership in any farm group	-0.70	0.9433
Transaction delay: incidence of misreading of boluses	-1.81**	0.9410
Grade uncertainty: buyers look for age as a quality attribute	-1.36*	0.9014
Speed of payment	0.47***	0.2185
Trustworthiness (incidence of non-payment by buyers)	2.59**	1.3042
Existence of formal contracts	1.32	1.1710
Herd size	-0.01	0.0095
Farmer's education	-0.12	0.2343
Farmer's age	-0.01	0.0319

Negotiation costs appear to also play an important role in market selection among the cattle smallholders in Botswana. Incidence of misreading of boluses and distance to commonly used market negatively influence the proportion of cattle sold to the market. A long distance to the commonly used market by farmers showed a negative effect on the proportion of sales through butcheries. These commonly used markets are usually where the butcheries and BMC buy cattle after they have gone through all inspections by the veterinary officials and police officers certifying cattle ownership. The animal identification-related issues are also found to significantly increase transaction costs in participating in markets, particularly the BMC cattle market channel. This might explain why farmers in Botswana have been opting for the butcheries rather than BMC since the latter imposes more quality requirements.

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9   Although a significant number of farmers sold their cattle to individual traders, such farmers are included in the econometric analysis only if they sold their cattle to butcheries or the BMC.

With regard to monitoring and enforcement costs, speed of payment and incidence of non-payment by buyers had a positive influence on market participation. Accordingly, the coefficients of speed of payment and incidence of non-payment by buyers (trustworthiness) increased the cattle transactions through butcheries. This implies that farmers incurred fewer monitoring and enforcement transaction costs when selling to the butcheries than to the BMC. As mentioned above, farmers had to wait two weeks to get paid once they had made transaction to the BMC. Payments from the BMC sometimes go beyond two weeks when financial circumstances do not allow farmers to be paid within the scheduled time. This could be one of the factors that discourage farmers from selling their cattle to the BMC, particularly at times when farmers are desperately looking for money to cover their household expenses.

Grade uncertainty (i.e. the risk that cattle sold directly to the BMC may not grade as expected) negatively influences proportion of cattle transactions through butcheries. This is consistent with the findings of Bahta et al. (2013), who identified the factors which lead farmers to access distant markets in search of better prices as lack of awareness and information about the quality requirements of markets such as the BMC. This also leads to the reluctance of farmers to sell young animals or weaners when BMC agents collect animals from farms.

The three household characteristics variables—herd size, level of education and age – do not have a significant effect on market channel participation. All three variables have negative coefficients, which suggests that a one-unit increase in each of the variables would have a negative effect on the butcheries market channel. For example, a one-unit increase in herd size is expected to decrease the proportion sold through butcheries by 1%. There would be a corresponding increase in proportion sold to farmers' participation in the BMC market channel.

Conclusion and implications

This study has attempted to analyse the downstream cattle supply chain and cattle farmers' marketing behaviour and decisions by employing TCE. The application of the TCE approach allowed us to explain the factors that influence the downstream cattle supply chain and marketing decisions by analysing cattle sales to butcheries and the BMC, the two main cattle markets used by livestock farmers in Botswana. Market participation decisions and transaction costs are found to be interrelated. Our empirical results shed some light on the existing question of why smallholder cattle farmers in Botswana make relatively little use of BMC livestock markets (the only entity allowed to export beef).

Our analysis confirms the hypothesis that transaction costs play a significant role in influencing the marketing behaviour of smallholder cattle farmers in Botswana. The results suggest that availability of market or price information reduces, while extension visits increase, the proportion of cattle sales through butcheries. This might be helped by the fact that farmers attain timely and reliable market price information from extension officers and the information disseminated via such means as radio and television, which a majority of the farmers (one third of our respondents) have access to. The implications of these results are that the institutions that attempt to reduce information costs may have to provide farmers with price information of other alternative market channels. This then increases their ability to discover market price information and negotiate better. Furthermore, the study confirms that the marketing environment does still impose a number of negotiation and bargaining costs, especially transaction delays, distance to the nearest market and monitoring costs (grade uncertainty) on farmers.

The negotiation, bargaining and monitoring and enforcement costs may prove more difficult to change; therefore, particular measures should be directed to addressing these transaction costs. To reduce the monitoring and enforcement costs, the BMC may consider fast-tracking payments to farmers, which in the long term may boost the trust between farmers and the BMC. Improvement of vertical integration between the two sectors will go a long way in helping Botswana efficiently use the lucrative EU market. Government policies that minimize the transaction costs of trading between cattle farmers and the BMC would also be very important in increasing market participation in that channel and improving the downstream cattle supply chain targeted for export, which is well known for its high supply fluctuations.

Acknowledgements

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Social networks and fodder innovations to enhance animal performance in communal areas' dairy value chain systems

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Abstract

Governments are main stakeholders in rural livestock enterprise development. However, national institutions have limitations with regard to financing of infrastructure, information and technology dissemination, and local social networks that are necessary for sustainable production of milk and meat. The added pressure of climate change causes severe shortages of forage, which affects dairy milk production from smallholder farms and subsequently results in suboptimal performance along the milk value chain. Inefficiency in resource utilization impedes values chains. The focus within the dairy value chain system is to build capacity by strengthening social networks, which would foster learning and uptake of forage production innovations; and stimulating network members to pool financial and physical resources in order to access input and product markets. Farmers with dairy cattle (two to six animals) were clustered into small groups of ten households per community that were linked to existing but dormant farmer groups involved with cropping within the same environment. Information and knowledge exchange engagements were facilitated which culminated in farmers selecting and testing productivity of grass under dryland conditions within their backyards. Thirty-three pasture gardens (100-200 m2) were planted in three sites during the 2014/15 season. Cactus, Napier grass, legumes (lablab and cowpea) were selected by most farmers and were adaptable. Wastewater and manure were recycled from the dairy system to feed the pasture. On average 60% of farmers indicated their intention to intensify pasture gardening or combine it with food crops to produce supplementary green fodder at low cost. Farmers tested the feeding of improved fodder to dairy cattle but milk production was slow due to low availability of supplementary fodder. This challenge was addressed by the Department of Rural Development, which supported the social networks of dairy farmers with non-dairy farmers. The platform created opportunity for milk producers to have more access to locally produced forage and crop residues. About 3–6 ha of dryland spineless cactus pasture were initially established by cropping groups in two sites, with 10 ha per site expected in 2016/17, to increase biomass production from both leguminous and grass-based dryland pasture. Expected improvements in milk and milk product sales will generate sufficient income to sustain cropping of adaptable forage species and reduce farmer dependency on external microfinance. There is a need to diversify forage production to include multipurpose trees, upscaling production of indigenous species to improve feed quality and fodder flaws. Continued mentorship and coaching is recommended to improve farmer skills and knowledge.

Keywords: communal grazing, forage nutrition, food security, climate-smart pastures, cactus

Background

Rural livelihoods in semi-arid rangelands of the Limpopo province are threatened by increasing human population and climate change. About 74% of the 12 million ha in the Limpopo province is grazing area. The province is divided into five districts: Sekhukhune, Mopane, Vhembe, Capricorn and Waterberg. Siebert et al. (2002) and Victor et al. (2003) noted that Sekhukhune was exceptionally rich in biodiversity. However, the rise in human and livestock population and modernization of rural communities have changed the Sekhukhune landscape. Initiatives to improve food and income security among the rural poor are commendable but implications of maximising natural resource utilizations for economic gain have not been fully explored against ecological consequences. The study evaluated trends in national forage production and the status of the communal grazing lands utilized by indigenous small stock and cattle, and assessed community engagement in cultivation of climate smart dryland pastures to optimize natural and human resource utilization in livestock value chains.

Rural livelihoods and grazing lands

Acocks (1988) characterized vegetation in the Sekhukhune district as semi-open woodland with a strong grass component (mixed bushveld, sour mixed bushveld) and grassland (Bankenveld and sour veld), as also noted by Palmer and Ainslie (2005). This vegetation plays a critical role in livestock nutrition and production. Ecological sustainability of the grazing areas is critical to communities as livelihoods are dependent on ecosystem services. Cattle are the preferred livestock in communal areas. The populations of cattle exceed 100,000 in Sekhukhune alone, followed by goats, with sheep numbers lower. Fewer farmers own more than 10 animals. Woody shrub encroachment has increased over the years (Hoffman and O'Connor 1999). According to Siebrits et al. (2002) and Van Wyk and Smith (2001), the Sekhukhune district has rich biodiversity and a high level of endemism. Victor et al. (2005) observed variations in species composition and abundance between under-utilized areas and grazed areas. Palatable species lose vigour, tuft mortality is high and plants disappear. Associated consequences including bare patches, poor water infiltration, high soil erosion, siltation of streams and bush encroachment, are also evident (Mpandile et.al. 2015; Tainton et al. 1981). Biomass production is reduced (Tilman 1999) and the nutritional quality of palatable species declines. This further translates into loss of livelihoods as livestock turnover is low.

Figures 1 and 2 illustrate national production status of hay crops in South Africa. The most commonly produced dryland fodder crops include *Medicago sativa* (lucerne), *Eragrostis tef* (teff), *Avena sativa* (oats), *Eragrostis curvula* (lovegrass), *Digitaria eriantha* (Smuts finger grass) and *Vigna unguiculata* (cow peas). Crop residues of grain sorghum, wheat and maize stover also contribute to forage supply, especially on commercial systems. There are clear cycles in the forage trend, possibly associated with droughts and economic recession. Forage seed and hay production is insignificant in communal areas where the needs are greater. The study illustrates the importance of examining the ecological history of natural environments shared by communal communities. The focus is on forages that provide nutrition for livestock. The soils in communal areas are highly degraded and susceptible to wind erosion; hence, a shift in land use toward water efficient crops is urgent.

Figures 1 (left) and 2 (right). National forage production and gross value in South Africa

Natural pasture assessment

Three adjacent wards of Makhuduthamaga municipality, the southeastern region of Sekhukhune district, which hosts the largest herds of beef cattle (52–55,000), sheep (11–12,000), goats (40–45,000) and dairy cattle (less than 100), were selected. The Sekhukhune district was described by Tainton (1999) as eastern mid-bushveld with a carrying capacity of 6–15 livestock unit (LSU/ha). Species identification and abundance were determined using the transect line method (Tidmarsh and Havenga 1955). Three plots of 100 * 100 m were selected in each ward and random transects of 100 m x 2 m used to determine the species composition. The wheel point apparatus was used. The number of dominant species was also estimated by measuring the diameter of the canopy in line with the transect and height of plant (Roux 1963).

The Sekhukhune communal area grazing lands are degraded (Figures 1 and 2). Increasers dominated the landscape and the most prevalent species were Heteropogon contortus and Eragrostis lehmaniana. Hyparrhenia hirta was the most dominant species. Bare patches constituted 13% of the grazing area. The decreaser had the least proportion and indigenous legumes were insignificant, indicating overgrazing (Ellery et al. 1995; Cowling and Richardson 1997).

Figure 3. Map of the Limpopo district
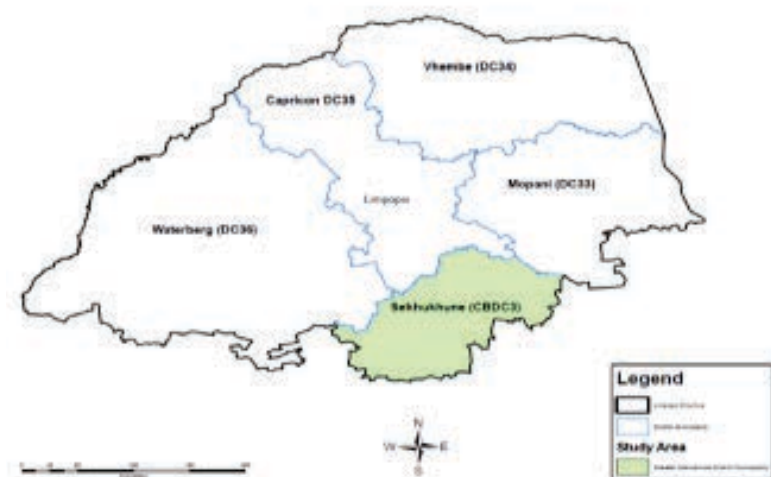
Source: ARC-ISCW (2014)

Disturbance indicators such as *Bothriochloa insculpta, Aristida adscensionis, Senecio microglossus, Eragrostis gummiflua and Elionurus muticus*, an unpalatable wire grass, were also identified. Themeda triandra, Digitaria eriantha, Brachiaria

nigropedata and Eustachys paspaloides were not recorded; usually these are the first grasses to disappear in overgrazed areas. The skew toward disturbance indicators and intermediate grasses was clearly an effect of overgrazing.

Figures 4 (left) and 5 (right). Grass species of the Sekhukhune district in the Limpopo province

It is very clear that veld condition is the first limiting factor to animal performance in the selected communal area. The livestock composition and breeds in Limpopo communal areas are transforming as the South African dairy industry transforms. The introduction of small sized dairy breeds such as the Jersey is certainly increasing grazing pressure on the fragile environments. The National Livestock Strategy for South Africa is aligned with strategies for farm fodder production. In these scenarios water-efficient crops are recommen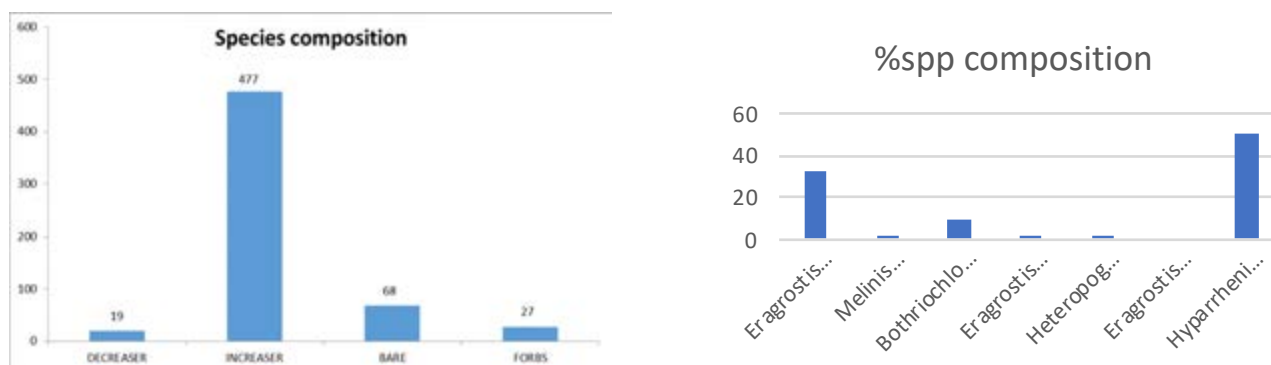ded as South Africa is a dry country and most areas are susceptible to climate change effects. The Forest and Veld Conservation Act (1941), the Soil Conservation Act (1946) the Conservation of Agricultural Resources Act (1983) and the National Grazing Strategy (1985) are supporting instruments for improving carrying capacity in communal areas. Frameworks proposed by the Department of Agriculture Forestry and Fisheries (DAFF) and include the National veld and forage programme, strategy and implementation framework, National veld and forage databank, the national veld and forage working group and the Interdepartmental technical working group (ITWG) on the sustainable management of veld and forage resources. The policy frameworks are not aligned with community working/social groups, where high-value livestock production is being piloted and limited progress in livestock development is therefore expected. Production of fodder in resource-limited environments has high input costs, mainly financial. Financial support to communal area livestock entrepreneurs is scarce. Promoting water-efficient crops on underutilized arable land is therefore key in increasing carrying capacity of communal area pastures.

Creating communal area fodder value chains

The aim of this case study was to assess community engagement in uptake of an innovation in collective fodder production. Spineless Opuntia ficus indica varieties were selected as test crops for establishment by collective groups of farmers in two semi-arid communal areas of the Limpopo province. The South African genebank hosts 42 cultivars which originated from Mexico (Felker et al. 2006). Most varieties are palatable, with annual yields of 100 leaves/plant.

Selection of farmer

Participation in the fodder value program was voluntary. Land availability was used as the selection criterion. Following focus group meetings with community members, a 'council of stakeholders' and key informants for the areas to characterize farming households, four scenarios were enacted which generally characterize the farming community.

Scenario 1: Defunct cooperative of 10 members. Owned arable land that had been fallow for at least three years. Referred to as Cooperative1.

Scenario 2: Cooperative of smallholder dairy farmers, with a herd of eight animals grazing on private and communal lands, and 0.2 ha fallow pastureland. Extensively supported through national programs but unsustainable. Referred to as Cooperative2.

Scenario 3: Smallholder farmer, 4 ha arable but fallow land next to homestead, no dairy cattle. Referred to as F1.

Scenario 4: Smallholder farmer practising mixed farming, small herd of semi-zero grazing dairy cattle and arable fallow land next to homestead. Referred to as F2.

Scenario 5: Ten smallholder farmers with Jersey dairy cattle (average of four animals/household). Less than 0.1 a arable land for pastures and did not plant cactus. Referred to as F3: milk producers, planned cactus buyers.

Resolutions with clear objectives on cropping and financial implications were signed with the Department of Rural Development and Land Reform (DRDLR) for Limpopo. Spineless cactus (*Opuntia spp*) pear pastures were established in October 2014. Long-term annual rainfall ranges between 350 and 800 mm, with a mean maximum temperature of 30oC and a minimum of 14oC. Healthy cladodes of *Opuntia ficus-indica* (L.)—fodder cultivars of Variety1, Variety2 and Variety3, weighing about 900 g and 40–50 cm long, were harvested from a cactus genebank. Mature cladodes were detached from the plant using a sharp knife, and treated with a disinfectant. Cooperative1 planted 400 leaves of variety1, 400 of variety2 and 360 of variety3 on adjacent plots. Cooperative2 planted 200 leaves of each variety; F1 planted 350 leaves of each variety; and F2 planted 200 leaves of each variety. Plant spacing was 2.5*2.5 m and no fertilizer or supplementary irrigation were applied. Regular pest scouting was conducted by owners. Technical support was provided and training in fodder bank management provided. All costs for initial establishment were funded. No additional funding was provided after year 1 harvest and sales.

Figure 6. Opuntia pasture integrated with natural grasses

Vegetative growth was assessed at 6, 12, 18 and 24 months to determine plant height, number of new cladodes and size (length and width). Variety1 and Variety3 averaged 51 cm at six months while Variety3 had the slowest growth (Figure 1). Variety3 had the tallest crop at 12 months, indicating that more rapid plant growth continued through the dry season compared to the other cultivars. Variety1 has an upright habit, is flat/round, and reaches 240 cm height at maturity while Variety3 is spreading, with lower height, and Variety3 is of medium habitus and grows to a height of 203 cm (Oelofse et al. 2006). At 12 months, Variety3, however, seemed to outdo the upright cultivar Variety1. Variety1 did not perform as expected for an upright habitus. Anomalous observations in plant habit are associated with phenotype elasticity in cactus which Pimienta-Barrios and Del Castillo (2002) attributed to adaptive survival.

Figure 7. Growth performance of three Opuntia ficus indica varieties on dryland pasture in Limpopo
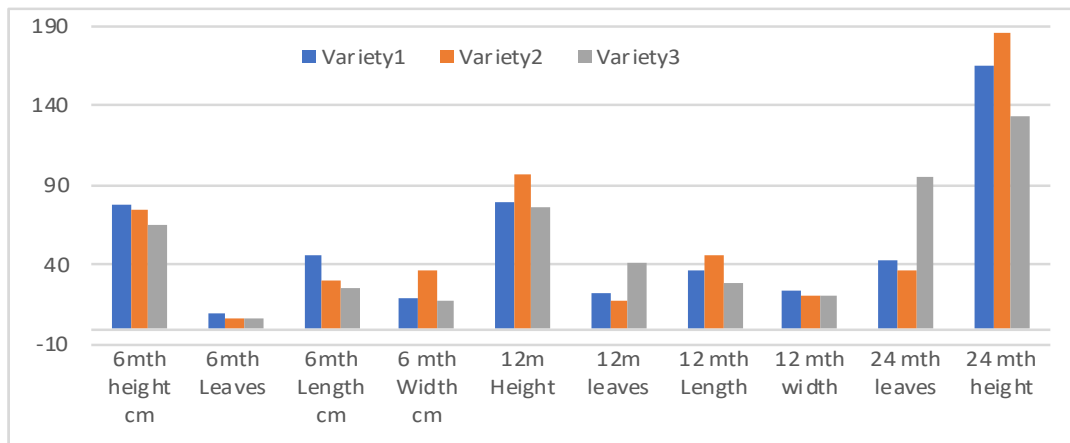
At six months, Variety1 was more prolific, reaching 10 cladodes/plant whilst variety2 and 3 averaged three cladodes and some plants did not have any pads. The growth patterns did not change with plant age, as these traits are mostly linked to crop morphology and adaptability. Variety3 was more prolific, with up to 42 cladodes, double that of other cultivars. Oelofse et al. (2006) observed early vegetative bud growth and maturity with Variety1 and Mashoke (2007) noted that Variety1 yielded about 51 cladode/plant/seasonal pruning and Variety3 had a lower yield than other cultivars. Variety3 tends to have heavier cladodes (2.8 kg) than Variety1 (1.5 kg/cladode) (Mashoke 2007). Within a period of six month new cladodes of Variety1 and Variety3 had grown to a length of 46 cm. Variety1 had wider cladodes while Variety3 had smaller leaves. Odd width measurements of 37 cm were noted for Variety3. Mashobe (2007) also found that fodder cultivars are prolific under the dryland conditions of Limpopo and recommended Variety3 for fodder production. There were no cladode deaths and cochineal infestation confirmation was low. Biomass yield was determined on 40% harvest at 12 months and 60% harvest at 24 months. The recommended waiting period is 18–24 months. The cooperative groups expected income seasonally and hence harvesting was carried out at 12 months. Biomass yield was affected by the 2015/16 drought; however, crop mortality was less than 1%. Results reported here relate to cooperative2 only.

The 12-month harvest and income from crop sales was impetus for Cooperative2, whose members requested further training and opportunity to expand the fodder bank. There was greater expectation in Cooperative2 and F2, who had direct use of the fodder for the dairy herd. The fodder bank at Cooperative2 was poorly established and management was poor. The F2 fodder bank was established well but neglected after year 1; farmers were not keen to feed their cattle even though they had feed challenges and the cattle were in poor condition. F2 did not harvest in both seasons. This scenario indicates that direct financial gains influence how farmer groups input into a production system. Lethargy was noted in farmers who owned dairy cattle and seemed to have the greatest need for the fodder. Cooperative2 had no other source of forage except grazing degraded natural pastures. The cattle were in poor condition and calf mortality was high.

Figure 8. Biomass yield, year 1 income and projected income for year 2 harvest
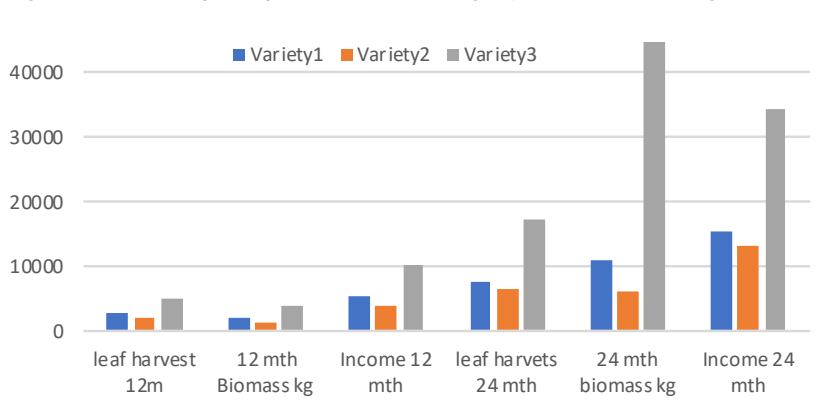
Conclusion

The Sekhukhune cactus pastures was the first commercial stand established for the production and sale of cactus cladodes as forage to smallholder farmers with dairy cattle in communal areas of Limpopo. All cultivars planted in the Sekhukhune district continued to grow during the dry season. The vegetative yield of the crops was within the norm for extensively managed pasture. Establishment of low input dryland cactus pastures will improve dry season fodder flow for smallholder dairy farmers in communal areas. It is important to understand the poor participation of dairy cattle owners in fodder value chains.

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Contributed papers session 6: Agricultural credit impact assessment and regional trade

Impact of environmental risk on livestock commodity trade in the Southern African Customs Union (SACU)

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Abstract

The performance of third world economies has generally been characterized by poor policy formulation and implementation; low production capacity and efficiency; low investments and savings; and poor infrastructure development. These chains of events have not only compromised their development endeavours but also compromised the operations of their core industries and eroded their competitiveness in international trade. By and large, these are a result of risks inherent in developing economies, i.e. low economic growth, small, fragile, and fragmented economies, erratic weather patterns and high dependence on the physical environment. While there is a general recent consensus in the empirical trade literature that risk is an important impediment to trade, there is still little empirical evidence. Therefore, this paper statistically analyses the impact of aggregate environmental risk on bilateral trade in the Southern African Customs Union (SACU). This will potentially help small-scale farmers tap into foreign markets to access much-needed funds. The unit of analysis in this paper is livestock commodity imports between bilateral partners within the SACU trade bloc. The analysis involves the construction of an environmental risk index (ERI) which is then used to estimate the effect of environmental risk on bilateral trade in a gravity model framework. From the empirical results, it can be deduced that the high incidence of environmental risk events in the SACU realm reduces trade within the bloc. This result is robust across different estimators and risk measures.

Keywords: Environmental risk index, livestock trade, SACU, gravity model

Introduction

By the year 2010, it was estimated that 1.5 billion people make their living on small family farms. Around the same time, in sub-Saharan Africa (SSA), it was reported that 80% of farmers practise subsistence agriculture and 65% of the active population make a living from agriculture. However, the estimated investment into the sector was a meagre 4%. This led researchers to conclude that there was a general lack of funding in small-scale agriculture, both from the public and private sectors (World Bank 2008).

The challenges facing small-scale farmers are well documented in the literature. These include lack of access to credit, inability to access foreign markets, low production capacity, overreliance on the physical environment, small subsistence-tailored enterprises, lack of insurance etc. Small-scale farmers from developing countries face additional problems and are most vulnerable to risky events. This is because of the characteristics of their home countries: low economic growth, small, fragile, and fragmented economies and erratic weather patterns.

These are a result of a problem which has, however, not been fully explored in the literature: risk. Risk affects small-scale farmers at all the levels of the value chain (inbound logistics, production, processing, marketing and trade). For a long time, access to credit has been headlined as the major constraint preventing small-scale farmers from making the transition to mainstream agriculture. However, the fact that a solution has not been found might mean that other avenues have to be explored. One of the undisputed ways by which farmers can access credit is through tapping into foreign markets. This is, however, not without its own challenges. As all business transactions involve some degree of risk, those that occur across international borders carry additional risks (Meldrum 2000). This is where the government can play the most crucial role in enacting policies that mitigate the risk.

This paper aims to investigate the impact of a specific type of risk (environmental) on livestock trade within SACU. Due to the important role that trade plays in the international economic system, unfavourable events, e.g. drought or disease outbreaks, in the domestic economy can negatively impact the economies of trade partners. Since developing countries are said to be less resilient to such risky events, it would not be inconceivable to expect that their fragile economies would be the most affected by unfavourable events.

The contribution of this study to literature is twofold: it advances our understanding of the risk-trade interaction in a South-South trade bloc setting and it contributes to the literature that seeks to understand why small-scale livestock farmers cannot readily make the transition to mainstream agriculture.

Literature

Finding a universal definition of risk in the literature is an impossible task is because risk means different things to different people in different disciplines (Robinson et al. 2007). A risk can be defined as a situation in which there is possibility of loss and volatility of returns (with known probabilities) but the ultimate outcome is not known (Kay et al. 2011).

The overlap between environmental factors and international trade was not satisfactorily explored in the literature until recently (Oh and Reuveny 2010). This is primarily because the scourge of climatic change had not been fully understood. Adverse weather and climatic conditions are likely to result in significant economic losses. These losses may be more pronounced in developing countries, which lack resilience (World Economic Forum (WEF) 2013). Researchers have noted the importance of economic development in reducing vulnerability to adverse environmental factors and their effects. They argue that a critical underlying factor for any economy's response to the effects of a natural disaster is the level of wealth at its disposal (WEF 2013; Oh and Reuveny 2010).

With the high global focus on climate change and environmental issues, much of the focus in the trade literature in recent times has been on the effect of trade on the environment (Managi et al. 2009; Frankel and Rose 2005; Antweiler et al. 2001). For some time, researchers have been analysing how trade intensity affects environmental quality and sustainability. However, both the theoretical and the empirical literature on trade, economic development and the environment are still largely inconclusive about the overall impact of trade on the environment (Managi et al. 2009). For the most part, the effect of environmental factors on trade has been neglected in the literature.

Drought, floods and other extreme weather patterns are some of the environmental risks facing SACU countries. Unpredictable rainfall patterns and extreme temperatures affect and compromise the competitiveness of the agriculture sector. Extreme rainfall and temperature patterns lead to floods and droughts which disrupt farm operations. They also increase the incidence of pests and infectious diseases which reduce productivity and profitability in agriculture. Rainfall and temperature are the chosen environmental indicators.

Methodology

This section presents the methodology used to empirically determine the impact of environmental risk on livestock commodity trade in SACU. The ERI is constructed following the methodology outlined in (Organization for Economic Co-operation and Development (OECD) 2008; Nardo et al. (2005).

Gravity Model

Due to its impressive record in empirical trade studies, the gravity model of trade is the model of choice in this paper. It postulates that the flow of commodities between two countries is positively related to their size and negatively to the distance between them (Anderson 2011; Martinez-Zarzoso et al 2009).

$$X_{ij} = \left(C\, Y_i^{\alpha}, Y_j^{\beta}, D_{ij}^{\delta}, \varepsilon_{ij} \right) \tag{3.1}$$

Where: X_{ij} is trade; Y_{ij} is a measure of economic size (proxied by GDP); D_{ij} is the distance between i and j; and εij is the error term.

Composite risk index

$$ERI_{ijt} = (Rain * \omega)_{ijt} + (Temp * \omega)_{ijt} \tag{3.2}$$

Where: ERI_{ij} is the ERI; Rain is average annual precipitation; *Temp* is average annual temperature; and ω is the assigned weight.

Model specification and estimation

$$\begin{aligned} lnX_{ijt} \\ = C + \alpha lnY_{it} + \beta lnY_{jt} + \delta lnD_{ij} + \theta lnYpc_i + \vartheta lnYpc_j + \varphi_1 lnERI_{it} \\ + \varphi_2 lnERI_{jt} + \lambda_1 Border_{ij} + \lambda_2 Lang_{ij} + \lambda_3 Col_{ij} + \lambda_3 Landlock_{ij} \\ + \lambda_4 Curr_{ij} + \mu_i + \nu_j + \varepsilon_{ij} \end{aligned} \tag{3.3}$$

Where: lnXijt is the natural log of the total monetary value of livestock commodity trade at time t; μ_i and ν_j are country-fixed effects of i and j (i.e. dummy variables for a country being either the importer or the exporter in a pair); Y_{ijt} is the Gross Domestic Product (GDP) of the importer and exporter at time t; and Y_{ijt} is the GDP per capita of the importer and exporter at time t. lnD_{ij} is the natural logarithm of the physical distance between the main economic centres (usually capital cities) of the trade partners *i* and *j*. Borderij takes a value of 1 if *i* and *j* are contiguous. Langij takes a value of 1 if *i* and *j* share a common official language. Colij takes a value of 1 if *i* and *j* were colonized by the same country. Currijt takes a value of 1 if the currency of *i* (or *j*) is an accepted legal tender in *j* (or *i*) at time t. Landlockij takes a value of 1 if both countries are landlocked. φ_1 $lnER_{ijt}$ is the importer and exporter at time t; it is expected to be negative as risky economies are expected to trade less, assuming that the risk is pure risk, i.e. the likely consequences of a risky event are considered to be bad, offering no prospect of a gain.

The analysis involved the use of the panel data technique of fixed effects estimation, using the method of Poisson Pseudo Maximum Likelihood (PPML) and homoskedastic standard errors. This methodology accounts for country heterogeneity and zero trade flows; most importantly, it addresses model misspecification and biased estimates by accounting for multilateral resistance terms (MRTs) (Head and Mayer 2013; Westerlund and Wilhelmsson 2011; Santos Silva and Tenreyro 2006; Anderson and van Wincoop 2003). The Ordinary Least Squares (OLS) and Generalized Least Squares (GLS) estimation methods served as robustness checks.

Results

This section presents the results of the environmental index construction stage. The model used is presented in equation 3.2.

Table 1. Statistical properties dimension risk indices of the indicators that compose the ERI

Sub indicator	Goalposts for calculating ERI		Statistics across SACU countries		
	Observed minimum	Observed maximum	Mean	Standard deviation	Skewness
Rain	22.4	131.4	50.5	19.3	1.18
Temperature	12.4	23.0	19.1	3.28	-0.947

Table 1 presents the values used to normalize the data. The minimum and maximum values are obtained from the data and used to convert the data into unit less values between 0 and 1 (OECD 2008).

Table 2 presents the ERI for the SACU states. The least developed countries in the bloc, Swaziland and Lesotho, have the highest indices over the time reviewed, 0.58 and 0.33 respectively. As expected, South Africa has the lowest index, 0.31.

Table 2. Dimension statistics of the ERI of the SACU states

Dimension statistics			
	Environmental risk index		
Country	Mean	Std.dev	PDF
Botswana	0.319	0.102	U
Lesotho	0.328	0.0482	Lp
Namibia	0.319	0.0955	Lp
RSA	0.308	0.0332	EVM
Swaziland	0.578	0.0975	EV

EVM (ExtValMin); Lp (Laplace); U (Uniform); N (Normal); T (Triangle); P (Pareto); EV (ExtValue).

Figure 1 below presents the probability distributions of the ERIs of the SACU states from 2000-2014. The most developed states in the bloc (Botswana and the Republic of South Africa) have more stable ERIs over the time period. This could be due to their accumulated resources and more dynamic economies, which help them recover more quickly from adverse events. Lesotho and Namibia have similar ERI distributions (Laplace). This distribution is characterized by a sharp increase for half the time period, mirrored by a sharp decrease in the other half. Swaziland had a high index early in the data range and then experienced a drastic decrease overtime.

Figure 1. The distribution of ERI for SACU states across time
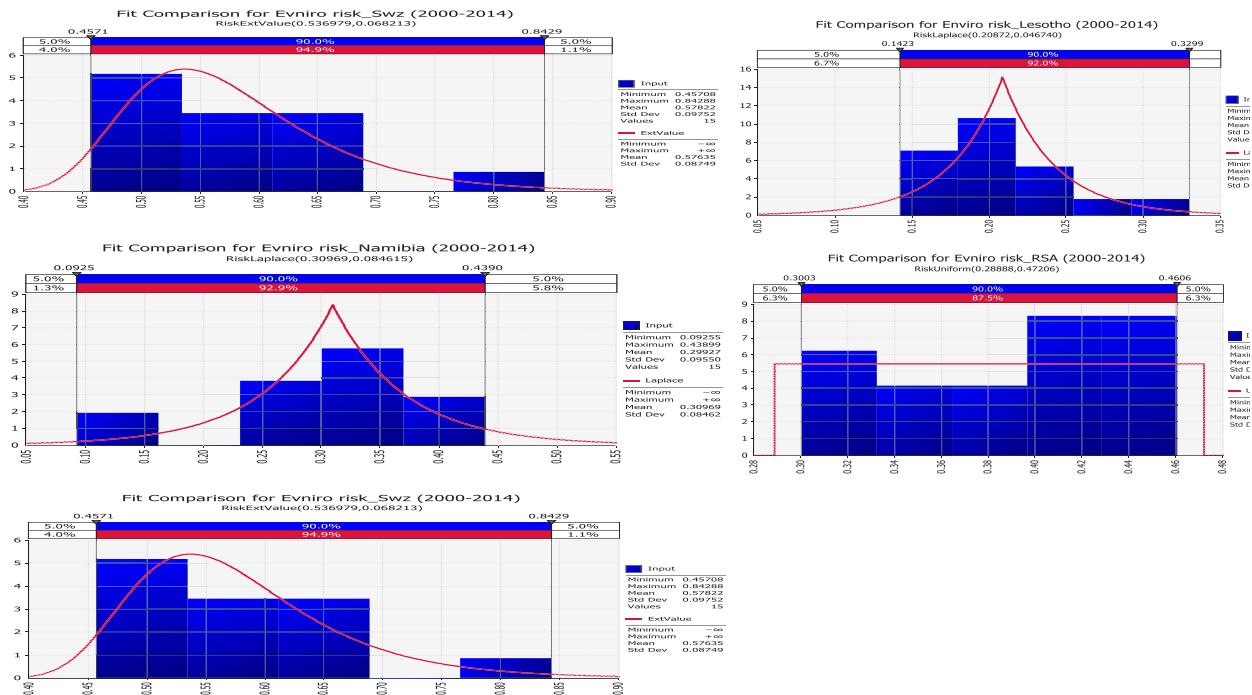
Table 3 below presents results from the augmented gravity model estimation. It presents the impact of the ERI on livestock commodities' bilateral trade for the importer and exporter in SACU. Significant variable coefficients are presented in bold, the asterisk represents the level of significance and robust standard errors are shown in parenthesis.

This paper investigated the impact of environmental risk on bilateral trade volumes. The model was augmented with an ERI for the importer and exporter; these are therefore the variables of interest. Both the variables of interest are significant and have the expected signs. A 10% increase in the incidence of environmental risks on the importer side decreases livestock trade by 4.9%. This result is conceivable because an increase in adverse weather conditions could disrupt daily operations in livestock farming. This would mean fewer animals are available to meet local and external demand. The exporter risk variable is also negative. A 10% increase in the incidence of risky events leads to a 2.3% decrease in bilateral livestock trade. This result was expected, as an increase in risk in the exporting country would mean that fewer goods are produced and available for export.

Worth noting is that the importer GDP variable is negative. This is plausible as, according to Engel's law, as a country's wealth increases the proportion of income spent on food commodities decreases. From the rest of the results, importer and exporter GDPs are both important factors in bilateral trade; they both have significant coefficients albeit with different signs. The sign of the importer GDP variable is positive. This means that an increase in GDP (growth in the domestic economy) increases imports as domestic consumers increase their consumption of food commodities.

Table 3. Gravity model results

Method Estimator Dependent variable	F.E PPML (Xij)	Pooled OLS OLS ln(Xij)	R.E MLE ln(Xij)	R.E GLS ln(Xij)	F.E ln(Xij)
lnGDP_im	-2.45*	0.480	-0.0695	-0.072	-5.87
	(0.00109)	(0.785)	(0.657)	(0.884)	(4.32)
lnGDP_ex	1.03*	1.66	1.10***	1.10	-6.17
	(0.00118)	(0.777)	(0.644)	(0.854)	(4.77)
lnDistance	-0.967**	-2.26	-1.84**	-1.84***	
	(0.852)	(0.780)	(0.808)	(0.934)	
lnGDPpc_im	2.51*	-0.962	-0.57	-0.569	-7.05
	(0.00124)	(1.15)	(1.05)	()1.34	(4.94)
lnGDPpc_ex	-11.3*	-2.27	-0.930	-0.923	7.81
	(0.00139)	(1.13)	(0.992)	()1.27	(5.74)
lnEnvR_im	-0.485*	-0.146	-0.378**	-0.380***	-0.502
	(0.0000579)	(0.206)	(0.180)	(0.223)	(0.251)
lnEnvR_ex	-0.228*	-0.598	-0.030	-0.0319	-0.211
	(0.0000776)	(0.264)	(0.202)	(0.237)	(0.279)
Border	-3.71**	-1.76	-0.722	-0.717	
	(1.78)	(1.46)	(1.63)	(1.72)	
Language	-3.27*	2.73	4.12**	4.13***	
	(1.52)	(2.16)	(1.83)	(2.38)	
Colony	-3.07	2.83	2.20*	2.20**	
	(1.09)	(0.839)	(0.915)	(1.06)	
Currency	-0.761	-2.84	-2.22**	-2.22**	
	(1.53)	(1.05)	(1.06)	(1.21)	
Landlocked	8.31*	-5.39	-2.85	-2.84	
	(3.01)	(2.93)	(2.88)	(3.28)	
R^2		46		45	24
Number of obs.	5796	2162	2162	2162	2162

*, **, and *** are confidence levels at the 1, 5 and 10% level, respectively.

As expected, the distance variable is significant and negative. This means the greater the distance between trading partners, the less commodity trade there will be. This was expected when dealing with live animals and perishable animal products.

Conclusion

This paper investigated the impact of environment risk on bilateral livestock commodity trade within the SACU bloc. This was done to ascertain another avenue which could help small-scale livestock farmers access investment funds. In the empirical analysis, the gravity model of trade was augmented with an ERI which quantified environmental risk in the economies of SACU states. An increase in environmental risk has a negative impact on livestock commodity trade. These results were robust under a number of model specifications. Botswana and South Africa had relatively lower ERIs across time. As expected, the more developed countries in the bloc, South Africa, Botswana and Namibia, were

found to be doing very well in managing the risks from the environment. This is evident in their lower environmental indices and better performing livestock sectors. The governments of the other less developed countries, Lesotho and Swaziland, would be best advised to come up with policies that help reduce the impact of environmental risks.

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Disaggregated supply response of cattle and beef in Namibia: An autoregressive distributed lag approach

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Abstract

The non-responsiveness of supply of beef cattle producers to prices in the domestic market is of great concern for the future growth of the Namibian cattle and beef industry. Production and marketing decisions of cattle producers in Namibia are reliant on and influenced by the condition of the rangeland and land tenure systems, coupled with fluctuations in producer prices. The model specified in this article incorporates the dualistic nature of the beef cattle sector. The disaggregation takes into account the existence of the formal and informal beef cattle markets in both the commercial and communal production sector. The objective of this study is to formulate a disaggregated, annual, simultaneous model of the Namibian beef cattle sector that will capture the supply dynamics of the beef cattle industry in Namibia. The autoregressive distributed lag approach is used to test for long-run and short-run response of cattle marketed and beef supplied. Model results show that there exists a long-run equilibrium. The formal beef market adjusts to equilibrium more quickly than the informal beef sector. Own price elasticities are elastic in the long run and inelastic in the short run. The finding is consistent with the argument that farmers who supply informal markets do not respond to selling of cattle stock because cattle is kept for several purposes such as store of value, provision of milk and animal draught power.

Keywords: Autoregressive distributed lag, beef, cattle, long-run equilibrium, supply response

Introduction

Production and marketing decisions of cattle producers in Namibia are reliant on and influenced by the condition of the rangeland and land tenure systems, coupled with fluctuations in producer prices. Of particular importance is that fluctuations are mostly in rangeland condition, leading to significant changes in the amount of beef produced. Rangeland conditions impact the beef cattle and the number of breeding stock retained for future production. Indirectly, the same factors influence the returns to the cattle sector, the utilization of slaughtering facilities, amount of cattle and beef export, income gains and the sector's contribution to the gross domestic product (GDP) of the country. It is important that economic theory postulates that Namibia has a comparative advantage in the production

of cattle and beef on its rangeland and a disadvantage in grain production. The dichotomy of the economic paradox is not unique to Namibia. In fact, Thornton (2010), in a study that outlines the livestock production recent trend and future prospects, states that some developing countries have a comparative advantage in grazing land as well as a disadvantage in grain production. Although Namibia has made use of the comparative advantage analogy to build an industry that has grown with meandering strides, recent data from the industry indicate that production, marketing and exportation of live cattle and beef has shown a modest growth and steady decline (see Figure 1). The modest growth has been overshadowed by the underutilization of domestic slaughter abattoirs and the failure to meet export quotas. Meanwhile, prices of both cattle and beef have shown an upward trend (see Figure 2). This has led to an economic paradox. Deducing from the neoclassical theory of the firm, where supply of a product is expected to match with derived demand, reflected in the price of a product, supply should have a positive relationship to a product's own price, ceteris paribus (Varian 2000). Therefore, it is argued here that the mismatch that exists between supply and price of cattle and beef products should receive considerable examination to provide an explanation of the status of the cattle and beef industry in Namibia.

The declining trend in the cattle industry can be partially explained by and linked to several basic explanatory relationships specified from neoclassical theory: rainfall, land tenure system and foot-and-mouth disease (FMD) outbreaks (particularly in the communal areas in the north of the country) and, recently, feed grain prices. The non-responsiveness of supply of cattle and beef to prices in the domestic market of cattle and beef is of great concern for the future growth of the industry.

Rainfall determines the quality and quantity of available grazing. Below average rainfall results in drought. Furthermore, prolonged years of droughts often extend the herd rebuilding phases. It is noted that during drought, cattle producers can either sell cattle to reduce stock numbers or feed animals with supplement harvested forages, which increases operating costs (Schroeder et al. 2013). The quality of cattle marketed during a drought phase has implications on the producer price. It is reasoned that the cattle classes (such as weaners, mature cows, bulls and oxen) and quality composition of carcass beef undoubtedly changes in response to prices changes in both commercial and communal subsectors.

Technological innovation pursued by the Meat Corporation of Namibia (MeatCo) abattoirs to allow improved slaughter plant capacity for more and larger animals with higher weights and the introduction of a feedlot system through the MeatCo Owned Cattle (MOC) are seen as advancements in attracting more cattle to boost the supply for slaughter stock at MeatCo export abattoirs (MeatCo report 2014). However, the initiatives and efforts pursued by MeatCo are impeded by the high costs of improved feeding and finishing off weaners to the required slaughter weights; grain prices, and quality and quantity of the pastures, influence cattle production costs and decisions.

There is a twofold land tenure system in Namibia: freehold with legal title deeds (in commercial areas); and non-freehold (in communal areas) without legal title deeds to land ownership (Ministry of Agriculture, Water and Forestry (MAWF) 1995, 2009). Under the non-freehold system, land is owned by the government and administered under customary law. The duality of the land ownership system, particularly north of the veterinary cordon fence (N-VCF) and south of the veterinary cordon fence (S-VCF), has resulted in disparities in land management and farming systems employed by cattle producers, with more sophisticated rangeland management practices being followed in commercial areas than in communal areas. The communal areas are home to large herd numbers, with pastures that are overstocked and overgrazed, resulting in lean to poor-quality cattle. Therefore, the land tenure system affects supply side production and the quality of live cattle in both the commercial and communal areas in Namibia (Agra Professional Vision report 2012). The Agra Professional Vision report reveals that most of the cattle marketed in communal areas are classified as grade C0 to C1 (mostly mature cattle (oxen) with lean weight), while in commercial areas cattle are classified as A1 to A3 or AB1 to AB3 (mostly young cattle and with good confirmation and fatness). For example, Figures 3 and 4 show that in 2014, the price difference between grades A and C, AB and C, and B and C, were NAD5.02, NAD3.69 and NAD3.52, respectively. Although the price difference provides incentives for quality-based cattle and beef production, it would impede the co-movement of prices between the two cattle production systems.

The objective of this article is to formulate a disaggregated, annual, simultaneous model of the Namibian beef and cattle sector that differentiates between formal and informal in order to estimate beef supplied and cattle marketed; and, furthermore, to use the model to obtain reliable elasticities for the Namibian beef cattle sector and assess the impact of policy changes on beef cattle prices, supply and demand composition.

The paper is organized as follows: the next sections provide discussion of methods and explanation of results; thereafter, summary and policy directives are suggested.

Figure 1. Marketing of live beef cattle in Namibia (1968–2014)
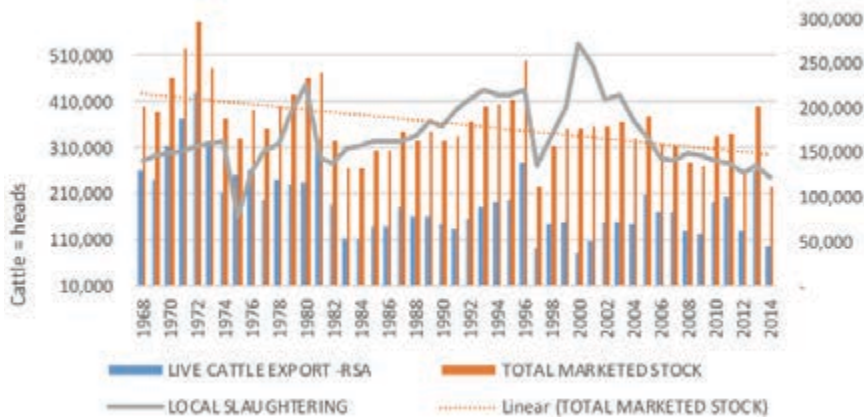
Source: Author's compilation using Meat Board of Namibia dataset 2014

Methods

Empirical research in economics and related fields involving the analysis of long-run relations has been the focus, particularly the application of econometrics approaches. The literature shows that where variables of interest have a stationary trend in a long-run relationship, the general approach has been to de-trend the series and model the de-trended series as stationary-distributed. Thereafter, inference concerning long-run properties of the model are carried out using standard asymptotic normal theory (Pesaran and Shin 1997). However, a large volume of alternative to estimate and hypothesis testing has been developed to analyse series that are integrated of orders 1(I(1)) and order 0 (I(0)). The Autoregressive Distributed Lag (ARDL) is one approach that has the ability to analyse long-run relations when variables are I(1) and I(0). In this study, we estimate two ARDL systems composed of cattle and beef, with each system consisting of two equations capturing the formal and informal subsectors of cattle and beef markets in Namibia. The equations are developed in such a manner that each of the two equations, the contemporaneous cattle and beef change, is expressed as a function of past changes and present truncation of the exogenous determinants and one-period-lag error correction term to capture the deviations from the long-run equilibrium.

Figure 2. Annualized real producer prices of cattle in the disaggregated markets of Namibia
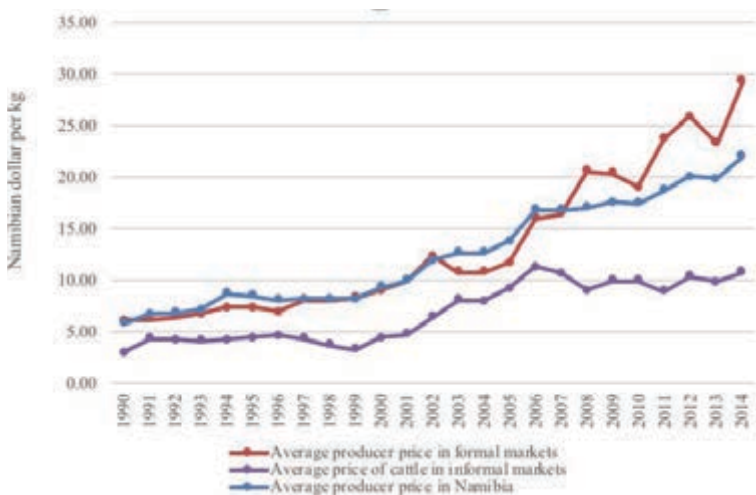
Source: Author's compilation using Meat Board of Namibia dataset 2014

Taking into consideration the narrative information stated above, the supply response model is specified as follows to estimate the supply elasticities for the dual beef cattle sector in Namibia:

i.   Formal market subsector of beef production

ii.   Informal market subsector supply response formation

It is hypothesized that changes in cattle numbers and quantity of beef produced could be initiated either by deliberate policy on the part of the producer or by physical factors such as quality of the available grazing affected by drought (proxied by the amount of rainfall) and technical factors such as carcass mass (proxied by the trend).

The supply response model for the formal market captures the volume of cattle and beef produced and marketed in the formal market channels. Formal market channels include export abattoirs, butchers situated both north and south of the veterinary fence, and exports to South Africa and the rest of the world (ROW). Therefore, four equations of the following functional relationships are formulated for cattle marketed and beef supply in each market:

$$BH1 = f(lnBPP, lnIC, lnSPP, lnRF1, lnBH1_{t-1},) \tag{1}$$

$$BS1 = f((lnBPP1, lnIC1, lnSPP, lnRF1, lnBH1_{t-1},) \tag{2}$$

Where: BH1 is the breeding herd in the formal subsector; BH2 is the breeding herd stock in the informal sub-sector; BS1 is the beef supply in the formal subsector; BS2 is beef supply in the informal subsector; BPP1 is the beef average producer price in the formal subsector; BPP2 is the beef average producer price in the informal subsector; IC1 is the input cost (average maize and veterinary costs) in the formal sub-sector; IC2 is the input cost (average veterinary costs) in the informal subsector; RF1 is the average rainfall in the formal subsector area; RF2 is the average rainfall in the informal subsector area; SPP1 is the sheep average producer price in the formal market; SPP2 is the small stock (goat) average producer price in the informal market; and SPP1 is the sheep average producer price in the formal market. More specifically, BH1 is the number of cattle marketed (1,000 heads) and BS1 is the quantity of beef supplied, based on the carcass slaughter weight (1,000 kg); BPP1 is the beef producer price in the formal market (Namibian dollars (NAD) per kg); IC1 is the input cost (NAD per kg); RF1 is the rainfall recorded S-VCF in millimetres (100 mm); and the inclusion of the lagged dependent variable as exogenous variable BH1 makes the model autoregressive with distributed lags in the independent variables.

Therefore, the following representation of ARDL equation is an expression that captures Equations 1 and 2 and the same representation is applicable to the formulation of the informal and rest of Namibia equation. For brevity, we show only one of the six expressions:

$$\begin{aligned}
\Delta LBH_t &= \alpha_0 \tag{3}\\
&+ \sum_{i=1}^{n} \alpha_{1i}\Delta LBH_{t-1} + \sum_{i=0}^{n} \alpha_{2i}\Delta LBPP_{t-1} + \sum_{i=0}^{n} \alpha_{3i}\Delta LIC_{t-1} + \sum_{i=0}^{n} \alpha_{4i}\Delta LSPP_{t-1} + \sum_{i=0}^{n} \alpha_{5i}\Delta LRF_{t-1} + \beta_1 LBH_{t-1}\\
&+ \beta_2 LBPP_{t-1} + \beta_3 LIC_{t-1} + \beta_4 LSPP_{t-1} + \beta_5 LRF_{t-1} + \varepsilon_i,
\end{aligned}$$

Where: Δ denotes the first difference operator; α_0 is a drift component; ε_i is the white noise residuals; β_1 to β_5 correspond to the long-run relationship; and α_1 to α_5 represent the short-run dynamics of the model. The dataset for estimating the supply response for the subsample (formal and informal) markets and the rest of Namibia has 24 observations (1990–2014) and incorporates data from several sources, such as the Meat Board data portal (2014), and the MeatCo records of the number and volume of cattle before and after the slaughtering process. MAWF, through the Directorate of Planning surveys, has produced data in statistical bulletins on informal beef production, marketing, slaughter weights and prices and Agra Professional Services.

Results and discussion

The ARDL approach has the advantage that it does not require all variables to I(1), a requirement for the Johansen approach (Johansen 1988). Bound test that captures both the I(1) and I(0) time variant data series. Table 1 shows that all the equations for the beef and cattle supply depict the existence of a long-run relationship between the exogenous and endogenous variables. Therefore, the Bound test method of co-integration provides both the short-run and long-run coefficients simultaneously. The null hypothesis that suggests no long-run relationship between the variables at both levels of significance is rejected.

Table 1. Bound Test result of cointegration for the beef and cattle markets in Namibia

Equations	Formal market	Informal market	Rest of Namibia	Critical value Bounds		
				I(0) Bound	I(1) Bound	Significance
Beef equation	5.6793	7.7536	13.7171	2.2	3.09	10%
				2.56	3.49	5%
				2.88	3.87	2.5%
Cattle supply equation	5.7547	15.6977	7.9797	3.29	4.37	1%

Source: Model result 2016

Disaggregated error correction model supply response results

The long-run relationship has been established; therefore, the Bound test and long-run equation provide the coefficients for each co-integrating vector. All the coefficients estimated possess the correct and expected signs. Based on the value of adjusted R-squared for the formal market, informal and the market in broad aggregated, almost 74%, 90% and 71% of the variation in the endogenous variable (cattle marketed) is explained by the variations in the exogenous variables, respectively. Similarly, the value of R-squared for the formal market, informal and the market in broad aggregated, almost 73%, 93% and 86% of the variation in the endogenous variable (beef produced) is explained by the variations in the exogenous variables, respectively. Coefficient signs and magnitudes are acceptable in terms of a priori expectations. Durbin-Watson statistic range is from 2.3 to 2.7.

The long-run supply response relationship

The long-run price of cattle and producer price of beef are significant in the formal market and when aggregated for the rest of Namibia but insignificant for the informal market. For example, the cattle supply response to price for the formal market is 1.894%, compared to 1.023% of the supply response at national level, meaning on average an increase in price for marketed cattle will result in a 2% response to cattle marketed in the formal market compared to 1% at national level. The national average response is low because of the non-response from the informal market. The poor supply response from the informal market is due to a poor off-take rate and poor calving rate, linked to the keeping of cattle for other purposes. The producer price of sheep and rainfall both have the correct signs and are significant at 5% and 10%, respectively. Lagged values of rainfall are important for determining the quality of rangeland: a negative sign implies that poor rainfall leads to drought and passively affects the quality of pasture, then indirectly affects the stocking rate and quality of cattle on pasture. The elasticity of supply with respect to input cost (LIC) is higher in absolute value than own price elasticity for the rest of Namibia.

The short-run supply response relationship

The coefficients in difference terms represent short-run elasticities. Given the nature of cattle production in Namibia, the short-run elasticities are low. The short-run elasticities are of 0.750, 0.625 and 0.863 for the herd of cattle marketed in formal, informal and Namibia (taken as a whole), respectively. Similarly, for beef supply the short-run elasticities are 1.880, 0.802 and 0.867 for the rest of Namibia, formal and informal cattle marketed equations,

respectively. The coefficients of -1.668, -1.347 and -0.737 on the correction term measure adjustment towards the long-run relationship between cattle breeding herd and the exogenous variables (cattle producer price, rainfall, input cost etc.) and are consistent with the a priori expectation because they have a negative sign and are below the value of 2. Similarly, the coefficients of -1.872, -1.323 and -0.813 on the correction term measure adjustment towards the long-run relationship between beef supplied and the exogenous variables (beef producer price, rainfall and input cost).

Own-price elasticities for beef and cattle in Namibia

The own-price elasticity of supply of cattle for marketing and production of beef is inelastic in both the short and long run in Namibia. This can be explained by the factors outlined previously. For example, Table 2 shows that the own-price elasticity for live cattle in a well-functioning formal market is 0.625 and 2.604 for the short run and long run, respectively, which translates to a 76% increase in the long run. Beef elasticities in the same market are 1.852 and 2.507 for the short-run and long-run elasticities, respectively. By comparison, own-price elasticities for the formal market are greater than the elasticities estimated for the informal market. However, taken in broad aggregates, the elasticities for the whole cattle sector are 0.367 and 0.750 for the short run and long run, respectively. Similarly, the elasticities for beef are comparatively higher in the formal than the informal market (0.018 compared to 0.625 and 0.367 at aggregated national level). This means an increase in the price of cattle and beef will result in a small responsiveness to the number of cattle marketed and amount of beef supplied. This is common for a commodity that is kept for both consumption and as a 'capital' good.

Table 2. Own price elasticities

Market segment and products		Short-run	Long-run
Formal market:	Cattle market	0.625	2.604
Beef		1.852	2.507
Informal market:	Cattle market	0.092	0.863
Beef		0.018	0.867
Namibian market:	Cattle market	0.367	0.750
Beef		1.880	1.872

Source: Model result, 2016.

Overall, the estimated elasticities (Table 2) are consistent with a priori expectations and superior to those previously estimated by Von Bach et al. (1998), firstly because we took care of the dynamics in cattle and beef production and marketing using the ARDL approach and Bound test for co-integration tests; and secondly, because the elasticities results reported here are the only complete set of cattle and beef supply elasticities available for Namibia.

Summary and conclusions

This paper estimates the supply response and long-run relationship between cattle and beef as endogenous variables and breeding herd size, input costs, prices and non-price factors such as rainfall in Namibia using the ARDL model. It is shown that both endogenous and exogenous variables exhibited a long-run relationship and appear to be generally acceptable a priori properties. The Bound test co-integration results indicate that there exists an evidence of first order I(1) among the variables. The ARDL form is relevant for modelling integrated series and allows for capturing long-run and short-run relationships. From an empirical analysis of the relationship between the breeding herd size of cattle and beef and producers' prices, rainfall and input costs which are reported here, it is found that the vector error correction model performs well in terms of the conventional criteria of coherency and consistency with theory. Estimated elasticities of cattle breeding herd and beef with respect to cattle and beef producers' prices, rainfall, input costs and prices of competing products are reasonable in terms of the a priori expectations concerning the signs and magnitudes, and econometrically sound. Therefore, recommendations for policymakers should aim at improving the

technical and management aspect of cattle farming such as, firstly, the land tenure system in the northern communal areas (NCAs). This will improve the land management practices and grazing productivity and ultimately improve the quality of cattle produced there. This has a multiplier effect on the cattle production in the NCAs. Secondly, a focus on measure will improve the cow ratio in the communal areas through improved farming practices. Currently the cow rate is too low, at an average of 37.8% as compared to 60% in commercial areas. Thirdly, measures to increase the cow rate can lead to an increased off-take from 9.5%. It is known that each cow will give birth to offspring (calves) annually. Farmers in the NCAs face challenges in accessing marketing facilities and auction points.

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Factors influencing communal livestock farmers' participation in the National red meat development programme (NRMDP) in South Africa: The case of the Eastern Cape province

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Abstract

In 2005, ComMark embarked on the Eastern Cape red meat development programme (ECRMDP) as an initiative to increase the formal market participation of communal farmers. With the end of support from ComMark in 2008, the National Agricultural Marketing Council (NAMC) took over. With funding from the Department of Rural Development and Land Reform (DRDLR) and partnerships with the provincial departments and the municipalities, the program has expanded effectively within the Eastern Cape Province and has been rolled out to other provinces as well; hence, it is now known as the National red meat development programme (NRMDP). The initiative emanated from the observation that the local demand for beef outstrips production, resulting in the importation of more beef. This was against the background that there was untapped potential in the communal farming areas, where 40% of beef production takes place in South Africa, of which 3.3 million head of cattle are found in the Eastern Cape alone.

Although the program has so far made a significant contribution to communal farmers' participation in formal markets, as well as their understanding of the value of formal market participation, empirical evidence to support this notion is still desirable. Hence, this case study was conducted to determine the factors that influence farmers' participation in the program, focusing on the Eastern Cape Province. A logistic regression model was used to determine factors influencing farmers' participation in the program, and the results indicated that distance to markets, stock size, days of fattening and the contribution of the program (income earned from livestock sales through the program) significantly influence farmers' participation. This is an indication that farmers are slowly beginning to understand how they can best make use of the opportunity presented by the program. As regards policy, therefore, it is recommended that communal livestock farmers be encouraged to participate in the program.

Keywords: Communal farmers, livestock, market access, the National red meat development programme

Introduction

Livestock in South Africa, as in other developing countries, is one of the important sources of livelihoods for the poor and has also been shown to be a good commodity for providing a steady and growing income to poor and rural women. For households affected by poverty, livestock products remain one of the few rapidly growing markets within the agricultural sector. It has also been shown elsewhere that the poor earn a higher income from livestock than the wealthy (Delgado et al. 1999). Studies in South Africa have shown that smallholders in some areas have a comparative advantage in certain commodities such as livestock which, if properly supported by targeted public investments, could result in multiplied income and employment benefits for the rural poor (Ngqangweni 2000).

Approximately 80% of the agricultural land in the country is mainly suitable for extensive livestock farming (Department of Agriculture, Forestry and Fisheries (DAFF) 2013), and the communal land occupies about 17% of the total farming area and supports approximately 52% of the total cattle (Beyene et al. 2014). In 2012, there were an estimated number of 3 million communal farmers, accounting for 40% of the total cattle available in South Africa (DAFF 2013). However, Ainslie et al. (2002) found that the quantity of livestock marketed by communal farmers in the Eastern Cape was well below 10% of the total herd size, compared to the 25–30% of their commercial counterparts. Comparing the two categories of farming, it is clear that communal farmers have challenges in marketing their livestock. Among other challenges, these farmers are characterized by lack of marketing infrastructure such as regulated grazing (camps), auctioneering facilities and rural feedlots. These challenges potentially prohibit farmers from full participation in the formal marketing of livestock, and non-participation in markets by livestock farmers in communal areas can mean an opportunity foregone to increase household food security, reduce poverty and export earnings.

Therefore, marketing of livestock is important for the development of the communal sector. Hence, the country embarked on the red meat program. After more than ten years since the start of the program in the Eastern Cape province, it is interesting to undertake some empirical analysis of it. However, this is just a baseline analysis. The objective was to determine the factors that influence farmers' participation in the program, focusing on the Eastern Cape province.

Background to the program

In 2005, South Africa embarked on the red meat development program as an initiative to increase the formal market participation of communal farmers. This initiative was driven by ComMark as the Eastern Cape red meat project (ECRMP) aimed at increasing the participation of communal livestock farmers in the formal market. This emanated from the observation that the local demand for beef outstrips production, resulting in the importation of more beef. This is adjacent to the recognition that there was untapped potential in the communal farming areas, where 40% of beef production takes place in South Africa, of which about 3.3 million head of cattle are found in the Eastern Cape alone.

The support from ComMark ended in 2008. Thus, the NAMC inherited the program. The program has since been funded by the DRDLR. A combined effort by the NAMC and DRDLR has seen the program expanding within the Eastern Cape and moving out to other provinces. Currently, the program covers six provinces and is effective in three, as presented in Table 1. The two partners (NAMC and DRDLR) work with the provincial departments and municipalities and this, so far, has proven to be a strong partnership. The program has so far generated 53.3 million Rand (R) from communal livestock sales since the NAMC took over.

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Table 1. The extent of the program

Province	Operational CFPs	Planned (some under construction) and ready for intake
	Number	Number
Eastern Cape	9	8
KwaZulu-Natal	3	8
North West	1	2
Northern Cape	0	1
Mpumalanga	0	1
Limpopo	0	2

An overview of communal cattle farmers in South Africa

The theoretical evolution of communal farming with its associated difficulties (some natural and others human-made) is presented in Mmbengwa et al. (2015). The authors further deliberate on the characteristics of South African livestock, showing that communal farmers have a low off-take (at about 5%) compared to their commercial counterparts, whose off-take is estimated to be approximately 30%. Some of the natural courses that can cause these imbalances are droughts and disease outbreaks versus the low ability of communal farmers to adapt to such; while the human-made ones can be associated with historical systematic policies that excluded black farmers from the farmer support services that were available in the country. As a result, small-scale farmers account for 40% of the cattle herd and only account for a 5% share of the formal market (cattle) participation in the country.

With livestock being the biggest enterprise in South Africa's agricultural sector, it is important to take a closer look at beef (as part of the red meat market). South Africa's cattle herd increased from 7.9 million cattle in 1970 to about 13.7 million in 2015 (DAFF 2016). However, there are years that saw decreases in numbers, such as 1979/80, 1984/85 and 1993/94, during this period. On the slaughter side, from 2010/11 to 2015/16 the country slaughtered about 3.7 million cattle per annum.

In terms of South African agriculture's contribution to gross domestic product (GDP) compared to sub-Saharan Africa (SSA), one would assume that agriculture is less important in South Africa than in other countries. The agricultural outlook of 2016–2017 of the Organization for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO) indicates that agriculture contributes an average of 15% of total GDP—this figure ranges from below 3% in South Africa and to more than 50% in Chad (OECD and FAO, 2016). However, agriculture, particularly livestock, contributes significantly to South Africa's GDP in the sense that it is the primary occupation. This makes South Africa significantly different from the economies in the rest of SSA in the aforementioned terms, which means that agriculture, and particularly livestock, is not becoming any less important in the economy of the country, including its rural areas.

Ngqangweni and Delgado (2002) argued that the relatively small share of agriculture in South Africa's national income, and the studies showing the importance of remittances and non-farm activities for rural households in South Africa, hide the potential contribution of agricultural (and particularly livestock) income in providing self-driven livelihoods for the poor. This is especially true for poor and vulnerable groups who live in the marginalized rural areas within an otherwise advanced industry-based national economy. They further argue that rural households' move away from dependence on agriculture is more as a result of lack of opportunities in agriculture rather than increasing opportunities outside agriculture in South Africa.

Ngqangweni and Delgado (2002), in a study based in the Limpopo province of South Africa, found that poorer households faced more hurdles in participating in the livestock value chain than their well-endowed counterparts in the communal areas. The relatively wealthier households also tended to own more livestock than poorer ones. The study showed that the state of being poor affected the ability of households to make investment decisions that

might be useful in achieving positive livelihood outcomes. The constraining factors included lack of access to financial services and infrastructure.

Market-related challenges faced by communal cattle farmers

Small-scale livestock husbandry remains a primary land use option in communal areas over most of Southern Africa (Dovie et al. 2006). A study by Masika et al. (1997) revealed that the production of cattle is the major animal farming in the communal areas. This is due to the multi-purpose nature of livestock production and its multiple benefits in communal rangelands, which has been noted to yield high economic returns (Barrett 1992). According to Turner and Williams (2002), communal farmers do not keep livestock solely for marketing purposes but as a means of storing wealth that is only converted into cash during times of crop production failure, among other reasons. This makes livestock, particularly cattle, the most valued assets in rural communities (Turner and Williams 2002).

Although a lack of buyers is frequently given as a reason that small-scale farmers are unable to access the market, the fact is that when such buyers do wish to buy from small-scale farmers, the poor condition of livestock results in lower farm gate prices, especially during dry spells. Livestock auctioneers and speculators often raise concerns that they cannot pay competitive prices for animals that are in poor condition or not ready for the market (Luppnow 2003). De Waal (2004) indicated that poor condition of livestock is important but the age of animals (too old) equally contributes to poor prices when farmers do sell. Poor condition of livestock is also attributable to inadequate grazing and the extreme degradation of the natural resource. Lack of suppliers of important agricultural inputs for livestock farmers, such as vaccines and feed supplements, and common problems of genetic inferiority of animals further reduce the desirability of animals. The low levels of technology adoption further compound the problem (Nell 1998).

Furthermore, the large numbers of cattle kept in villages leads to overstocking and severe overgrazing, especially in winter, when natural pasture is reduced to zero. This results not only in inadequate feed but poorer quality pastures each year. Since supplementary feeding is hardly provided, due to the costs involved, insufficient nutrients result in high loss of weight (Soun et al. 2006). In addition, high costs of veterinary services prohibit the constant and continuous use of these services (Copeman et al. 2008; MAFF 2006). There is also a shortage of family labour and unreliable hired labour to cover all the activities performed at the same time on the farms (crop production, livestock production of various types and requirements, and off-farm activities). This tends to result in poor management of stock (Food and Agricultural Organization of the United Nations (FAO) 2005).

Other major challenges include high transaction costs. Various researchers (Jari 2009; Emongor, et al. 2004; Gong et al. 2004) highlight transactional costs as barriers to the efficient participation of emerging farmers in different formal markets. Emerging farmers will not use a particular channel when the value of using that channel is outweighed by the costs of using it. Key et al. (2000) have isolated high transaction costs as one of the key reasons for emerging cattle farmers' failure to participate in formal markets. For example, the remote location of most emerging cattle farmers, coupled with poor road networks, results in high transaction costs (especially transport costs), thereby reducing the price that traders are prepared to pay for the cattle (Musemwa et al. 2007).

Makhura (2001) and Nkhori (2004) noted that even if emerging farmers are in areas with good road linkages, the distance from the formal markets tends to influence transaction costs. The further away the emerging farmers are from formal markets, the higher the transport costs they incur. As it is a statutory requirement that when purchasing or selling cattle, producers and consumers must have a valid identification certificate and transporting permit (National Development Agency (NDA) 2005), farmers incur extra transport costs to obtain transporting and selling permits from the police station and veterinary offices, respectively. These restrict farmers' participation in distant markets.

Furthermore, smallholder farmers tend to underestimate the value of collective action. As a result, they often sell small and varying numbers of livestock individually and directly to the buyers without linking to other market actors (World Bank 2005; Coetzee et al. 2005). In other words, smallholder farmers lack collective action in markets and this weakens their bargaining positions and often exposes them to price exploitation by traders.

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Methodology

Data and sampling design

Secondary data were obtained from the farmers' database that was developed through the program – the sampled data constituted 513 farmers. The data covers only one province, Eastern Cape; hence, this study is referred to as a case study. The Eastern Cape province is where the program was born and where it is widespread in terms of operating custom feeding facilities and farmers' participation. The sample was drawn randomly from five district municipalities: Amathole, OR Tambo, Alfred Nzo, Chris Hani and Cacadu.

Analytical methods

Farmers within the province differ on how they market their livestock, considering the constraints engulfing market participation. Therefore, it was observed that using the off-take rate alone to determine farmers' market participation was insufficient. Hence, a logistic regression model was used to determine the factors influencing formal market participation, where the dependant variable is a dichotomous variable. The model was expressed as follows:

$$Y_i = X1 + X2 + X3 + X4 + X5 + \varepsilon_i$$

Where: the outcome variable Y_i equals 1 if the respondent participates in the program and zero otherwise. Other explanatory variables are presented in Table 2.

Table 2. Explanatory variables used

Variable	Description
Y_i	Outcome (participant or not participant)
X1	Stock size
X2	Distance to the market
X3	Condition of livestock
X4	Days of fattening
X5	Contribution of the program
ε	Error term

In addition, the logistic regression model was necessary to estimate the percentage of variance in the dependent variable explained by the independent variables. Independent variables included in the model are stock size, distance to market, condition of livestock, days of fattening and contribution of the program. Other variables were excluded by virtue of being insignificant.

Results and discussion

Descriptive analysis

The domination of males in the agricultural sector is still common in the communal areas of South Africa (Montshwe 2006), and the Eastern Cape is no exception. For example, the gender distribution of the sampled farmers was 85.63 % (males) to 14.37% (females). This can be attributed to the fact that cattle herds are associated with the social status of men in the communal areas. In addition, women can only herd households when they are single or widows. However, there is no evidence of the contribution of women to household decision making regarding livestock ranches.

Empirical analysis

Table 3 indicates an increase in off-take rate, which shows that communal farmers are progressively improving their participation in the formal markets . This is against the background that communal farmers are in possession of about 40% of cattle but only about 5% make it to the formal market. However, the off-take rate presented in Table 3 is an approximation; it was calculated from the sales and population of livestock data from the sampled farmers. Nevertheless, the results indicate that the average off-take rate for Alfred Nzo is the highest, at 15.77%. The average off-take rate for the five municipalities is 12.7 %, which is still below the 25 % for the commercial farmers. However, it is higher than the off-take rate of the communal cattle sector (5%) in South Africa.

Table 3. Off-take rate (%)

Year	Amatole	OR Tambo	Alfred Nzo	Chris Hani	Cacadu	Average
2005	10.9	10.1	13.2	9.8	8.6	10.52
2006	12.8	9.8	15.6	10.2	9.9	11.66
2007	13.9	12.1	15.9	10	10.5	12.48
2008	15.9	12.9	17.1	10.7	8.8	13.08
2009	14.7	12.8	14.92	13.8	11.3	13.504
2010	13.5	11	15.3	12.4	10.8	12.6
2011	13.9	13.5	16.64	12.8	11.1	13.588
2012	14	13.8	17.5	13.9	13	14.44
Average	13.7	12	15.77	11.7	10.5	12.734

Determinants of formal market participation

The NRMDP was initiated to narrow the gap between communal farmers and their commercial counterparts in terms of formal market participation. In this way, the untapped potential of beef production from the communal areas would not be overlooked. Therefore, it was interesting to undertake an empirical analysis of factors that influence farmers' participation in the program, thereby participating into the formal market opportunities it entailed.

a.   Distance to markets

The results presented in Table 4 point out that there is a positive significant correlation between distance to market and formal market participation. The results explicitly show that there is a 48.205-fold increase in odds of formal market participation for every unit increase in distance to the market for livestock farmers in the communal CFPs. This implies that there is greater participation in the formal market by these farmers, regardless of the distance to the market, when other factors are kept constant.

Table 4. Economic impact of the NRMDP on communal livestock in the Eastern Cape

Formal market participation	Odds ratio	SE	Z	P > |z|
Stock size	2.818	1.23	2.38	0.017
Distance to market	48.205	49.07	3.81	0.000
Days of fattening	1.070	0.02	4.03	0.000
Contribution of the program	1.002	0.00	2.18	0.030
Constant	0.003			
N	511			
LR Chi-squared	205.85			
Prob > Chi-squared	0.000			
Pseud R-squared	0.778			

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Stock size is an important factor that can increase the economic viability of livestock farming. With an increase in stock size, more cashflow is likely to be achieved by farmers. The results indicate that stock size is positively correlated with the formal market participation of communal livestock farmers. The odds ratio for the association between formal market participation by communal livestock farmers and stock size, adjusting distance to market, days of fattening and contributing to the program, is 2.818. This implies that there is a 2.818-fold increase in the odds of formal market participation for every unit increase in stock size. This appears to indicate the significant impact the NRMDP can have on the economic viability of farmers, considering its impact on the increase in stock size.

b.   Days of fattening

The body condition of any livestock in formal markets attracts good market prices and therefore increases the profitability of the enterprise. In this study, it was found that there is a positive correlation between the days of fattening and the formal market participation of communal livestock farmers. Furthermore, the results indicate that formal market participation will increase 1.07-fold for every unit increase in the days of fattening. This appears to indicate that increase in body condition of the livestock could possibly increase formal market participation by the farmer when other factors are kept constant.

Conclusion

The model used in this paper was fit for the analysis and the results indicate that the communal farmers' odds of participating in the program increase when stock size, distance to markets, days of fattening, and income received from livestock sales through the program are adjusted. Furthermore, this correlation is significant on all four occasions. To some degree, this is an indication that farmers are slowly beginning to understand how they can best make use of the opportunity presented by the program. As regards policy, therefore, it is recommended that communal livestock farmers be encouraged to participate in the program. In other words, supportive policies and institutions could substantially improve productivity and income generation and make a major contribution to poverty reduction in the communal space.

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Factors influencing communal livestock farmers' participation into the National red meat development programme (NRMDP) in South Africa: The case of the Eastern Cape Province

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Impact of agricultural credit on livestock income: A case study of Lasbela District, Balochistan[*]

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Abstract

This study has evaluated the impact of agricultural credit on livestock income in Lasbela District, Balochistan. For assessment, we have used primary and secondary data to test the relationship between agricultural credit and livestock income. The results of the study indicate that agricultural credit helps to develop the livestock sector and enhances the livestock income of the farmers by 65%. Furthermore, the elasticity of agricultural credit is higher than the elasticity of family size and education level. The elasticity of the credit, family size and education level are 11%, 0.09% and 0.05%, respectively. Thus, this paper argues that if policymakers give priority to livestock in agricultural credit and devise easy credit procedures for the small farmers, it will ultimately result in alleviating the problem of poverty and unemployment in the region.

Keywords: Agricultural credit, livestock income, poverty, Lasbela

[*]Upon request from the lead author, we have remove the full paper. To access the full paper, you can visit the Sarhad Journal of Agriculture (SJA).

Effect of the agricultural credit guaranteed scheme fund (ACGSF) on loan accessibility and livestock sub-sectorial productivity in Nigeria (1978–2014)

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Abstract

In a bid to increase livestock and crop farmers' access to credit facilities, the Nigerian government established the Agricultural credit guaranteed scheme fund (ACGSF). This aimed at enhancing food security and the protein requirements of the populace. The main objective of this study is to analyse the relationship between the fund obtained by the livestock farmers through the ACGSF scheme and their livestock productivity. This study employed time series data over a period of 36 years obtained from the National Bureau of Statistics, the Central Bank of Nigeria (CBN) and the Food and Agricultural Organization of the United Nations (FAO). The analytical tools used include trend analysis and a co-integration test. The result shows that productivity in the livestock subsector shows a steady increase from 1978 but declined sharply between 1980 and 1983. As of 1990, livestock production remained constant with a slight decline at intervals. There was a rise in livestock production from 2005 to 2014. The co-integration test shows a positive long-run relationship between livestock productivity, population and the amount of loans granted by the ACGSF scheme while a negative relationship exists between livestock production, interest rate and exchange rate. It is therefore recommended that the government increase the funding capacity of the ACGSF and that appropriate disbursement techniques be implemented so that the fund reaches the appropriate target.

Keywords: loan accessibility, livestock productivity, co-integration test, Nigeria

Background of the study

Livestock rearing plays a key role in the economies of West African countries, providing 44% of agricultural gross domestic product (GDP) (South West Africa Company (SWAC)-OECD/Economic Community of West African States (ECOWAS) 2008). With 60 million head of cattle and 160 million small ruminants and 400 million poultry, the Sahel and West Africa is an exceptional region for livestock rearing. In numbers, and of the entire sub-Saharan Africa (SSA) region, the Sahel and West Africa contain 25% of the cattle, 33% of the sheep and 40% of the goats (SWAC-OECD/

ECOWAS 2008). Livestock rearing is one of the main economic activities on which the poorest populations depend for food and income. It is one of the areas of agriculture which is a major source of foreign exchange in Africa as it is forms a substantial part of their exports (Salami and Arawomo 2013). According to a number of studies carried out to ascertain the problems of agriculture (Ansariet al. 2011; Salami et al. 2010), there is a problem of poor access to credit facilities. This is because credit has been identified as one of the crucial factors in agricultural production and, in many cases, may be a limiting factor in smallholder crop and livestock production. In a bid to combat this, the ACGSF was established by Decree No. 20 of 1977 and started operations in April 1978. Its original share capital and paid-up capital were NGN 100 million (Nigerian Naira) and NGN 85.6 million, respectively. The Federal Government holds 60% and the CBN holds 40% of the shares. The capital base of the scheme was increased to NGN 3 billion in March 2001. The Fund guarantees credit facilities extended to farmers by banks of up to 75% of the amount in default, net of any security realized. The Fund was set up with the sole purpose of providing guarantees in respect of loans granted by any bank for agricultural purposes (Central Bank of Nigeria (CBN) 1990). Nwosu et al. (2010) noted that the ACGSF was formed solely with the objective of encouraging financial institutions to lend funds to those engaged in agricultural production as well as agro-processing activities, with the aim of enhancing the nations' export capacity and local consumption. This enabled livestock farmers to be integrated into the program.

Methodology

Study area

Nigeria came into existence in 1914 as a result of the amalgamation of the north with the southern protectorates. Nigeria became independent in 1960, and a republic three years later (1963). Nigeria is located in West Africa. It lies between latitude 10° North and longitude 8° East, respectively. The Republic of Benin, Niger, Chad and Cameroon and the Atlantic Ocean respectively border Nigeria in the west, north, east and south. The country covers a land area of 923,768 square km. The vegetation ranges from mangrove and thick forests in the south, savannah, and the Sahel in the middle belt and the north, respectively. The National Bureau of Statistics (NBS) (2014) puts the estimated population of Nigeria at 178 million. The Nigerian economy is dominated by agriculture. Over 60% of the population is engaged in this sector, with an average 41% contribution to the gross domestic product (GDP). Despite the dominance of agriculture, the crude petroleum subsector contributes over 80% of Nigeria's foreign exchange. The manufacturing sector's contribution to the economy is minimal, with an average of 3%. Also, the communication sector has witnessed tremendous growth in recent times, with an average contribution of 5.5%.

Types of data and methods of data collection

Secondary data were used for this study. These were data on fund disbursement by the ACGSF taken from CBN's annual publications and records on agricultural production from FAOSTAT, NBS and the World Bank online database spanning 1978–2015.

Analytical Techniques: Trend analysis and co-integration analysis were carried out on the data collected. The model for the co-integration test is given as:

$$Y1, = \sum \alpha Y_{t-1} + \sum \beta IX_{1-1} + \sum \beta IX_{2-1} + \sum \beta IX_{3-1} + \sum \beta IX_{4-1} + \sum \beta IX_{5-1} + U_t \qquad (1)$$

$$Y1 = \sum \beta IX_{t-1} + \sum \beta IX_{2-1} + \sum \beta IX_{3-1} + \sum \beta IX_{4-1} + \sum \beta IX_{5-1} + Ut$$

$$Y = Y_t - Y_{t-1}$$

Where: it is assumed that the disturbance term Ut is uncorrelated; Y_1 = livestock production at time t; X_1 = funds from ACGSF scheme at time t; X_2 = interest rate; X_3 = exchange rate; X_4 = inflation rate; X_5 = budgetary allocation by the government; X_6 = population; X_7 = area of arable land; U_t = error; and $_{t-1}$ = lag variables.

Results and discussion

The trend analysis in Figure 1 describes the relationship between the loans which the ACGSF scheme has granted to the livestock subsector and their productivity since the inception of the scheme in 1978.

Figure 1. Trend analysis showing the relationship between loans granted by ACGSF and livestock productivity
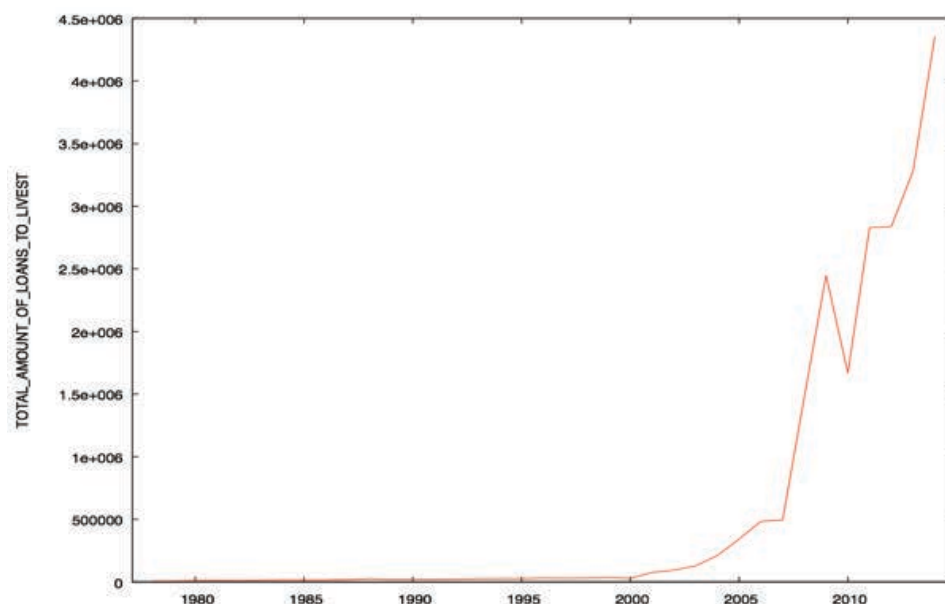
The trend analysis shows that the productivity in the livestock subsector shows a steady increase since 1978 but had a sharp decline between 1980 and 1983. As of 1990, livestock production has remained constant, with a slight decline at intervals. There was a rise in the livestock production between 2005 and 2014.

Table 1. Result of unit root test

Variables	Statistics	P-value	Implication	Lag Length	Order of integration
Total number of loans to livestock	-2.96913	0.6785	Non-stationary	10	Stationary at level
Total amount of loans to livestock subsector	-3.11821	0.1019	Non-stationary	7	Stationary at level
Nigerian population	-2.99625	0.1332	Non-stationary	6	Stationary at level
Total livestock production (tonnes)	-2.01174	0.5943	Non-stationary	8	Stationary at level
Total arable land (sq. km)	-1.47091	0.8396	Non-stationary	8	Stationary at level
Interest rate	-3.53923	0.08535	Non-stationary	10	Stationary at level
Exchange rate	-1.98669	0.5886	Non-stationary	10	Stationary at level
Budgetary allocation	2.33161	0.9957	Non-stationary	10	Stationary at level

Source: Data Analysis 2016

Table 1 presents the result of the unit root test from an Augmented Dickey-Fuller test. All the variables exhibited unit root at the level, which means variables are non-stationary. However, at the first differencing, after they were lagged with different lag lengths, they all became stationary. The differencing is required to avoid a spurious regression. Since the differenced variables are stationary, there is a long-run relationship between the variables to be observed.

Table 2. Unrestricted co-integration rank test (TRACE)

Hypothesized no. of CE	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.991338	508.8918	159.5207	0.0000
At most 1 *	0.989805	347.4337	125.6154	0.0000
At most 2 *	0.823309	191.5791	95.75366	0.0000
At most 3 *	0.770420	132.5791	69.81889	0.0000
At most 4 *	0.631420	82.54804	47.85613	0.0000
At most 5 *	0.591523	48.61270	29.79707	0.0001
At most 6 *	0.369268	18.17186	15.49471	0.0193
At most 7	0.070950	2.502138	3.841466	0.1137

Source: Data analysis 2016
Trace test indicates seven co-integrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Table 2 shows that there are seven co-integrating equations. This is shown as the critical values of those variables greater than the trace statistic and maximum value. For a check, a TRACE (maximum eigen value) was also used. The result is presented in Table 3.

Table 3. Unrestricted co-integration rank test (Maximum Eigen value)

Hypothesized No. of CE	Eigenvalue	Max-Eigen statistics	0.05 Critical v	Prob.**
None *	0.991338	161.4582	52.36261	0.0000
At most 1 *	0.989805	155.9206	46.23142	0.0000
At most 2 *	0.823309	58.93397	40.07757	0.0001
At most 3 *	0.770420	50.03109	33.87687	0.0003
At most 4 *	0.631420	33.93534	27.58434	0.0067
At most 5 *	0.591523	30.44084	21.13162	0.0019
At most 6 *	0.369268	15.66973	14.26460	0.0298
At most 7	0.070950	2.502138	3.841466	0.1137

Sources: Data analysis 2016
Max Eigen Value test indicates seven co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4. Co-integration result

Variable	Coefficient	Std. error	t-Statistic	Prob.
Loan amount	0.054175	0.013838	3.914798	0.0005***
Budget	1.07E-06	7.64E-07	1.405944	0.1707
Exchange rate	-872.4195	192.1488	-4.540332	0.0001***
Inflation rate	-9.692911	207.3426	-0.046748	0.9630
Interest rate	-3024.932	1123.984	-2.691260	0.0119**
Land	0.000906	0.186288	0.004863	0.9962
Population	5.097510	0.807613	6.311824	0.0000***
Constant	-168444.1	36182.71	-4.655376	0.0001
R^2 = 0.979	Adjusted R^2= 0.974	S.E. of regression = 023501.86	Durbin-Watson stat = 1.140589	Mean dependent variable = 433593.6
S.D. dependent variable = 146203.7	Sum squared residue = 1.55E+10	Long-run variance = 2.41E+08		

Source: Data analysis 2016

It is evident from Table 4 that there is a long-term relationship between livestock productivity, population, interest rate, exchange rate and amount of loans granted to the livestock subsector. Thus, a change in any of the independent variables, either positive or negative, will lead to a corresponding change in the dependent variable. The livestock production responds negatively to exchange rate and interest rate. A positive relationship exists between population, loans granted under ACGSF scheme and livestock productivity in the country.

Conclusion and recommendations

This study reveals that the relationship between loans granted under the ACGSF to livestock farmers actually improved their productivity, when all other factors contributed positively. It is therefore recommended that:

- The government should increase the funding capacity of the ACGSF.

- The interest rate of loans should not be too high to encourage farmers to access loans.

- The government should increase the percentage of the country's budget allocated to the agricultural sector to boost agricultural production in the nation.

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Roundtables

Set-up and process of the 'roundtables'/ 'panel discussion' sessions

There were three sets of participants for each of the 'roundtable'/ panel discussion sessions:

a. **The panel members or panellists** consist of experts in the field concerned. They were stakeholders who, though they did not make formal written presentations, had vast experience and could talk about what they practised. The panellists for the first-roundtable were farmers: five from Swaziland and two from Mozambique. The second and the third set of panellists were financial institutions and development representatives, including Nedbank, Micro-Finance Unit (Swaziland), Jaltech, Genesis, IFAD etc.

b. **The audience** was predominantly scientists who, in this session, had to learn some role reversal as they were addressed by stakeholders whom they normally present to in conferences. They listened with great enthusiasm and asked the panellists clarification questions.

c. **The moderator** introduced the topics, initiated the discussion, coordinated the questioning from the audience, synthesized and summarized the key points.

The roundtables were set up as follows.

Experts in the field were invited as panellists to sit in front. They were informed in advance but did not have to prepare a formal presentation. They were requested to talk about what they do and they were encouraged to just share their experiences as they were.

The organisers introduced the theme and the moderator introduced the panellists. The issue under discussion was initiated by posing a set of questions and the panellists were called (in a predetermined order) to respond by expressing their views and sharing experiences. Panel members were also asked to react to, respond to or complement the views expressed by co-panellists.

The audience was then encouraged to ask clarification questions, or comment. At the end of each session, the moderator integrated and synthesized the different points of view by way of a summary and presented to the audience.

The farmers roundtable

There were a total of seven farmers on the farmers' roundtable: five from Swaziland and two from Mozambique.

Jabulani Ntsabetse of the Swaziland National Agricultural Union (SNAU) represented the farmer organization (FO). He introduced his organization and its role in value chain financing. Ntsabetse mentioned that SNAU is facilitating finance for farmers through initiatives that include support in running agro-shops for animal feed and medicines, supporting chicken farmers' access to finance for the purchase of feed and machinery for abattoirs, and support in upgrading their buildings. However, he indicated that the main challenge they face at SNAU is how to unite the farmers, as they tend to work in 'silos'. There is a need to come together as farmers across the value chains. For example, beef farmers and pig-producing groups need to come together to strengthen their voice when advocating for government support.

Jafta Dlamini, representing Swazi farmers in the feedlot business, shared his experiences of using his own fodder to feed cattle. He is growing soya, maize, mucuna and elephant grass as fodder. So far, he has 23 cattle in the feedlot. He faces major challenges when buying cattle from owners. They do not trust the scales and want hard cash, which puts him at risk from criminals when carrying large amounts of money. Transportation is also a challenge as he buys cattle from dip tanks that are scattered. To address the challenge, the group members are planning to have their own

herd of cows that will produce for the feedlot. They are already in discussion with the team from the Department of Agriculture to lend them bulls.

Zanele of eSwatini Meats, representing cattle buyers, indicated that she slaughters about 50 animals a week. She buys cattle from farmers but also has her own feedlot. She noted that farmers usually sell old, untreated animals, resulting in additional costs to the buyer. Farmers also tend to complain about selling per kilogram and the prices per kilogram. The buyers deduct the cost of treating the animals which reduces the price further. Zanele recommended that the government should intervene in the pricing systems to ensure uniformity. Another major challenge is that buying from isolated farmers in remote locations is costly, and that there are high transaction costs due to the long distances travelled for small numbers. Sometimes, after travelling the long distances, they failed to agree on the prices. She also confirmed the challenge indicated by the feedlotter that farmers want cash because they normally sell their cattle in an emergency. Zanele also indicated that the issue of the age of cattle is another major bone of contention: 'as buyers we need soft and tender meat, yet farmers sell old animals; there is a need for farmers to understand these realities', she lamented. She also indicated that there are very few abattoirs around and it is the responsibility of the buyer to get a veterinary officer to certify the meat. She concluded that, as such, the costs of cattle buying are too high.

Nora Magagula from the Mukamamba district presented the experiences of her group. The group keeps cattle and also has a feedlot. They buy from different dip tanks from 4000 Rand (R) upwards. At the moment they have 20 cattle, which is still very little considering that the buyer said she wanted 50 cattle per week. The group has a vision that in three years they should have their own farm to produce for the feedlot. The main challenge they face in expanding their business is that they do not have cash in hand to buy cattle, as farmers prefer cash. When there are delays in getting money, cattle owners sell to another person by the time a buyer returns with cash.

Another person represented commercial farmers in Swaziland. She indicated that she is farming on 400 ha of private, individual, farmer-owned land. She is farming with Brahman and Simentaler in the low veld, where everything does well. She explained that of the two breeds, the Brahman is hardy while the Simentaler has more meat. As a commercial farmer, she is collaborating with small-scale beef farmers by selling breeding stock to Swazi farmers who want to improve their genetics. The main challenge is that as the farm is formally registered, when they sell cattle to small-scale farmers they have to charge value added tax (VAT) to all clients, including smaller farmers. This means they have to pay an additional 14%, which pushes up the price to beyond the reach of most farmers. She indicated that cattle in Swaziland are completely inbred because there not enough genetics are imported. She is now changing from Simentaler to Romanyala, a breed with longer legs, as she needs the cattle to be able to adapt to the long walking distances. She said she saw an opportunity of improving her business as she supports small-scale farmers. It is a win-win situation – when small-scale farmers get more cash they buy more from large-scale commercial farmers. There is, however, a need to change the attitude of small-scale cattle producers. While the cattle indicate wealth in Swazi culture, there is a need to change with the times—from farming as cultural to cattle farming as a business. There is also a need to a share information on new development in cattle farming. By way of conclusion, she said that 'as farmers, we are unfortunate because we have to buy retail and sell wholesale'.

Another farmer from Mozambique is farming in the Manyisa district. She keeps cattle, goats and chicken. She also owns a fodder bank for supplementary feeding during the dry season. The farmer indicated that she plants moringa, leuceana and elephant grass as fodder on two ha.

The second farmer from Mozambique (Florida Shabangu) was from the Maguti district. She is a farmer, trader and butchery owner. She buys animals from different regions and uses live weight when buying the cattle. Interestingly, while cattle farmers have challenges with the market, for her as a trader the main problem is availability of animals (she simply cannot get enough). This is worst during droughts when animals are very few and the few available are in terrible condition. Another major issue in cattle buying is that there is no grading of cattle: the same price is charged regardless of the condition of the animal. The issue of finance is also a problem in Mozambique as it is difficult to get a loan from the bank, especially for older entrepreneurs

Summary of comments/discussion points

The following were the main conclusions and recommendations of the session:

Transport

The quality and volume of livestock are generally low, and road infrastructure is not very good. As a result, transport costs are very high. It was recommended to consider organizing farmers so that they could share transport, which is a possibility but problematic if buyers are in different locations.

Government support to livestock

It was agreed that the livestock sector does not have the same support as the crop sector. It was recommended to lobby governments to recognize the contribution of the livestock sector and provide more support.

Organizing farmers for livestock farming

It was noted with concern that farmers tend to like to work in silos. As a result, they lose out on economies of scale. Some argued that 'working in silos' is not the problem but a symptom of poor farmer organizational development. It was recommended to closely look at the governance issues in FOs. Other participants also argued that there is a lot of government interference in FOs. There have been attempts to break the silos by working in associations; however, when sharing of benefits is perceived to be unfair, hard-working members have tended to leave. Opportunities to benefit from working together as a group were identified during marketing time and input procurement. It was recommended to organize farmers to fully benefit from working together during these times.

Feedlotting

There were questions on how long animals are kept in feedlots, what their age should be and what criteria are used for buying animals. All these questions appear to have been answered in the study, as elaborated by one farmer who indicated that they keep cattle in a feedlot for three months, buy animals aged from one to three years old, weigh the cattle, make a visual inspection and count the teeth to determine age. It was noted that, contrary to what is taught in colleges, farmers have found if they use winners in feedlots, they get negative profit as quality is currently not recognized in the grading systems.

Information communication technology (ICT)

The use of ICT for sharing market information was identified as having considerable potential to help address most of the challenges identified. An example was shared of a program called AgriSP that uses SMS to communicate; beef farmers can easily market a single cow on the platform, regardless of their location. Another farmer said: 'I use WhatsApp to sell cattle to Swazi farmers. We must all try and use it to reduce transaction costs'.

The financial institutions roundtable

The Nedbank representative mentioned that cattle can be used as collateral if they are ear-tagged. Using cattle as collateral also eliminates the problem that most Africans have of being so closely attached to their livestock that they give them specific names and end up treating them like pets, or members of the family. Furthermore, he mentioned that farmers should keep business records in order for them to be eligible for formal credit.

Customers should remember that bank staff are like them, as differences might arise in opinions and the whole idea is about relationship building. There is a drive by the Ministries of Agriculture around the world to address constraints that livestock farmers are encountering with financial institutions (FI). Brazil, India and Indonesia are working with FIs to address constraints faced by the latter in contributing to small enterprises. In international trade FIs should not compromise inflows and outflows, at the same time protecting the Swazi farmer. The European Union (EU) has put together a financial package that provides 70% and FIs top up the remaining 30%.

However, there is 'no one size fits all' in financial packages. Different sectors are dealt with separately. Risks borne by the banks are measured monthly and this governs the way banks give credit to farmers.

Evan, the Jaltech representative, mentioned that he did not have much to say but would rather take questions from the floor. However, he noted that financial statements need to be put in place to access financial support from FIs. There is a need to understand value chains, relationships and project documentation.

Mutamba Manyeu of Genesis alluded to the fact that the financing of smallholder farmers is key in making the value chain a success; however, he noted that there are other areas of the value chain that need to be addressed before the model can be viable. He further mentioned that the value chain should be made inclusive of all the livestock value chain actors. An opportunity was identified related to innovative financial packages specifically designed for smallholder livestock farmers and crafted by FIs. If properly crafted according to the needs of the livestock farmers, these packages would enable increased productivity.

The director of the Micro-Finance Unit, David Myeni, made mention of the importance of financial inclusion, mainly of livestock farmers. However, he said the main challenge faced by commercial banks was how they could minimize transaction costs. He gave an example of transaction costs being such that they were the same or almost the same for a SZL 1 million loan and a SZL 10,000 loan, which made the expenses of these banks high for small amounts.

There is a major gap between the financial needs of smallholder farmers and insurance products tailored for them. There is a need for the development of agreements (i.e. payment agreements) that would harmonize and strengthen the relationship between value chain actors; this was identified as an imperative gap that urgently needs to be addressed.

Comments/discussion points

Discrimination against small-scale farmers—One contributor passionately alleged that FIs, especially the commercial ones, treat farmers in a discriminatory manner, in terms of not granting them loans even when they have all the proper documents and pass all the requirements stated by the banks. Basically, he mentioned that banks have a negative attitude towards farmers. It was recommended that bank officers be trained on the type of businesses in which their clients are engaged since this would enable banks to design suitable services or products for smallholder farmers.

Monitoring of financial institutions—It was recommended that FIs be monitored to see whether they are really helping farmers, in terms of accessing credit, offering banking information to farmers, coming up with suitable financial products and granting loans to those farmers who meet all the criteria set for accessing credit. This was informally mandated or suggested to be done by the Microfinance Unit.

Unfair competition for farmers—Farmers felt that they were facing undue competition and needed to be protected from this through policy. The farmers were assured that there was indeed a need to look into policies and regulations so as to ensure that domestic farmers are not exploited by outside competition.

Livestock financial products—The participants expressed a concern that there was no clarity on the criteria used to design financial products and specifically asked Nedbank how they designed financial products targeted to their livestock clients. Nedbank responded that there was no specific way in which the bank designed services or products targeted at livestock farmers. It was recommended that FIs design specific products for the livestock sector since it is key for agricultural development, and unique.

The implementing agencies and donors roundtable

The roundtable focused on the role of implementing partners and development partners (donors). The context was the importance of providing infrastructure on a grant basis versus as part of the loan to farmers. It was clearly indicated that the facilities were provided to farmer companies as a risk reduction measure in their participation and a catalyst to demonstrate, through a pilot, the viability of a model that involved revolving loans in beef value addition.

The panellists emphasized that development partners' and implementing agencies' role is to facilitate development, bringing beneficiaries to a level where they view their operations as business, and identifying their role along the value chain. This is done through the selection of business-minded participants for the development projects, training and awareness-building activities within projects. In the case of the Swazi beef project, the fact that feedlot companies contributed 10% towards financing their operation demonstrated their understanding of their role.

The biggest gap identified among value chain actors was that of lack of trust. The panel highlighted that this can be facilitated by the implementing agencies. SWADE, MFU and ILRI played this role prominently in linking farmer companies to markets and to financial institutions in the Swazi Beef project.

There were concerns that sometimes beneficiaries do not differentiate between support and facilitation roles when interacting with development partners and donors. This is a function of the communication strategy employed by implementers and development partners and a history of support for beneficiaries. Investment in communicating clearly what the partners and donors' role in an action is will go a long away to clearing up some of these misconceptions.

The importance of co-creation among implementing agencies and beneficiaries, supported by donors, was highlighted as a key factor that can yield success, reduce misunderstanding and lead to greater adoption of technologies and function of value chains.

The roundtable discussion concluded that the key to success in projects that are market-oriented lies in

- Facilitated realization of farming as a business; market-orientated farming.

- Transparent interaction among value chain actors.

- Functional markets.

- Supporting passionate and business-minded individuals and groups.

- Strong government policies that support value chain performance.

- Producer, public, private sector partnerships that are strong and enabled.

Annex 1. Conference program

International conference on livestock value chain finance and access to credit

Royal Swazi Spa—Ezulwini, Swaziland, 21–23 February 2017

Day 1	
Tuesday 21 February 2017	
8:00–9:30	Registration
9:30–10:00	Welcome remarks and setting the scene
10:00–10:30	Tea and coffee break
10:30–11:15	Plenary session 1
	Karl Rich – 'Perspectives on improving financial access for livestock value chain development'
11:15–13:00	Contributed papers session 1 (5 papers)	Contributed papers session 2 (5 papers)
13:00–14:00	Lunch
14:00–15:30	Farmers' roundtable
15:30–15:45	Tea and coffee break
15:45–16:30	Plenary session 2
	Kennedy Dzama 'Smallholder livestock production and market participation in Southern Africa: lessons learnt'
16:30–17:50	Contributed papers session 3 (4 papers)
17:50–18:00	Wrap-up day 1
19:00–21:00	Conference dinner
Day 2	
Wednesday 22 February 2017	
8:00–8:45	Plenary session 3
	Calvin Miller – 'Inclusive value chain financing and investment for livestock'
8:45–10:30	Contributed papers session 4 (5 papers)	Contributed papers session 5 (5 papers)
10:30–11:15	Official opening by the Honourable Minister of Agriculture, Moses Vilakati
11:15–11:30	Tea and coffee break
11:30–13:00	Banks and financial institutions' roundtable
13:00–14:00	Lunch
14:00–15:45	Contributed papers session 6 (5 papers)
15:45–16:15	Tea and coffee break

16:15–17:30	Implementing agencies' and donors' roundtable
17:30–18:00	Wrap-up and closure

Day 3	
Thursday 23 February 2017	
7:00	Assembly point of participants and departure to field visits
7:00–12:30	Field visits
12:30–13:30	Lunch (bag/takeaway lunch)
13:30–16:30	Visit to a Swazi handicrafts shop
16:30–17:30	Back to the hotel/assembly point

Contributed papers sessions

Day 1		
Tuesday 21 February 2017		
11:15–13:00	Venue 1 – Main conference room	Venue 2 – Conference Room 2
	Contributed papers session 1 Smallholders access to credit	Contributed papers session 2 Value chains and market participation
	Chair: Abdrahmane Wane	Chair: Isaac Busayo Oluwatayo
11:15–11:35	'Factors affecting household decision to allocate credit for livestock production: Evidence from Ethiopia' *Shiferaw K., Geberemedhin B., Legesse D.*	'Influence of microfinance participation on dairy commercialization: case of small scale dairy farmers in Kenya' *Korir H.C., Cheruiyot k., Apind B.O.*
11:35–11:55	'The role of contracts in improving access to credit in the smallholder livestock sector of Swaziland' *Mamba T.X., Machethe C.L., Mtimet N.*	'Analysis of beef cattle value chain in the forest-savannah transitional zone of Ghana' *Owusu C., Mensah-Bonsu A., Amegashie D.P.K., Kuwornu J.K.M.*
11:55–12:15	'Factors influencing farmers uptake of credit for cattle fattening in two districts in East Java, Indonesia' *I-G.A.P Mahendri, Waldron S., Wegene M., Cramb R.A.*	'Smallholder goat farmers' market participation in Choma District, Zambia' *Chipasha H., Ariyawardana A.*
12:15–12:35	'Microcredit financing in rural economy or formal banking institutions—which has better positioned the smallholder livestock farmers for credit access in southwest Nigeria?' *Ajibade T.B., Ajibade E.T., Oloyede W.O.*	'A triple-hurdle model of small ruminant production and marketing in the highlands of Ethiopia: implications for commercial transformation' *Gebremedhin B., Shiferaw K., Gizaw S., Tegene A., Hoekstra D.*
12:35–12:55	'Risk assessment and management to enable access to credit for livestock actors' *Wane A., Mballo M.A.D.*	'Inclusive value chain and marketing among smallholder goat farmers in rural Limpopo Province, South Africa' *Oluwatayo I.B.*
12:55–13:00	Wrap-up	Wrap-up
Day 1		
Tuesday 21 February 2017		
16:30–17:50	Venue 1 – Main conference room	
	Contributed papers session 3 'Governmental schemes and private funding models'	
	Chair: David Myeni	
16:30–16:50	'An innovative approach to cattle fattening/finishing in Swaziland: a financial perspective' *Naicker E.*	

16:50–17:10	'Rural financial services and their effects on livestock production in Ethiopia'
	Fitawek W.B., Kalaba M.
17:10–17:30	'Can value chain financing work for livestock in smallholder systems? Insights from the Zimbabwe Agricultural Development Trust'
	Mudyazvivi E., Mutamba M.
17:30–17:50	'Bridging the financing gap for smallholder agriculture in Swaziland'
	Myeni D., Nhleko P.N.

| Day 2 | |
| Wednesday 22 February 2017 | |

8:45–10:30	Venue 1 – Main conference room	Venue 2 – Conference room 2
	Contributed papers session 4	Contributed papers session 5
	Economic valuation of value chains	Livestock production, efficiency and marketing
	Chair: Oluwafunmiso Adeola Olajide	Chair: Florence Nherera–Chokuda
8:45–9:05	'Value chain analysis of goats in Zambia: challenges and opportunities of linking smallholders to markets' *Namonje-Kapembwa T., Chiwawa H., Sitko N.*	'Beef cattle fattening using fodder-based rations' *Dube S., Thwala M., Lukhele A., Sihlongonyane M., Sihlongonyane N., Mkhombe R.*
9:05–9:25	'Value chain analysis of beef in Swaziland' *Fumani Ndlovu*	'Measuring impact of access to livestock services on technical efficiency of small-ruminant production in rural Ethiopia' *Kassie G.T., Rischkowsky B., Haile A., Yitayih M., Legesse G., Fantaye Y.*
9:25–9:45	'Growing a PPP- the case study of the Ngwane Mills – SWADE Joint Venture' van Niekerk W., Gama R., Dlamini M., Rendall D., Thwala M., Dlamini F., Maseko S., Ntuli F., Mkhombe R., Mangwe M., Kunene T.	'The various problems associated with financing livestock production in northern Nigeria' *Oke M.A.*
9:45–10:05	'Smallholders and livestock value chain actors' access to credit in Tanzania' *Mlote S.N.*	'Market channel choice decision in Botswana cattle markets' *Bahta S., Temoso O., Gatsoswe K.*
10:05–10:25	'Economic valuation of cattle value chain in Oyo State' *Amole O., Adeoye I.B., Olajide O.A.*	'Social networks and fodder innovations to enhance animal performance in communal areas dairy value chain systems' *Nherera-Chokuda F.V., Muya M.C., Mantji M., Maphahla V.V., Makgobatlou G.M., Mbi N.M.*
10:25–10:30	Wrap-up	Wrap-up

14:00–15:45	Venue 1 – Main conference room
	Contributed papers session 6
	Agricultural credit impact assessment and regional trade
	Chair: Grace Oluwabukunmi Akinsola
14:00–14:20	'Impact of environmental risk on livestock commodity trade in SACU' *Mlipha S.S.B., Blignaut C.B., Kalaba M.*
14:20–14:40	'Disaggregated supply response of cattle and beef in Namibia: an autoregressive distributed lag approach' *Kalundu K.S., Meyer F.*

14:40–15:00	'Impact assessment of the National red meat development programme (NRMDP) on formal market participation of communal livestock farmers in South Africa: the case of the Eastern Cape Province' *Sotsha K., Fakudze B., Ngqangweni S., Nyhodo B., Ngetu X., Mazibuko N., Lubinga M.H., Khoza T., Ntshangase T., Mmbengwa V.*
15:00–15:20	'Impact of agricultural credit on livestock income: a case study of District Lasbela, Balochistan' *Khan K., Khan G., Ramazan S., Faiz J., Abdul Kamal M., Ali G.*
15:20–15:40	'Effect of the agricultural credit guaranteed scheme fund (ACGSF) on loan accessibility on livestock sub-sectorial productivity in Nigeria (1978–2014)' *Ayinde O.E, Akinsola G.O., Onilude K.O., Ajibade T.B.*
15:40–15:45	Wrap-up

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