UNIVERSITY OF KWAZULU-NATAL

FORAGE SEED PRODUCTION AS A BUSINESS IN SMALLHOLDER SYSTEMS OF ZIMBABWE: A VALUE CHAIN APPROACH

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DECLARATION

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DEDICATIONS

This work is dedicated to my family: my husband Charles and children Jasmine Chiedza and Chengetai. I love you all.

GLOSSARY OF ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
AGRITEX	Agriculture, Technical and Extension Services
ACTESA	Alliance for Commodity Trade in Eastern and Southern Africa
AGRA	Alliance for a Green Revolution in Africa
AMA	Agricultural Marketing Authority
ANOVA	Analysis of variance
AU-IBAR	African Union-Inter-African Bureau for Animal Resources
BCS	Body condition score
BMC	Business Model Canvas
CA	Conservation Agriculture
CBI	Crop Breeding Institute
CFA	Confirmatory factor analysis
CGIAR	Consultative Group of International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Centre
CRS	Catholic Relief Services
CSO	Central Statistics Office
DBA	Doctor of Business Administration
DDP	Dairy Development Programme
DfID	Department for International Development
EFA	Exploratory Factor Analysis
LPD	Division of Livestock Production and Development
DR&SS	Department of Research and Specialist Services
Econet	Econet Wireless
FARNPAN	Food, Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agriculture Organisation of the United Nation
FFS	Farmer Field School
FGD	Focus Group Discussion
FI	Financial Institution
FTLRP	Fast Track Land Reform Program

GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GM	Gross Margin
GMB	Grain Marketing Board
GMCC	Green Manure Cover Crops
Ha	Hectare
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research in Semi-Arid Tropics
IFC	International Fertiliser Centre
IFPR	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IOSR	International Organization of Scientific Research
IP	Innovation Platform
KII	Key Informant Interview
Km	Kilometre
LiDeSA	The Livestock Development Strategy for Africa
LPD	Livestock Production and Development
masl	Metres above sea level
Mil. Ha.	Million hectares
MoAMID	Ministry of Agriculture, Mechanisation and Irrigation Development
NARES	National Agricultural Research Stations
NGOs	Non-Governmental Organisations
N_2	Nitrogen
NPV	Net Present Value
NR	Natural Region
OCHA	United Nations Office for the Coordination of Humanitarian Assistance
PSGA	Pasture Seed Growers Association
SARO	Southern Africa Regional Office
SEM	Structural Equation Modelling
SI	Sustainable intensification
SNA	Social Network Analysis
SPSS	Statistical Package for Social Scientists
SWOT	Strengths, Weaknesses, Opportunities and Threats

TI	Total Income
TVC	Total Variable Costs
UKZN	University of KwaZulu-Natal
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Organization for Education, Science and Culture
UNIDO	United Nations Industrial Development Organization
Vet	Veterinary Services
WLS	Weighted Least Squares
ZFU	Zimbabwe Farmers' Union
ZimAIED	Zimbabwe Agricultural Income and Employment Development
ZimCLIFS	Zimbabwe crop-livestock integration for food security
ZimSTAT	Zimbabwe National Statistics Agency
ZSTA	Zimbabwe Seed Traders Association

ABSTRACT

The demand for forage seed in Zimbabwe is set to increase as a result of increased demand for high yielding and quality fodder for livestock. There is a projected increase in demand for livestock products, even though livestock productivity has declined due to factors including shortages and reduced quality of feed particularly during the dry season and worsened by frequent droughts. There is need to develop alternative feed resources that would improve livestock productivity at lower costs. Forages have been highlighted as an alternative to livestock feed supply. However, unavailability of forage seed has been a major drawback, especially in Zimbabwe. The forage seed industry has been underdeveloped, coupled with the absence of forage germplasm, efficient seed suppliers and support services. The study focused on developing a model for forage seed production as a business among smallholder farmers. This was built up from investigating forage seed production, challenges faced and opportunities along the seed value chain, actors involved and characterizing factors that could enhance competitiveness of forage seed production in smallholder systems. For data collection, a household survey was conducted to 414 households, 4 Focus Group Discussions and 10 key informant interviews. Multi stage sampling involving purposive sampling of districts and wards, and random sampling techniques were employed during the study. Quantitative data was analysed using SPSS version 21, economic analysis (Gross margin and sensitivity analysis) and Structural Equation Modelling (SEM), whilst qualitative data, NVivo 10 and UCINET for social network analysis were employed.

Farmers owned an average of 2.2 ha of land and 63.0 % of this is put under crop and forage production. Forage seed yields were at 89 kg ha^{-1} and 753 kg ha^{-1} for lablab and mucuna respectively with gross margin of US$70.89 for lablab and US$611.61 for mucuna. Challenges included lack of knowledge and information, limited land, lack of forage market, lack of ready market for forage seed, lack of knowledge on planting and marketing of forage seed and poorly resourced extension staff to out-scale forage seed production. Opportunities identified include climatic conditions that are conducive for seed production, even without irrigation facilities, availability of extension staff who would be willing to assist farmers and give technical advice, viable seed industry where forage seed can ride on, willingness of private companies to engage farmers in seed production. Actors that interact with farmers along the value chain include researchers, extension personnel, farmer unions and agro-dealers. The Structural Equation Modelling revealed that household gender, level of education, land size and inputs availability positively influenced farmers to adopt forage seed production interventions.

Recommendations include intensification of production, investment in irrigation infrastructure, stakeholder engagements and trainings that support farmers along the whole forage seed value chain. The research generated information that farmers could tap into to improve livelihoods. Policy and decision makers could utilize the research findings to develop forage seed-based income generating and livestock improvement interventions that

are adaptable to smallholder systems. There have been contributions to knowledge in forage seed production in Zimbabwe and this would inform future forage seed initiatives.

Keywords: *Adoption, forage seed, smallholder, value chains, Zimbabwe*

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Definition of terms

- **Agro dealer** - a retail business enterprise usually located in rural areas and provides a variety of products from groceries to agricultural inputs, tools and hardware, and services such as services acting as market for agricultural products (grain) and information.
- **Formal seed system -** is an organised way in which farmers access, share and dispose excess seed.
- **Forage crop** - plant material grown and conserved as feed livestock feed
- **Informal seed system –** is un-formalised way of accessing and disposing seed that is used by farmers. There is no marketing system that is followed, even quality is not guaranteed. Farmers have used this system since time immemorial as a way to ensure availability of seed of underutilised crops or those of low economic value.
- **Ruminants** – livestock species (cattle, goats, sheep and donkeys) that each have a stomach which has four compartments, that is, the rumen, reticulum, omasum and abomasum. The ruminant also chews cud (partially chewing of the feed) which it later regurgitates.
- **Seed** – Is the primary source of plant life and considered the most important input in agriculture. It also acts as a repository for the genetic material of crop varieties and this is improved through selection over time.
- **Seed production** – It involves activities that include varietal selection for planting, land preparation, crop management, seed harvesting, processing and certification.
- **Smallholder** – According to the FAO, this category includes farmers producing crops on land which is about 2 ha and includes farmers who are engaged in livestock production at a small scale.
- **Smallholder farmers** – that group of farmers that produce on small pieces of land on a subsistence level. Resources are limited in most cases and they make use of inputs within the household including family labour.
- **Value chain –** is a chain of activities performed by a company to produce a product or service for the market. In this study the value chain includes input suppliers (seed, fertiliser and chemicals suppliers), producers (farmers and seed companies that produce seed), traders (wholesaler and retailers), processors (packaging) and consumers (livestock keepers, forage producers and seed companies).
- **Value chain analysis** - in this study looks at all activities that take place for a product to be produced, the processes, the actors involved along the value chain and the consumers of the product. It also identifies the relationships that exist and how they can be improved.
- **Wards -** these are subdivisions of districts or local authority areas which are made up of villages and each village consists of households. Each ward is represented by a councillor who reports to the Chief Executive Officer in charge of the district.

CHAPTER 1. INTRODUCTION

1.1 Background

Seventy percent of the population in Sub Saharan Africa depends on smallholder farming where the sustainability of natural resources is now threatened [Food and Agriculture Organization of the United Nations (FAO), 2012; Alliance for a Green Revolution in Africa (AGRA), 2014]. The farming system includes the production of crops and livestock. Crops rely on livestock for draught power and manure whilst livestock benefit from the crops as feed through fodder and crop residues, as a supplement to natural grazing which is the main source of feed. In addition, humans get household nutrition and income by having crops, meat, milk, wealth and status realised from owning and production of crops and livestock. Unfortunately, grazing for livestock is becoming scarce as productivity of grazing lands is deteriorating. Many grazing lands are being turned into settlements as the human population increases. The condition of grazing land has also been exacerbated by the negative effects of climate change. There is also an increase in demand for livestock products [Food and Agriculture Organization of the United Nations, 2012], which is driving the need for improved production of livestock feed but at lower cost. The food security situation is worsening (FAO, 2012) as a result of inconsistent rainfall, deteriorating economic environment and ineffective agricultural policies among other factors (Moyo and Yeros, 2007). Thus the world over, especially in developing countries, strategies have to be developed that address these issues and save the vulnerable communities and the environment at large. Livestock, which is a main asset in rural population needs to be saved and have access to adequate and quality feed.

In developing countries, livestock is one of the fastest growing agricultural subsectors, being driven by a rapid increase in demand for livestock products (Gardner, 2013). Scarce feed resources and the poor quality of available non-commercial feed are the major constraints to increased livestock productivity in sub-Saharan Africa (Lamy, van Harten, Baptisa, Manuela, Guera and de Almeida, 2012; Duguma and Janssens, 2016). To improve on livestock feed availability, strategies should be focussed towards the improvement of grazing lands and planting of forages to make fodder. To produce fodder, seed material is required that will be planted and once the forage crop reaches a certain stage during the growing period, it is then harvested and conserved as feed. Plant life starts from seed of which availability and maintenance of quality genetic material is of paramount importance. Knowledge and access to information is also important as this helps farmers in their activities. Whilst some studies were conducted on effectiveness of smallholder farmer‐led seed systems to supply good quality seed (Kusena, Wynberg and Mujaju, 2017) and the development of community seed business in Zaka (Munyaka, Mazarura and Mvumi, 2017), focus was on food crops including small grains

(sorghum), cowpea and sugar bean. Successes on forage seed production ventures have been recorded in Kenya (Lugusa, Wasonga, Elhadi and Crane, 2016), Ethiopia (Alemu, 2015; Welu, 2015) and Thailand (Hare, 2014). However, not much work has been conducted, particularly in Zimbabwe, on participation of smallholder farmers in input and output markets for forage seed and how these contribute to the farmers' livelihoods. Participation in input and output market impacts significantly on farmers' choices, decision making and resultantly adoption of technologies (Awotide, Karimov and Diagne, 2016). Forage seed value chain involves supply of inputs (including seed material), field management practices and processes, seed cleaning, packaging and marketing, and utilisation.

Production of forage seed depends on a number of factors including germ plasm and inputs availability, infrastructure (road network, market) availability, selling price and demand for the seed. Knowledge and expertise in seed production quality standards and availability of support services are also critical. In many cases, the improvement of seed technology is hampered by an underdeveloped forage seed industry (Mulugeta, Eshetu and Nikus, 2010). There is need for improved forage germplasm, committed input suppliers, stockists and traders, policy makers, extension and other support service providers. The production and marketing of forage seed needs to be well established, being driven by a high demand for forage seed by various sectors. These may include, livestock keepers who grow forages for feeding their animals, livestock feed producers who will then sell to livestock keepers or crop production farmers who intend to include forages in the cropping systems for soil conservation purposes. In livestock feed production, forage seed becomes an input to forage production. Therefore, forage markets are a prerequisite in such environments and these will make provision for forage seed access.

Forages support a number of agricultural production activities including crop and livestock production (Gebreyowhans and Gebremeskel, 2014). Both forage grasses and legumes offer an alternative to increase the supply and quality of feed to livestock and pasture development, which depends on reliable seed supply. They also reduce run-off through vegetation cover and conserve moisture in the soil. Forage legumes improve soil nutrient status through nitrogen fixation. Researchers have found out that common bean is capable of fixing between 50 and 80 kilograms nitrogen per hectare (kg N ha^{-1}) annually (Woomer, 2010), whilst legumes like *Mucuna pruriens* (mucuna) and *Lablab purpureus* (lablab) can fix up to 100 kg ha^{-1}. This therefore benefits subsequent cereal crops and saves the cost of buying fertiliser incurred by the farmer. However, seed of forages need to be available to enable successful development of forage systems for improved livestock production. This is more so in rural communities where grazing land is no man's land and there are no grazing management plans in place (McGranahan and Kirkman, 2013). For the forage system to be sustainable, there should be constant seed supply.

Value chains play a role in the access of forage seed and there are different players that ensure supply and distribution. Figure 1.1 shows the value chain processes which include supply of inputs, production of the forage seed in the field, seed harvesting, cleaning, seed quality controls and certification, seed marketing and consumption which is the utilisation of the seed by forage producers and livestock keepers. Seed breeders avail initial parent material which is then multiplied through seed production programs. Such programs involve seed producers who are qualified and have the expertise in seed production. Once the seed is multiplied, it is then certified and ready for marketing to other farmers as certified seed for forage production. The processes in seed production do not occur in isolation and are bound to be influenced by economic environmental changes, technological advancement and availability of human resources support. There is need for an improved understanding of challenges, relationships among actors and help to deal with power within and at each of the stages along the value chains. Strengths of the forage seed business will depend on the effectiveness and efficiency of support services (extension, research, development partners, private sector, and local authorities), knowledge, skills and motivation of the farmers, participation of value chain players, resources available (land, finances, human resources and technology), access to markets and availability of improved seed.

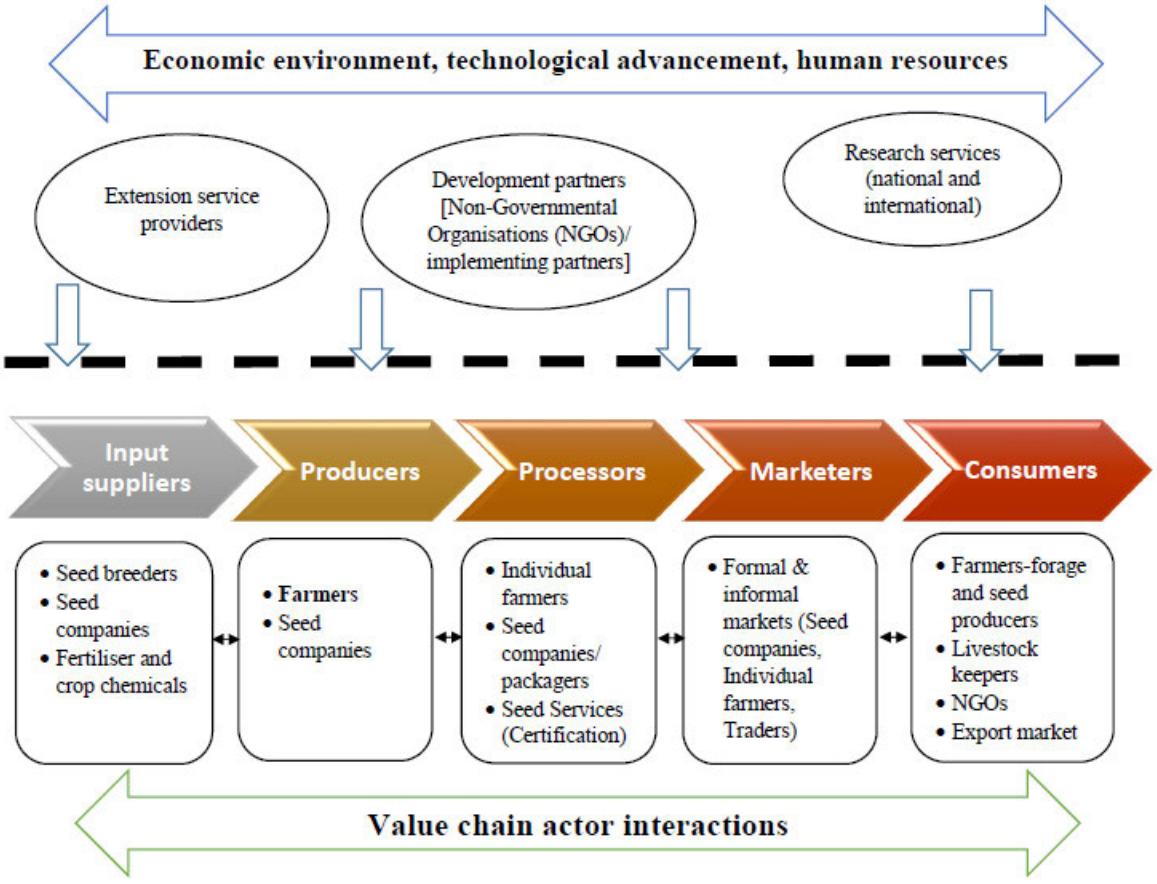


Figure 1.1: Value chain for forage seed (Source: Adapted from Porter, 1985)

Value chains may form the link between adoption of forage seed production and income and outcomes, for example, smallholder farmers who venture into forage seed business may generate increased incomes within the household. This is by way of diversifying farming activities, improving farming practices through trainings and knowledge sharing with other farmers, being in farmer organisations and having more assets.

Forage seed production as a business can be conceptualised as a process in which smallholder farmers are integrated into input and output markets including input supply markets, labour markets and output markets (including livestock feed), processes that take place and interacting with different stakeholders at different levels. This can be viewed as an indicator of commercialisation (Poulton, Dorward and Kydd, 2010; Kilelu, Klerkx and Leeuwis, 2016) when farmers participate in such markets. Thus, the integration into and participation of farmers in such markets lays the foundation for the analytical portion of the study. Therefore, it becomes essential to understand the environment smallholder farmers operate in, how the markets are set up and operate, opportunities and challenges being encountered and whom they interact with at the different levels in order to develop sustainable strategies that enhance their businesses in forage seed production and increase income generation within the household (Figure 1.2). Double sided arrows indicate that there are linkages for the different processes and stakeholders. However, forage seed business is very uncompetitive, especially in the smallholder sector. The dotted arrows in figure 1.2 show what is missing and expected within the value chain for it to be competitive. Thus the complexity of the forage seed business requires the employment of models that are able to explain interactions in these systems. Competitiveness of forage seed business in smallholder systems is key to the study.

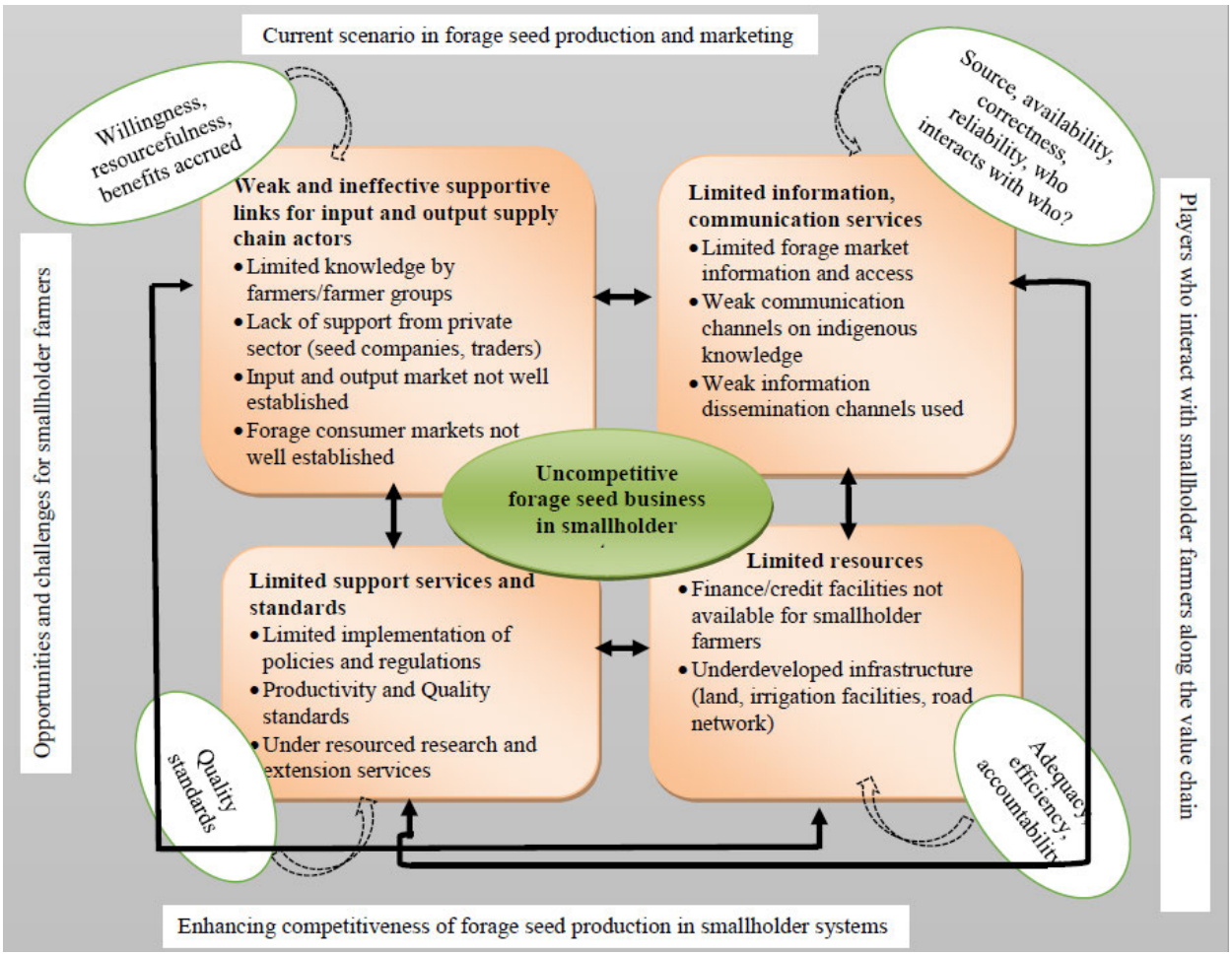


Figure 1.2: Conceptual framework for forage seed value chain (Source – Researcher)

Most smallholder farms in the developing countries practise mixed farming, where there are crop and livestock activities. Farmers in such environments tend to be opportunistic [United Nations Conference on Trade and Development (UNCTAD, 2015)] and diversify farm activities to spread risks (Shiferaw, Tesfaye, Kassie, Abate, Prasanna and Menkir, 2014; Wan, Li, Wang, Liu and Chen, 2016). In making such decisions, they consider such factors as costs and labour involved, and benefits to be derived in the farming activities. Motivating factors can include getting well informed about the enterprise, interactions with stakeholders or market price of the commodity. Unfortunately many governments in developing countries have neglected smallholder farmers, even though they supply about 80.0 % of the food requirements (UNCTAD, 2015). For the smallholder farmers to be market oriented, input and output markets need to be accessible at low cost. The high cost of seed certifications have also deterred farmers from producing adequate quantities for the market (Severine, Lazaro, Kledal, Karantininis, Sibuga and Mbapila, 2014: UNCTAD, 2015).

Integrating farmers into forage seed value chains and markets may facilitate the adoption of new forage and other crop varieties, thus increasing crop and livestock productivity for the smallholder farmers. On the other

hand, increased productivity of forages and livestock will lead to more market integration and meeting the increased demand for livestock products. Thus, a two-way relationship exists where instrumental variable techniques for endogenous (influenced by other variables) variables can be applied. This calls for the analysis of variability occurring in related variables such as farmers adopting forages or what motivates them to participate in forage seed markets. The adopting households may be seed producers themselves who then sell their produce (forage seed) to other farmers and seed companies. They may also be forage users who are crop farmers who intend to improve soil structure and nutrient status through crop rotations, soil cover crops and soil nitrogen fixation by legumes, thus improved farming practices. On the other hand, adopters, may be livestock producers who buy forage seed to produce forage for livestock feed or crop farmers who grow forages to sell to livestock owners. The livestock owners will benefit from livestock sales after feeding their animals with the conserved forage. All this may result in increased land use as fallow land will be utilised for cropping and crop rotations. As farmers understand more about forage seed input and output markets, develop, understand and increase interactions with value chain actors, they are able to negotiate for better prices and services and they are able to fully participate in forage seed businesses.

This, therefore, requires to explore a better understanding of the forage seed production and marketing practices, relationships that exist along the value chain and their effectiveness, challenges and opportunities that exist through the use of modelling approaches.

1.2 Problem statement

In Africa, 60.0-70.0 % of the population own livestock and ruminant nutrition has been cited as one of the major constraints to improved food security. In Zimbabwe, grazing areas are being turned into land for cultivation and human settlements, due to an estimated 2.68 % annual increase in human population [Zimbabwe National Statistics Agency (ZimSTAT, 2013)], whilst Ministry of Agriculture, Mechanization and Irrigation Development (MoAMID) Reports indicate that livestock numbers, especially cattle, have remained relatively constant at 5.4 million from 2013-14 growing season to 2015-16 growing season. Climate change (erratic rainfall and frequent droughts) has also contributed to decline in livestock productivity and their resultant value. In Zimbabwe, seasonal variations in rainfall quantity and distribution causes forage quantity and quality to decline, reducing livestock productivity especially during the dry season (Topps and Oliver, 1993). Ruminants' body condition deteriorates (Gusha, Chiuta, Katsande, Zvinorova and Kagande, 2015) especially in the dry season, from a body condition score (BCS) of between 3.5 and 4 to an average score of 2. Current livestock productivity has been low because of lack of adequate and quality feed, despite the fact that there is an increase in demand for livestock products. Thus, human nutrition is threatened.

Pasture production programs to support livestock productivity have been less successful with germ plasm unavailability as one of the reasons, both on formal and informal input markets in the country (Mapiye, Mwale, Chikumba, Poshiwa, Mupangwa and Mugabe, 2006). Reasons for the unavailability of forage seed has been sighted and these include high risks involved in forage seed production, financial limitations, unavailability of the market and limited knowledge and information on how to conduct the forage seed interventions. This is despite the fact that forage legumes have been proved to be beneficial for livestock as feed, soil improvement and to humans as food (Waddington, 2003; Smartt and Nwokolo, 2012; Stagnari, Maggio, Galieni and Pisante, 2017). Forage seed production dates back to 1940s in African countries including Kenya, South Africa and Zimbabwe focusing on commercial production of grasses such as *Chloris gayana* and *Digitaria eriantha* (Fairey, Loch, Hampton and Ferguson, 1997). Katambora grass was mainly used as a rotation crop in tobacco production. Smallholder farmers started to be involved in legume seed production in countries like Ethiopia where lablab, Leucaena legumes were being promoted (Griffiths, 1990).

The Zimbabwe Fast Track Land Reform Program (FTLRP) was initiated with the objective of improving the wellbeing of the majority (Tom and Mutsvangwa, 2015), many of whom fall in the category of peasant farmers. An understanding of farming practices after this historic event would facilitate development of relevant interventions like forage seed production that are inclusive of perceived neglected farmers. Since seed production in Zimbabwe was focussed on food and cash crops and in the commercial sector, smallholder farmers' (producers) participation and decisions to venture into the forage seed business became very limited. Such practices have been attributed to lack of business skills and limited translation of forage seed value to livelihood benefits (Guidi, 2011; Chapoto, Mabiso and Bonsu, 2013; Mwambi, Oduol, Mshenga and Saidi, 2016). Integration of farmers into markets is also limited as forage seed is considered a less important crop as compared to field crops. Crop value chains are more active for field crops including maize, groundnuts and soybeans. Forage seed production has been limited to the commercial farming sector and national research institutes. Thus the markets have never been developed and seed continues to be produced and traded in the informal sector, if ever there are any initiatives taking place. Little or no information is available that can highlight if there is any business potential in forage seed production and marketing. Data on forage seed production and marketing is lacking in Zimbabwe, making it difficult to track production trends and adherence to quality standards by Seed Services, even though there is a Seed (Certification Scheme) Notice 2000 for pasture seed. Therefore, there is need for an investigation into forage seed production in order to understand the value chain and be able to develop sustainable strategies that enhance forage seed business, especially in smallholder systems.

1.3 Research questions

The research questions are:-

1. What are the current forage seed production systems available in Zimbabwe?
2. What are the challenges encountered and opportunities that exist on forage seed business management in smallholder systems?
3. Who are the players in the forage seed value chains and what are their roles?
4. What strategies can be developed that enhance competitiveness of forage seed production in smallholder systems?

1.4 Objectives

The primary objective of the study is to develop a model for forage seed production as a business with particular focus on forage seed in smallholder systems of Zimbabwe. This objective is built upon and supported by secondary objectives of the study which are to:-

1. Characterize current forage seed systems in Zimbabwe;
2. Identify challenges and opportunities in smallholder forage seed production and marketing;
3. Characterize forage value chain players and their roles in forage seed systems;
4. Suggest options for enhancing competitiveness of forage seed production as a business in smallholder systems of Zimbabwe.

It should be noted that all the secondary objectives lead to the primary objective of the study, which is to develop a model and thus the chapters will be based on the research objectives.

1.5 Research approach and methods employed

The study makes use of both household surveys, Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) in looking at the potential of forage seed business in smallholder systems in Zimbabwe.
This enables the understanding of the context, processes, behaviours and interactions, and help to explain the outcome of results through the use of structured questionnaires. Survey research describes, characterizes and reveals trends that assist in developing strategies that contribute to the enhancement of competitiveness of the forage seed business. In-depth interviews also explain findings from the research and method involves fewer participants who are only generalizations and will employ Focus Group Discussions (FGDs) to gather general views and opinions, whilst Key Informant Interviews are meant for those with in-depth knowledge of the

situation under study, such as extension staff in the area and District Authorities. A total of four FGDs (two in each of the two districts) will be conducted. Approach is important to crosscheck outcomes from quantitative research. It becomes necessary to employ both methods, using multiple data sources to shed more light and have a better understanding of the study in question. For the purposes of this study, mixed method research was used. There was collection of data that was analysed statistically, including non-quantitative data after it had been transformed. Triangulation was employed to cross-check on validity of data collected. The approach involved interviewing farmers in their rural setting and responses were cross checked through discussions with organizations and extension staff they interacted with in the area.

On development of the model, Structural Equation Modelling (SEM) was considered as the main method, which is a second generation technique for data analysis. The modelling technique is highly regarded in measuring direct, indirect and wholesome influences of variables on each other irrespective of biases that are inherent in techniques that involve the least squares methods. It is highly recommended for analyses that involve endogenous variables and between visible and latent variables. This technique enables one to get answers from interrelated scenarios through modelling of dependent and independent variables simultaneously. The model also allows simultaneous inclusion and analysis all in one model, of variables that are observed and latent. The study made use of a structured questionnaire in order to collect data for the model. Data was collected from a total of 414 households in the study area, coded and captured and analysed using Statistical Package for Social Sciences (SPSS) version 21, UCINET 10, NVivo and STATA version 13 for structural equation modelling.

1.6 Reliability and validity of study

1.6.1 Reliability

For the study, data collection tools were pre-tested and corrected to ensure similar responses when the same tool is administered to different respondents. FGDs involved the use of participants with a better understanding of the sites who could provide useful information. In-depth interviews were conducted with known companies and organisations within the seed value chain.

1.6.2 Validity

In the study, validity was ascertained by cross-checking farmers' responses with the Key Informants (extension staff and other value chain players). Also to ensure increased validity of data collected, tools were made to match study objectives.

1.7 Dealing with bias

Random selection of households was employed for the study. For FGDs, participants were those with a better understanding of the area and knowledge of the subject for discussion. This was to keep focus on the discussion topic and not waste participants' time. Interviewer bias as minimized by training the enumerators and data encoders on pre-testing survey tools.

1.8 Ethical considerations

Authority to conduct the study in the selected study area was sought from the Ministry of Agriculture, Mechanization and Irrigation Development, who is the responsible authority for the farmers and the activities associated with such. Since the organisation I work for is implementing a project in the study site and has an interest in the study, permission was also granted to collect and use data from the same area. In preparation of questionnaires and interview guides, consent forms were prepared in local language. Contents of the consent form were explained in full to the participant and then signed by respondents just before commencement of participation in the household survey. For FGDs and KIIs, a consent form was also developed, assuring them of confidentiality, highlighting the objectives and importance of their free participation.

1.9 Overall significance of study

The study seeks to advance a better understanding of the forage seed production and marketing, and the potential of smallholder farmers venturing in such farming enterprises with a resultant improvement in income generated and farmer livelihoods. Modelling will contribute to development of better informed strategies, adaptable and relevant interventions. The model to be developed will help better understand the observable and latent variables and their effects on forage seed adoption and competitiveness in smallholder systems. This will also inform policy makers and the seed industry on the most suitable, adaptable and sustainable way to engage smallholder farmers in forage seed production and marketing. Highlighting aspects that support competitiveness will enlighten stakeholders, including government, on forms of support they can offer to improve competitiveness of forage seed value chains. Competitiveness of the business potential of forage seed and what contribution forage seed can make to the sector. The model to be developed will make stakeholders realise their importance and need for concerted efforts to improve livestock nutrition in the livestock industry. In academia, this will act as a basis for further research in the forage seed industry.

Policy makers need to make informed decisions, therefore, the study of forage seed production and marketing provides an avenue to develop sustainable forage seed markets and avail adequate livestock feed for improve

livestock productivity. There will also be efficient utilisation of resources and improve availability of quality feed for livestock.

1.9.1 Significance of objective 1

By characterising current forage seed systems, the study will reveal current gaps and insights for considerations for the future on forages and forage seeds. Farmers and other stakeholders will really understand and appreciate where the problem is on feed and livestock production. This will be of interest to policy makers, stakeholders in the livestock industry and farmers as focus is being made to improve livestock production among smallholder farmers. The important aspects of the study will guide research, extension, private sector, decision makers and farmers to focus and plan for relevant interventions on forage and pasture management. In academia, this will act as a basis for further research in the forage seed industry. Farmers will benefit from the study as it will assist in better understanding of what the real situation is and make plans of how to improve on practices.

1.9.2 Significance of objective 2

The study seeks to identify and analyse challenges and opportunities along forage seed value chains, which will be useful in the formulation of focused and relevant interventions. The SWOT analysis will help relevant authorities to make informed decisions on planning and implementation of interventions. Farmers will benefit in that they will be able to envision their future from current challenges.

1.9.3 Significance of objective 3

The study will help to identify who the players are and what role they play along the value chain. This will assist farmers and other stakeholders in identifying who to engage with for what purpose. Farmers will have knowledge and will develop skills on how to build relationships with the various players at different levels along the value chain. The study will develop potential pathways and interventions on forage seeds that include participation of smallholder farmers. These pathways will assist policy makers, government, seed industry players, academia, research and extension and development partners to embrace farmers and their efforts.

1.9.4 Significance of objective4

Farmers will benefit from the study as this will assist in decision making in their venture to increase income sources and diversification of farm activities. The study will provide an in-depth understanding of the seed industry including forage seed, existing gaps and challenges, and opportunities that can be created for farmers

and other value chain players. This will also assist in the development of forage business models in smallholder systems within and beyond study sites. In the long run, it will improve livestock production and farmers' livelihoods through income generation. Improved access to markets and full participation of smallholder farmers in value chains is believed to increase their income sources and diversity of income generating activities, besides building resilience against shocks triggered by food insecurity. Linkages can also contribute to employment creation among communities and improved involvement of youths.

1.10 Study limitations

The study intended to assess the potential of forage seed production in smallholder farming systems of Zimbabwe. It considered Goromonzi and Murewa districts in the sub-humid region of the country, where a project is being implemented. The main forages considered in the study were *Mucuna pruriens* (Velvet bean) and *Lablab purpureus* (Lablab), which are forage legumes, as extensive work has been done before in such environments, hence results will mainly apply to these forage legumes, including social Costs and other financial expenditures based on the prevailing economic environment. Unstable economic climate in Zimbabwe may cause seed prices not to be a true reflection of actual prices. Findings from the study may be generalised although they may not apply to other agro-ecological zones. Previous studies on this subject in this region and specifically in smallholder systems have not been conducted, therefore there is no reference to such material. The study is subject to limitations that maybe associated with the methods used, including triangulations, although every effort was made to minimise such limitations.

1.11 How the dissertation is organized

Chapter 1 gives background and introduction to the study. The chapter highlights the main and specific objectives, problem statement, limitations and significance of the study. Chapter 2 focuses on review of earlier scholarly articles. The chapter reviews literature on farming system, livestock and seed industry in Zimbabwe, other studies that have been done on fodder production including methodologies and analytical tools that they used. It also reviews value chain studies that have been done by other scholars in the seed sector. Gender issues and how they affect the forage seed value chain is highlighted. In chapter 3, the methodology is discussed, including a description of the study sites, research design used, techniques used in sampling and data collection, and data analysis in relation to seed value chains.

Chapters 4-6 mainly focus on study findings. Chapter 4 highlights research findings on characteristics of the current forage production systems and issues of gender and decision making along the forage value chains. Study findings on challenges being encountered and opportunities that exist for the different stakeholders and

processes along the seed value chains are dealt with in Chapter 5. Chapter 6 explains research findings on value chain actors identified and explains how they relate among themselves and the farmers.

Chapter 7 Structural Equation Modelling (SEM) was employed based on data collected and analysed in chapters 4-6 to investigate and understand factors affecting adoption and venturing into forage seed business especially in smallholder systems. The chapter also highlights the aspects that need to be looked at in order for forage seed production to be enhanced and made adaptable to smallholder farmer environment and circumstances.

The last chapter (Chapter 8) focuses on summarising research findings, conclusions and recommendations. Figure 1.3 illustrates how the thesis is outlined and arrows showing flow of chapters from introduction to the last chapter.

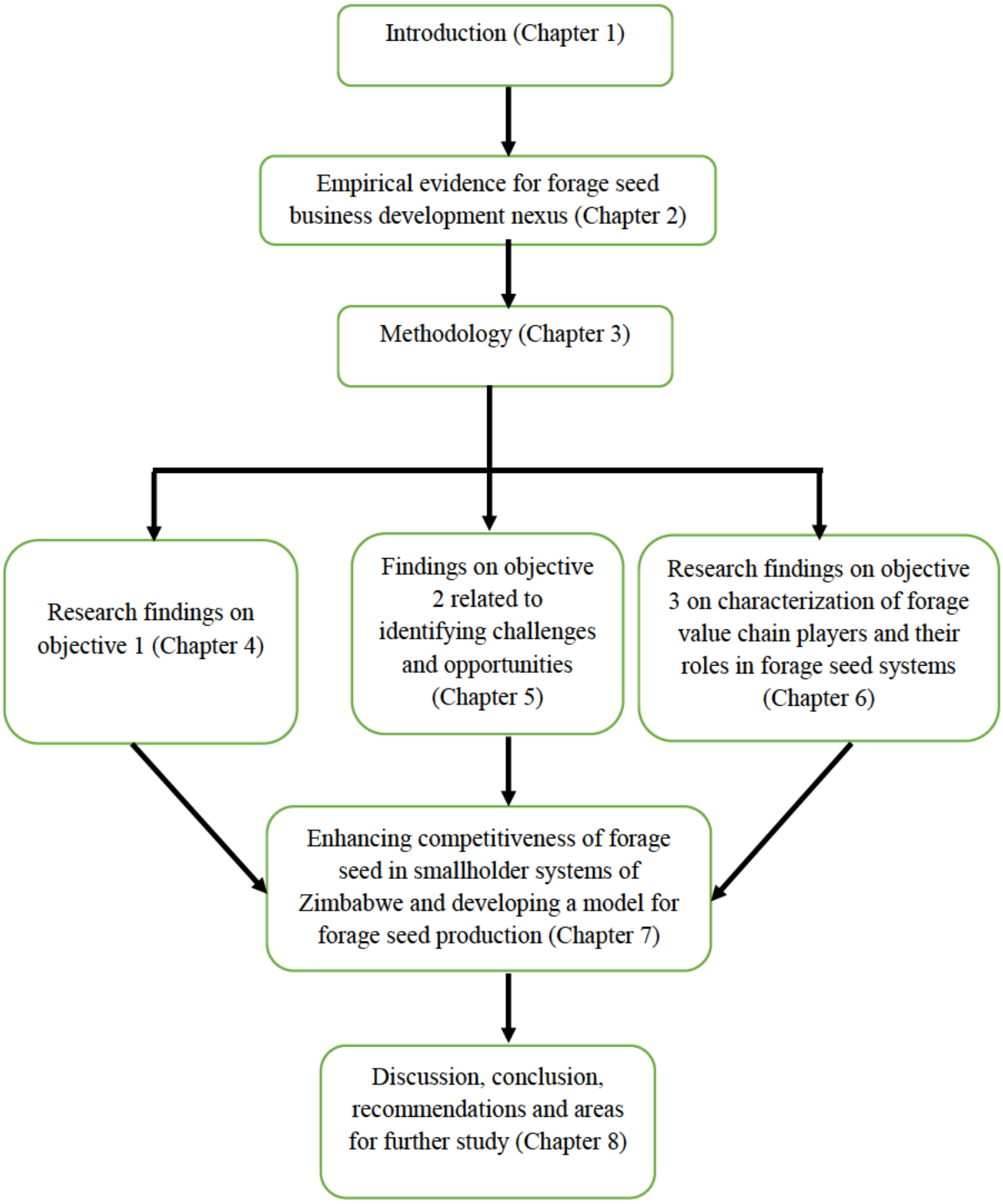


Figure 1.3: Thesis outline. Source: Developed by the Researcher

CHAPTER 2. A REVIEW OF FORAGE SEED PRODUCTION AND ITS VALUE CHAIN

2.1 Introduction

Seed production in particular for forages, is important for improving livestock productivity through proving feed and nutrients in soils that support crop production. Although forage production remains an important aspect in increasing feed availability, farmers' income and alleviating poverty, farmers experience challenges such as unavailability of quality seed, underdeveloped forage seed, limited knowledge and lack of institutional support among others. This also has an implication on livestock productivity and supply of livestock and associated livestock products.

In this chapter, there is review of scholarly articles, prior work conducted and reported in the form of books, journal articles and other publications on the subject of forage seeds. The chapter also reviews literature relating to forage seed production as a business in smallholder systems in Zimbabwe. The importance of forages and seed production is highlighted. In addition, it will critically analyse existing knowledge on the fodder seed industry in order to solve the shortage of livestock feed during the dry season. This is beside the fact that forages also play a role in improving the soil structure, soil cover and nutrient status. Forages also interfere with other farming activities such as the production of food crops and livestock, thus competing for land, labour, other resources and decision making within the household. Literature also discusses inclusion of forage seed on the market and possibilities of farmer participation in such markets.

There are discussions on the seed industry in Zimbabwe, marketing of seed, the value chain actors involved and how they relate to each other. Also discussed are factors affecting success of a seed enterprise, the environment climate for marketing of forage seed and how smallholder farmers participate in forage markets. The chapter is mainly concerned with the analysis of literature with a focus on forages, forage seed and livestock, and how seed production can be a successful business venture within smallholder systems. It is hoped that the literature review will present a better understanding of forages and forage seeds and their importance within the livestock sector and also a value chain analysis within the context of forage seed as a business especially in smallholder systems.

2.2 Farming system in Zimbabwe

Zimbabwe is divided into five major agro-ecological zones [Natural Regions (NRs)] that are based on rainfall pattern, soils and vegetation. Vincent and Thomas, (1961) and Moyo, (2000) assert that the highest amount of

rainfall per season is received in Natural Region I (NR1) and this amount decreases as regions progress towards NR V. Natural regions I-II are suitable for intensive farming activities, including crop production (Figure 2.1 and Appendix 1). These regions are also suitable for seed production for crops, whilst the drier regions mainly focus on intensive livestock production.

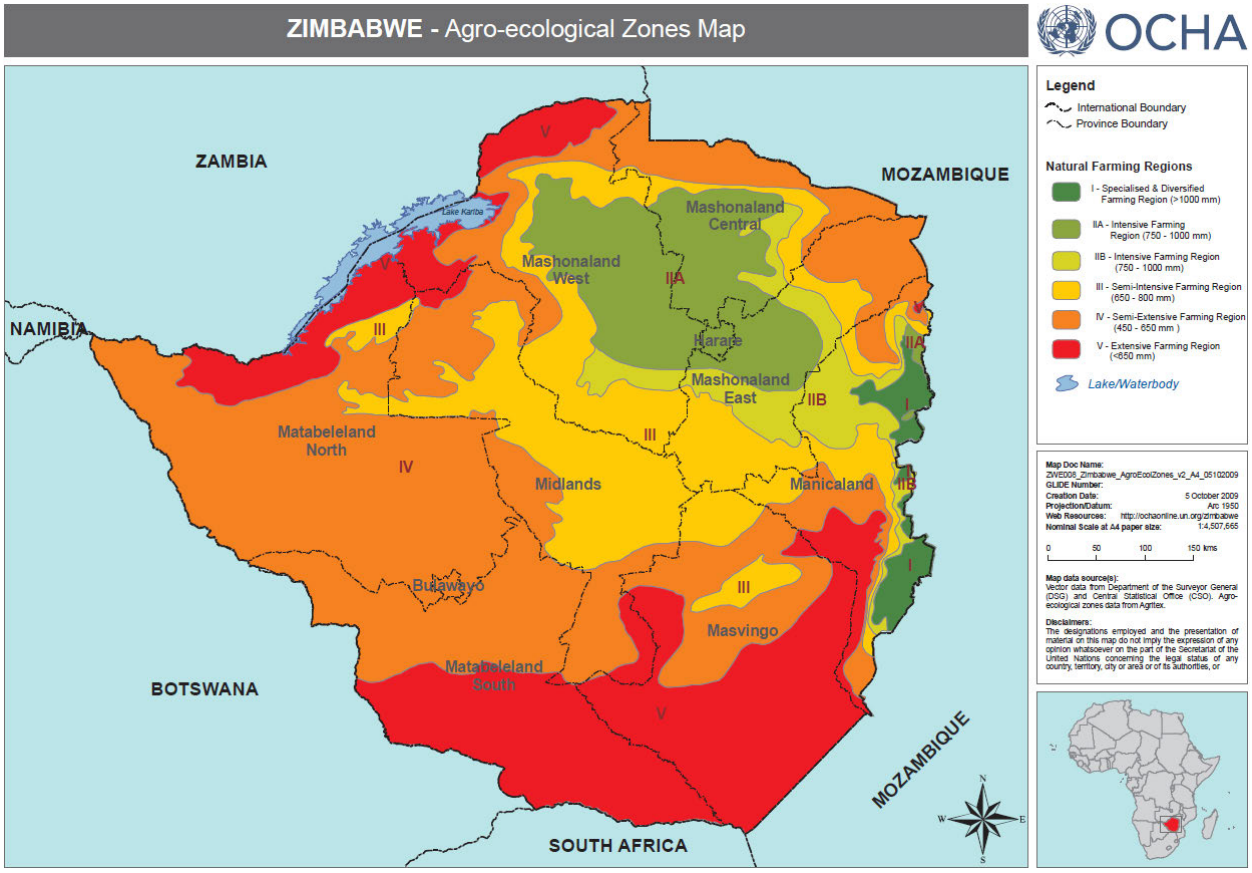


Figure 2.1: Agro-ecological zones of Zimbabwe. Source: FAO OCHA Maps, (2010)

Agricultural land in Zimbabwe is divided into a number of categories that are related to the NRs. In NRI, there is specialized (dairy, timber, tea and coffee production) and diversified farming. NRII has intensive and semi-intensive production of crops (maize, tobacco and soya beans) and livestock (beef, dairy, poultry and pigs), whilst NRIV and V are more into semi-extensive and extensive production of livestock. The main agricultural sectors in the country comprise of the large scale A2, A1, Old resettlement and communal areas, of which some of the farming areas changed from being large scale or national parks over time as a result of the Fast Track Land Reform Program (FTLRF) initiated in 2000. The most affected farming sectors were the large scale farms and the national parks that were reduced in total land area as some of the land was set up for A2 and A1 farming models. The large commercial farming sector which covered 30.0 % of total land area in the year 2000, reduced to 1.77 % by 2011. This land was reallocated into A1 and A2 farms. The Model A1 which is a communal area and farming activities are subsistence based, and the Model A2 which consists of the small, medium and large

scale farmers and is a commercial settlement scheme (Moyo and Chambati, 2013). It can be noted from the table that most of the commercial farms were redistributed as Model A1 and A2 farms. Area covered by communal lands was maintained around 16 million ha. By 2011, area under national parks had reduced from 15.0 % to about 2.0 % as shown in Table 2.1.

Table 2.1: Land ownership before and after Fast Track Land Reform Program (FTLRP)

Category	**Prior FTLRP (as at June 2000)**		**After FTLRP (as at July 2003)**		**As of 2011**	
	Area (Mil. ha)	**% of total land**	**Area (Mil. ha)**	**% of total land**	**Area (Mil. ha)**	**% of total land**
Large scale commercial	11.8	30	2.6	6	0.7	1.77
Small scale commercial	1.4	4	1.4	4	1.4	3.54
Communal areas	16.4	41	16.4	41	16.0	40.4
Resettlement areas	3.7	9	3.7	9	3.7	9.34
Model A1farms	-	-	4.2	11	6.8	17.17
Model A2 farms	-	-	2.2	6	3.0	7.58
National Parks	6.0	15	6	15	0.8	2.02
Institutional farms	-	-	-	-	0.2	0.51
State land	0.3	1	0.3	1	-	-
Unsettled gazetted land	-	-	2.8	7	0.8	2.02
Other land to be settled	-	-	-	-	6.2	15.65
Total	**39.6**	**100**	**39.6**	**100**	**39.6**	**100**
	Source: Utete Report, (2003)		Source: Utete Report, (2003)		Source: Matondi,(2012)	

Notes: **Category** – refers to land ownership by farming sector and state land such as national parks and unsettled land

Fast Track Land Reform Program – a program implemented by the Government to redistribute land for the benefit of the majority of the people in the country.

2.3 Livestock production systems in Zimbabwe

Livestock in Zimbabwe is considered an important asset as it plays a number of roles in the livelihood and economic lives of the population. Among the livestock species, cattle play a major role in the livelihoods of smallholder farmers, being kept for wealth, meat, milk, draught power and manure. Zimbabwe's livestock sector is on an upward trend in terms of numbers especially from 2013/14 season to 2014/15 season (Appendix 2). There was a 2.0 %, 2.7 % and 0.9 % increase in number of cattle, goats and pigs respectively, despite that sheep population decreased from 521 607 to 456 627 during the same period. Livestock, especially ruminants, is considered the greatest user of land globally, mostly through the use of grazing lands (FAO, 2015). In Southern Africa, rangelands are being threatened by unsustainable land-use practices (Biggs, Simons, Bakkenes, Scholes, Eickhout, Van Vuuren and Alkemade, 2008; McGranahan and Kirkman, 2013) and overgrazing by ruminant livestock has been identified as one of the factors responsible for that. In order to support initiatives to renew rangelands and quality grazing, there is need to find alternatives to livestock feed production and availability.

More than 70% of the livestock population is kept in the rural areas under integrated crop-livestock farming which is the predominant production system. Productivity of the livestock in this sector is very low due to factors that include limited supply of quality feed during the dry season. Grazing, which forms the bulk of the feed for ruminants, declines in quality and quantity in the dry season (Topps and Oliver, 1993; Gwiriri, Manyawu, Mashanda, Chakoma, Moyo, Chakoma, *et al.,* 2016). Supplementation of ruminant livestock is not much practised by smallholder farmers because of high feed costs. Masikati, (2010) also asserts that besides feed shortages, high incidences of diseases and mortality rates, and unavailability of water which is a common feature in communal areas lead to low livestock productivity. With the cultural attachments cattle have in the African culture, selling off livestock is almost non-existent except when a financial crisis arises, such as payment of children's school fees or meeting huge medical expenses, leading to overgrazing of natural pasture. Finishing of cattle is mainly off-veld, except for those few farmers with irrigation facilities where it is off planted pasture or those who can afford to purchase fattening meals for the animals. Pastures are mainly natural grass and shrub species which become unpalatable in the dry season, thus leading to low productivity. Improvement of pastures is limited as a result of factors that include the lack of forage seed, limited knowledge and inadequate management practices. Production of forages results in improved feed availability for livestock production, hence the need to avail good quality forages that produce quality seed. The projected future demand for livestock also presents opportunities that will improve farmer incomes and livelihoods, besides the environment (Mc Dermott, Stall, Freeman, Herrero and van de Steeg, 2014).

2.4 The seed industry in Zimbabwe

The seed industry in Zimbabwe was started in the 1920's by some farmers' associations with support from government (Rusike and Donovan, 1995; Havazvidi and Tattersfield, 2006), with the main focus being on maize improvement. Since then, the government through research and plant breeding in collaboration with statutory bodies have supported the initiative. This was also a result of successes made by the then Southern Rhodesia (now Zimbabwe) Maize Seed Association and various maize trials at Harare Research Station through the Department of Agriculture. Many other crops followed with the main crop seeds being supplied on the market through the Ministry of Agriculture and Crop Seeds Association being sorghum, wheat, soya beans and groundnuts, whilst maize seed continued through the Seed Maize Association. This guaranteed the supply of good quality seed and acted as a seed reserve. Even though support has been given to crop breeding programs, adoption of improved varieties remains low and one of the reasons cited is inefficient systems put by government and include the use of parastatals, government departments and private seed companies whose focus is profit making (Rusike, Howard and Moredia, 1997; CIAT, CRS, World Vision, Care, AGRITEX and CIMMYT, 2009). Breeding and bulking of certified seed is being left to private companies as government lacks adequate funding, leaving farmers to retain seed for the following season (Rusike *et al*., 1997). The Crop Breeding Institute (CBI), a government arm is mandated with the breeding of field crops and these do not include forages which are usually under the umbrella of livestock and pastures.

Zimbabwe, like other African states is making efforts to modernise and commercialise seed production and the development of commercial seed systems. Before then it had been established that seed systems in Africa, particularly in Zimbabwe, were organised at local level and outside the global arena (Venkatesan, 1994). Venkatesan, (1994) also highlights that this was true for maize which was distributed through a seed company which had an agreement and had been given sole rights by the Ministry of Agriculture. Unfortunately the company could not meet farmer-customer demand and this left local farmers to venture into producing their own seed, share with neighbours and other community members that farm-saved seed. Through the legislation for control and organization of the seed industry by the government, it is now mandatory to certify seed of maize, soya bean, tobacco, cotton, wheat, barley, oats and potatoes only in Zimbabwe (Mujaju, 2010).

However, the Zimbabwe seed legislation (Seed Act of 1965 and amended in 1971) only covers agricultural seeds (Nyoka, Ajayi, Akinnifesi, Chanyenga, Mng'omba, Sileshi, Jamnadass and Madhibha, 2011). Crops covered include grain legumes which are used as food for human consumption. Other crops are cereals, roots and tubers which other soil benefits and crop rotation options (Monyo and Laxmipathi, 2014).

According to Rusike *et al.* (1997) and CIAT *et al.* (2009), setting up viable marketing channels in rural areas is too costly as infrastructure (roads, communication) is not reliable and agro dealers are not credit worthy and are considered as high defaulters. Producer organizations have the potential to invest in these areas but face complex challenges which impede their desire to deliver their full potential. Government subsidies and donor dependencies which undermine self-reliance also has a negative impact on effectiveness of service delivery by these organizations (Bijman, Muradian, and Schuurman, (2016). Also FAO and ICRISAT (2015) mention that forage seed volumes for the market are too low and uneconomic on an individual farmer basis.

2.5 Seed supply and marketing

Seed is accessed through the formal and informal system and Wekundah (2012) mentions that these seed systems vary in their degree of mechanisation. The formal system constitutes mainly crop seeds of maize, soybeans, groundnut, cowpea, cotton, wheat and vegetable. The formal system is market centered and mainly governed by the private sector, whilst the informal sector is dominated by the local seed system (Mutonhodza-Davies and Magunda, 2012). According to Rubyogo *et al.*, (2010), private seed companies which form the greater part of the formal sector, focus on breeding, multiplying, certification and marketing of hybrid seed at the expense of open-pollinated varieties which they view as less profitable. Formal system for open-pollinated varieties is considered uneconomic as it involves private seed companies (Aw-Hassan, Mazid and Salahieh, 2008). However, earlier studies have revealed that formal seed systems do not reach many farmers especially in isolated locations and fail to meet their needs for access and information (Cromwell, 1990). For those farmers who will have accessed seed of marginalised crops like forage crops, they will plant small areas, observe performance and later utilisation. Expansion in land area and utilisation will occur only if desirable to the farmer. This is done to minimise risks whilst diversifying activities at the same time.

Access to improved seed, especially for underutilised or marginalised crops and those produced in drier environments is usually a problem (Aw-Hassan *et al.*, 2008). This is no exception for forage seeds in most parts of Sub-Saharan Africa where production of food crops is of priority. The informal system has been in existence since time immemorial and it is a tradition used by farmers to ensure supply of crop seed to meet food security requirements (Mulugeta *et al.*, 2010; Wekundah, 2012). In smallholder systems, there is widespread informal seed production and dissemination (Nyoka *et al.*, 2011) and existence of such a sector is important as it ensures food security (Wekundah, 2012). This is through farmer-to-farmer sales, exchanges, gifts and payment for labour and is increasing within the Sub-Saharan Africa region. In Zimbabwe when the formal seed system collapsed in 2005-2009 (Mutonhodza-Davies and Magunda, 2012), farmers relied on the informal system for seed access. Therefore, the informal seed system has remained the main seed source for smallholder farmers (Ndjeunga, Anand Kumar and Ntare, 2000). However, the sector is not able to avail new and improved varieties.

Farmers focus on varieties that are profitable and introducing better adapted and drought tolerant varieties that will enhance livelihoods (Katungi, Karanja, Wazemba, Mutuoki and Rubyogo, 2011). Seeds that are viewed to be of lesser importance such as millet and forages also find their way through the informal market. In Kenya, Wanyama, Lusweti, Njaruid and Cheruiyot, (2011) observed that forage seed business is seasonal and had low sales, resulting in traders engaging in other activities to sustain their livelihoods.

In East Africa, efforts are being put in place to promote viable and economic forage seed systems to avail highly productive and good quality forages to smallholder farmers (Wambugu, Place and Franzel, 2011). Besides these efforts, there is a limitation of governing regulations to ensure availability of quality germplasm. (Nyoka *et al.*, 2011). Production and supply of forage seed was more concentrated in the former commercial farming sector and on National Agriculture Research Stations (NARES) and yields have not matched those realised on-farm. Recommendations to alleviate forage seed scarcity have included the need to avail pasture seed at subsidised rates (CA17 International, 2013) and to fully support the forage seed value chains.

2.6 Why forage seed production?

Forage production is becoming increasingly important in many farming systems (Jensen, Peoples, Boddey, Gresshoff, Hauggaard-Nielsen, Alves and Morrison, 2012; Mulugeta, Tesfaye and Dagne, 2015), including the smallholder farming systems (Kabirizi, Ziiwa, Mugerwa, Ndikumana and Nanyennya, 2013; MacLeod, Waldron and Wen, 2015). This is because of the several functions they play in the farming system. Forages provide feed for livestock, forage legumes fix nitrogen in the soil, act as cover crops to conserve moisture, reduce erosion and weed densities.

Firstly, in developing countries, demand for livestock and livestock products is increasing, thus causing a tremendous rise of the subsector in the agricultural industry (Food and Agriculture Organization of the United Nations, 2012). Forecasts reveal that demand for livestock food products (particularly beef and poultry) will continue to increase and may double by 2050 (Alexandratos and Bruinsma, 2012; Gardner, 2013). Consumption of meat is projected to increase from 25 to 37 kg person^{-1} annum^{-1} from 1999 to 2030, in developing countries. Consumption of dairy products is set to rise from 45 to 66 kgperson^{-1}annum^{-1}. Improved livestock production systems will inevitably increase demand for adequate quality feed and forage seed to sustain the system. In Southern Africa, where 60.0-70.0 % of the population own livestock (FAO, 2015), grazing areas are dwindling as a result of increased population who are turning these grazing areas into human settlements. This has been a result of widespread environmental degradation in many African farming systems, causing a major drawback in improving livestock production (Maitima, Olson, Mugatha, Mugisha and Mutie, 2010). In Zimbabwe, with

a population of 5.4 million cattle, of which 90.0 % is in smallholder areas [Zimbabwe National Statistics Agency (ZimSTAT), 2013; Ministry of Agriculture Mechanization and Irrigation Development (MoAMID), 2014], there is need to develop strategies to sustain the livestock numbers on the available land area and meet product demand.

Secondly, the Southern Africa region has experienced a rise in temperatures (over 0.5 ^{0}C) in the last 10 years associated with erratic rainfall and frequent droughts. Vegetation cover has declined and livestock productivity is thus reduced, creating an opportunity for farmers to increase livestock production in an environment of high demand (Adugna, Yami, Mengistu, Alemu, Geleti, Assefa, Gizachew, Bediye and Woldesemaya, 2012). Grazing declines in quality during the dry season, increasing the scarcity of feed for cattle (Bacigale, Paul, Muhimuzi, Mapenzi, Peters and Maass, 2014). In a study conducted in Uganda, Kenya, Tanzania and Burundi, Kabirizi, Mugerwa, Ndikumana, Njarui, Kaganda, Mwilawa, Minani, Nijimbere, Wanyama, Zziwa (2014) observed that use of drought tolerant forages improved fodder availability as a strategy for coping with climate change and further suggest that policies should be put in place that enhance adoption of technologies and improve livelihoods.

Thirdly, forages provide feed for livestock, food for human consumption, and act as cover crops. Forages, especially legumes, contribute to the economic and environmental sustainability of small-scale farmers as the forages provide improved fodder and improve the soils through nitrogen fixation (Jensen *et al.*, 2012; Gebreyowhans and Gebremeskel, 2014; International Livestock Research Institute, 2014).

Scarce feed resources and the poor quality of available non-commercial feed are the major constraints to increased livestock productivity in sub-Saharan Africa (Lamy *et al.*, 2012; Valbuena *et al.*, 2015). This has been coupled with socio-cultural factors in such areas (Makwara and Gamira, 2012). Thus it requires farmers to resort to cheap and sustainable livestock feed sources. Planted pastures offer an alternative to increase the supply and quality of feed to livestock, and pasture development depends on reliable seed supply. Use of forages has been identified as a way to improve livestock production (Tavirimirwa, Mwembe, Ngulube, Banana, Nyamushamba, Ncube and Nkomboni, 2012). It is projected that livestock production, particularly dairy, can significantly improve with increased utilisation of improved forage seed. Cattle fed forages at 1.5 % body weight as daily requirement, have improved on body condition and conception rates Mashanda, 2014). Effect of feeding forages to dairy cows is comparable to commercial feed, at a lower cost (Mashanda, 2014; Gusha, Katsande, Zvinorova, Halimani and Chiuta, 2015).

Forage crops (plant material grown and conserved as feed livestock feed) support livestock productivity directly as feed or by-products and raising household income when marketed. These include forages such as *Mucuna*

pruriens (mucuna), *Lablab purpureus* (lablab) and *Panicum maximum* (panicum), which are self-pollinating, drought tolerant and can produce good quality seed under average management levels. Modern agricultural systems have promoted a few crop species that have a high input requirement (Chivenge, Mabhaudhi, Modi and Mafongoya, 2015) at the expense of other desired species like forages. Seed vigor is becoming an important aspect in Seed Technology advancement (Marcos-Filho, 2015) although associated costs should be low especially when it involves smallholder farmers (Welu, 2015). As seed production is a specialised enterprise, farmers need to have adequate inputs, the know-how of seed production, infrastructure in order to meet set quality standards. With lack of irrigation facilities in most smallholder systems, seed varieties should match the climatic conditions (Munyaka, Mvumi and Mazarura, 2015). They cannot be compared to commercial farmers whose production is large-scale, mechanized and market oriented. Companies prefer to deal with large farmers who have non-farm assets, have irrigation facilities and produce large volumes. Establishing forage markets in poorly developed markets presents challenges as farmers may be subjected to exploitation (Singh, Singh, Jha, Singh and Singh, 2012), although forage seed value chains have been successful in Asia and Kenya. It is hypothesised that the participation of smallholder farmers in agriculture-related value chains can reduce poverty and improve livelihoods (Guidi, 2011). It is essential to have a stable and reliable seed supply system to enhance adequate and quality of livestock feed production. Thus, an opportunity arises for smallholder farmers to improve productivity to meet demand in livestock and livestock products.

However, the adoption and use of improved forages has been limited to a few species found in the commercial farming sector as a result of a number of factors including unavailability of quality germ plasm, difficult socio-economic environment and limited knowledge on production and maintenance of forage fields (Kamanzi and Mapiye, 2012; Bacigale *et al.*, 2014). Quality seed production by farmers is crucial as it determines the success of crop yield, market value and contributes to ensuring food security (Beyene, 2010; Louwaars and de Boef, 2012), as seed is considered a basic unit of crop production. Challenges also include limited land area, socio-cultural norms, limited resources and limited access to markets to ensure full participation (Jones, 2014; Shiferaw, Kebede, Kassie and Fisher, 2015). Forage seed demand has not been matched to production in the countries through national programs (Haque, Jutzi and Neate, 1986). Even when agriculture input programs have been designed, they have not included forages as these programs have focused on emergencies and meeting immediate household food security.

Some prior studies have suggested that forage seed supply remains one of the major challenges affecting adoption of forage technology as a viable enterprise (Hacker and Lochi, 1997; Franzel, Carsan, Lukuyu, Sinja and Wambugu, 2014; FAO and ICRISAT, 2015). Similar findings in Ethiopia (Welu, 2015) revealed that forage seed production and marketing by commercial companies is often hampered by the risky nature of forage seed production, the long value chain between forage seeds and livestock commodities and distorted forage seed

prices due to lack of information and market value. In Zimbabwe, despite some studies indicating the benefits of forages as a feed source (Buwu, 2014; Mashanda, 2014; Gusha *et al.*, 2015), access to seed remains a major challenge as there is no seed on the market. Smallholder farmers have been engaged in seed production in some developing countries such as Thailand (Hare, Phengphet, Songsiri, Sutin, Vernon and Stern, 2013; Welu, 2015), Ethiopia (Alemu, 2015; FAO and ICRISAT, 2015) and Nigeria (Oyekale, 2014) and it is emphasised that this has not fully developed as a result of factors that includes poor investment in infrastructure and capacity development, communication mismatch and weak linkages. There is therefore, need to frame strategies that enhance the competitiveness of forage seed business and engage smallholder farmers with other value chain players for positive benefits. Involvement of smallholder farmers in forage seed production will improve livestock and crop productivity, improve market participation and household income through seed sales.

2.7 Pasture seed production in Zimbabwe

In the early 1980's, the development of pasture seed systems was to be underdeveloped in most parts of sub-Saharan Africa except for Zimbabwe and Kenya (Haque, Jutzi and Neate, 1986). Because of the small scale of operations, efforts by national programs to effect legislations of forage pasture seed did not materialise. Pasture seed production has long been given low priority as focus is diverted to seed of food crops. It is important to note that seed legislation was introduced in the then Rhodesia in 1952 and forage seed was handled by the Pasture Seed Growers Association. Seed was produced both for the local and export market, with Katambora Rhodes grass dominating the exports market (Kategile, 1985). Demand for quality Rhodes grass had increased as a result of the need to rotate tobacco lands with a grass that controlled nematodes. Research work which included the breeding of improved varieties of Rhodes grass was implemented at Grasslands Research Institute and also at the Tobacco Research Board (Dzowela, 1988). Traits being investigated were root knot nematode and seed yield and it was concluded that the traits can be combined in breeding programs. Even though seed was produced in the commercial farming sector, no production figures are available in literature. Mapiye, Mwale, Chikumba, Poshiwa, Mupangwa and Mugabe, (2006) highlight that there is great potential in evaluating and screening forage grasses for improved farm productivity and reducing environmental degradation. Much work has been done at the national research station to identify suitable and adaptable forage species although their performance depends also on social settings within the establishment sites. Besides low adoption in smallholder systems as a result of the high risks involved, limited knowledge, lack of information and lack financial support, there is also a challenge of low small seed volumes that are involved (Pitman and Sotomayor-Rios, 2000). Authors also note that on a commercial basis, forage seed production presents challenges. Demand is driven from the market to such an extent that price differences among varieties are huge. A buyer may prefer low quality seed compared to high yielding varieties. Also lack of stable markets at global level presents

challenges in forage seed market viability. Even though there might be increased availability of forage species, NARES and extension services lack the capacity to take up the innovations.

Much of research work conducted on national research stations has been applied to commercial farms (Kategile, 1985). Adoption in communal settings has been low as a result of the use of common grazing areas. Where adoption has taken place, this has been possible through the use of arable lands. Also most of the research on forages in Zimbabwe have considered biomass production only, not taking into account seed production aspects.

Forage seed research in Zimbabwe is mostly carried out at National Research Institutes and universities, with little involvement of the private sector. Production of forage seed at NARES on a commercial basis is low (<30.0 % of potential production capacity) due to financial resources and this has affected income generating potential of these institutions. During the period between 2014 and 2016, Grasslands Research Institute produced and sold 3 legume and 4 grass species where it has potential to work with more than 50 grass and legume species (Table 2.2). Support to such institutions will have a positive effect on availability of seed and scientific evidence on forage performance under different production systems. Private businesses have been involved in breeding programs focusing on crops, therefore, farming systems need to consider livestock feed production (Shumba, 1995). They also lack adequate resources to fully support forage seed production initiatives. Commercial multiplication is taken up by private companies if it is economic, although this is associated with increase in prices that the farmers will pay to purchase the seed. On the other hand, NGOs are concerned with the development aspect and thus focus on meeting food security. Rusike *et al.* (1997) add that adoption of improved varieties is associated with subsidized and free inputs. However, efforts are being made by NARES to produce and sell more forage seed to farmers, besides offering technical support on production and management of the forage crops.

Table 2.2: Average forage seed sales by NARES per season from 2014 to 2016

Forage species	**Seed material sold per season from 2014 to 2016**	**Price (US$)**	**Income generated (US$)**
Rhodes grass	400 kg	10 kg^{-1}	4000
Sunhemp species	200 kg	3.50 kg^{-1}	140.00
Velvet bean	250 kg	3.50 kg^{-1}	700.00
Star grass species	500 bags vegetative material	5 bag^{-1}	2500.00
Paspalum species	250 bags vegetative material	5 bag^{-1}	1250.00
Brachiaria species	600 bags vegetative material	5 bag^{-1}	3000.00
Bana grass	325 bags vegetative material	5 bag^{-1}	1625.00

Source: Grasslands Research Station unpublished reports (2016)

Prior to the Land Reform Program, the commercial farming sector played a role in availing seed of different forage species both to the formal and informal market. A Pasture Seed Growers Association (PSGA) once existed, whose mandate was to multiply and distribute seed of pasture grasses and legumes. This is no longer in place as farmers preferred producing own forage seed, a practice perceived to be economic and made seed availability easy, thus affecting the supply of pasture seed on the formal market. However there are initiatives through projects such as the ZimCLIFS for forage seed production. Since 2012, farmers have been trained in forage seed production (Figure 2.2) and also on ways of generating income from it.

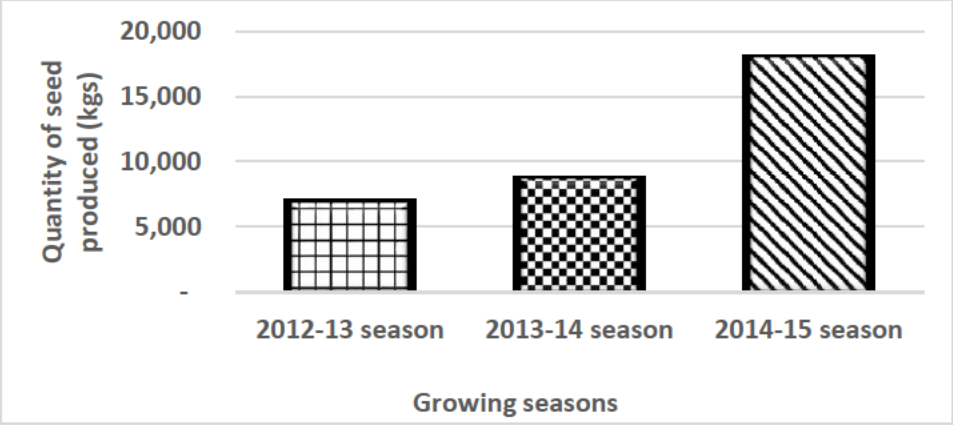


Figure 2.2: Forage seed production in Goromonzi and Murewa. Source: Chakoma *et al*. (2016)

A study on seed dissemination pathways in Goromonzi and Murewa revealed that farmers can access seed through sharing, as gifts, payment for labour services and sales (Chakoma *et al.* 2016). However, more is required to be documented from the smallholder systems to be able to account for and institute relevant interventions in the future.

However, efforts are being made to address forage seed scarcity through the development of a Livestock Policy (Ministry of Agriculture, mechanization and Irrigation Development, 2014), although the timeframe and implementation modalities are yet to be put in place. Such arrangements have been viewed as slow to avail quality seed to the farms (Rubyogo, Sperling, Muthoni and Buruchara, 2010). Beyene (2010) suggests that an understanding of their operations and challenges will assist in developing sustainable forage seed value chains.

2.8 Forage seed market development

Input and output marketing of agricultural products has been well organized in Zimbabwe, with little activity of informal markets, until after land reform, when a lot of the informal supply chain activities became active. Crop markets have involved grain trading, whilst livestock and livestock products included live animals, meat

and hides (CA17 International, 2013). Private companies were diversifying laterally and horizontally to remain in business in the prevailing economic environment. Marketing of agricultural products from rural areas requires good logistical approach in order to manage the handling, storage and transportation of goods, and this is no exception for forage seed. Imperfect markets (limited or lack access to information, capital and improved seed varieties) have also led to non-adoption of technologies, including seed supply (Shiferaw *et al.*, 2015).

Markets for forages have developed around the commercial farming sector, with little or no business being registered for smallholders. In poorly developed markets Singh, Singh, Jha, Singh and Singh (2012) note that it is not viable to establish forage markets for smallholder farmers who may be subject to exploitation. Regardless of that observation, forage seed value chains have been successful in Asia (Hare *et al.*, 2013) and Kenya (Lilleso, Graudal, Moestrup, Kjaer, Kindt, Mbora, *et al.*, 2011) and such models can be adapted for the sub-humid environments of Zimbabwe. However, smallholder farmers have to deal with transaction costs, market intelligence and stakeholder support to fully participate in value chains. Meeting market standards for seed is also a challenge for smallholders who usually focus on food crop production and seed production is a secondary activity. This is besides the fact that seed is the start of life and quality matters (Welu, 2015).

2.9 Inclusive forage seed value chains

In recent years in sub-Saharan Africa and other developing regions, the use of value chain approaches is becoming increasingly important as a framework for the inclusive development of smallholder agriculture. This is as a result of local, national, regional and global changes in agricultural practices, human population, food preferences, technology, social and economic environment and interactions, among other factors (Ayele *et al.*, 2012). Even in pastoral systems, the practice of fodder production, conservation and marketing has become very important in the provision of feed to livestock, combating land degradation, increase in household incomes through fodder sales and reducing conflicts over grazing lands (Lugusa *et al.*, 2016).

However, many smallholders produce for subsistence and little effort is made to have market-oriented production (Hounkonnou, Kossou, Kuyper, Leeuwis, Nederlof, Röling, Sakyi-Dawson, Traore´, and van Huis, 2012). To upgrade smallholders in inclusive innovative value chains, there is need to facilitate integration of stakeholder processes. Little attention has been paid to the analysis of integrating smallholders in inclusive value chains. Value chain analysis is one of the ways that can be applied to explain this even though some of the aspects such as political issues and determinants of social capital remain unexplained.

Various authors define value chain as follows:-

- It is value-adding activities of an organisation where inputs, processes and marketing of products involves looking at the pricing strategy and cost structure. The firm should be able to identify its capabilities and produce a product that fits customer requirements (Porter, 1985).
- It is a full range of activities that are required for a product or service to be availed, that is, including sourcing of inputs, production processes that take place, product marketing and consumption and after sales (Kaplinsky and Morris 2001).
- It consists of those activities that are required to make a product or service (Lugusa, Wasonga, Elhadi and Crane, 2016).

All the above definitions point to the same aspect of activities and processes from sourcing of inputs to the final product that gets to the consumer. This is the same definition that will be used in the study. The definition further elaborates on forage seed as outlined by some authors below.

- Seed value chain involves activities and processes from use of plant genetic resources, plant introduction and management, packaging, storage and marketing of quality seed to farmers who are the consumers (Audet-Bélanger, Thijssen, Gildemacher, Subedi, De Boef and Heemskerk, 2013).

The main operations in seed value chains include activities and processes undertaken by operators and service providers who are the actors. There may be differences in structure and composition of seed value chains, but operational activities are not different, even within different crop production systems. Value chain analysis starts with mapping, indicating all the actors, their relationships and what processes are involved at each stage of the value chain. Questions against each step help to guide and clarify areas to focus on during the development of a seed value chain (Table 2.3). It outlines the main steps involved in seed value chain analysis, where the crop to be studied is identified, followed by establishing the processes and services, actors and benefits derived from involvement then followed by the identification of challenges and opportunities existing along the seed value chain.

It also involves taking into account all aspects of a product from its development, production or manufacture, packaging until its consumption by customers. Institutional and functional analysis of particular chains is usually represented by mapping (Lugusa *et al.*, 2016). This mapping involves the construction of a map showing all the actors along the value chain and their roles, thus indicating the institutional analysis. How the actors interact with each other is represented by the functional analysis. All these functions of the value chain actors can be represented in tables or in flow chart diagrams.

However, seed value chains may differ from other crop value chains in that operational activities can be in the hands of a single stakeholder or actor (Audet-Bélanger *et al.*, 2013). This is in the case of large and global seed

companies who handle production and marketing at the same time, besides breeding and maintaining plant genetic material.

Table 2.3: Main steps and guiding questions for seed value chain analysis

Main steps	Issues and guiding questions
Step 1: Seed system indicator crop	Identify a good indicator crop to study the seed value chain of the respective system.
Step2: Operations and operators	Identify and characterize the operators in the seed value chain. - Who are the operators in the seed value chain? - What are the functions of the operators in the seed value chain? - What is the performance of each operator? - What is the number of operators at each level? - Who are the most influential operators in the chain? (actions and power)
Step 3: Services and service providers	Identify and characterize the service providers in the seed value chain. - Who are the service providers? - What are the services provided? - What is the performance of each service provider?
Step 4: Operators, service providers and incentives	Analyse the incentives for operators and service providers - What are the marketing strategies of the different operators? - What are profit like incentives for operators - What are other type of incentives? - What are the marketing strategies of the different service providers? - What are profit like incentives for service providers? - What are other incentives? - Where in the seed chain are incentives lacking?
Step 5: Enabling environment	Identify the key issues in the enabling environment. Issues may relate to: - Seed policies, laws and regulations promoting or hindering the seed value chain - Import and export regulations - Sector growth; industries pulling seed markets - Trust and accountability Identify in the enabling environment: - What are the bottlenecks? - Can they be removed? How? By whom? - What are opportunities?
Step 6: Value chain map	Structure a general overview of the seed value chain in a map. - How are operators linked? - Which services are private and which services are public? - What are the links between operators and service providers? - How does seed move between operators? - What are conditions under which seed moves? (contractual arrangements, credit) - How do financial resources flow between stakeholders? - How does information flow between stakeholders? - How do stakeholders communicate? - Are they stakeholders in the value chain who are not currently involved, which should be integrated to increase value chain performance?

Adapted from: Audet-Bélanger *et al*., (2013)

Although the steps are clearly outlined, some steps occur faster or earlier than others, depending on the type of seed and who is involved along the value chain. There can be a combination of steps taking place at the same time, thus creating a complex scenario. In value chain analysis, efforts are defined which are developed and meant to strengthen linkages to work together among actors along the chain. During this process, there are win-win situations, value addition of products, information and knowledge exchange, generation of employment and income, gender and youth involvement, and economic growth (UNIDO, 2011). Another approach to value chain mapping is the use of social network analysis which involves mapping and analysing relationships and flows between organisations and people with the use of chain relationships by way of mathematical and visual analysis. Social network analysis (SNA) has also gained popularity in recent years as an approach to mapping, relationship analysis and interactions among people, organisations and groups along value chains. In social network analysis, besides the visual presentation of the value chain relationships, there is also mathematical analysis (Scott, 2012; Poudel, Sthapit and Shrestha, 2015).

Social networks are dynamic in nature as a result of factors including socio-cultural influences, environment, technological advancement, human behaviour and political environment (Poudel *et al*., 2015). Therefore it is important to study the stability of such networks over a long period of time. This also tends to assess the value or importance that is attached to such networks and associated relationships. Even though SNA has been studied in other areas for some time, its application in seed systems is not well known, although some studies have applied the centrality theory in order to explain how farmers are networked (Abay, de Boef, and Bjørnstad, 2011; Thomas, Demeulenaere, Dawson, 2012).

2.10 Actors and their roles in forage seed value chains

Value chain, as initially defined by Porter (1985) involves a linked set of activities that add value in the production, processing and marketing of a product up to when it gets to the final consumer (Wheeler and Hunger, 2008). These activities include supply of raw materials, the processing, packaging, delivery and is supported by infrastructure, the workers and management, technology involved and other services, which form a complex matrix.

Value chains have become important and more popular as they clarify roles and responsibilities for each stakeholder, although they lack consensus among them to improve its development and linkages (Rubin and Manfre, 2014). Actors along the value chain include producers, processors and consumers, whilst being supported by services providers, regulators and policy makers, among others. Coordination among stakeholders along the value chain will help farmers to benefit from access to resources and services, and add value to the chain. Their relationship building in the form of responsibility and resource sharing will enhance productivity

and help to resolve conflicts. It is important to understand the governance, organisation and coordination in value chains as this enhances profitability in all segments along the value chain. This will ensure better quality and safe products, and the development of marketing strategies will be stimulated.

2.11 Value chain actors

2.11.1 Input suppliers

Input suppliers comprise seed breeders and those that multiply seed for certification before it is sold on the retail market. Individual and farmer groups are also included in this group of suppliers as they are responsible for the provision of initial planting material. Given the scarcity of forage seed in Zimbabwe, farmers tend to scrounge for the little seed they can get hold of. If available, it is mainly found on the informal market. Farmers also share and recycle seed for use in the following farming seasons. It is important to note that in many developing countries, including Zimbabwe, governments provided inputs to smallholders (Hanyani-Mlambo and Hobane, 2011) as a way to cushion them against high input costs and the need to meet country food requirements. Other input suppliers include those who supply fertilisers, crop chemicals, machinery and labour. There is need for close cooperation with input suppliers so that correct inputs are available timely and in the right quantities. Input suppliers need to be afforded the resources to produce or acquire raw materials for the production processes to take place.

2.11.2 Producers

These comprise individual farmers, farmer groups or companies who are involved in the primary production activities. Their support in the form of access to inputs, finance and information is essential. For smallholder farmers, working with farmer groups and farmer organizations has been found to be beneficial (Alemu, 2015; Welu, 2015) as it enhances productivity and the negotiating platform.

Unfortunately smallholder farmers have to grapple with interdependence and interaction of crops and livestock within their farming system (Friis-Hansen, 1992). They are also characterized by limited resources, work as individuals and the farm is the main source of income (Harvey, Rakotobe, Rao, Dave, Razafimahatratra, Rabarijohn, Rajaofara and MacKinnon, 2014) as compared to commercial farmers whose focus is on market driven production. Shenggen, Brekza, Keyer and Halsema (2013) suggest that it is not all smallholder farms in developing countries that have the potential to be profitable and any form of support is not a one size fits all. However, a smallholder farmer needs social interactions which are outside the household to have the capacity to produce improved seeds. These interactions and social dynamics play a significant role on the farmer's

decision making. Within the internal setup, the farmer is affected by asset endowment, available labour, financial resources and knowledge about the enterprise (Figure 2.3).

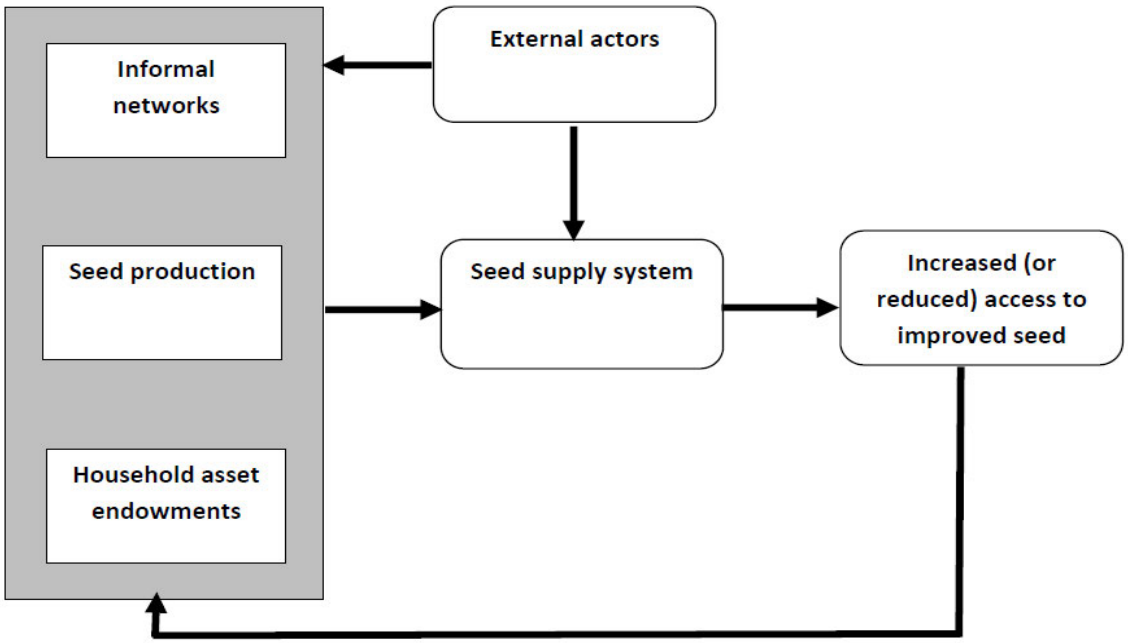


Figure 2.3: Model of a household seed production and supply system - Adapted from Beyene, 2010.

When one is into seed production, seed quality standards have to be adhered to as this affects the viability and reputation of the seed industry. The Alliance for Commodity Trade in East and Southern Africa (ACTESA) supports the integration of smallholder farmers into national, regional and international markets and lobbies for governments to avail enabling environments (Mukuka, 2014). This also encompasses the strengthening of smallholder seed production initiatives. As value chains go global, it is a result of reduced barriers to trade and more favourable conditions for trading internationally (Trienekens, 2011).

2.11.3 Processors

In Zimbabwe because of the economic turn down experienced in the last decade, producers have also become processors and traders, even retailers (Dhewa, 2017). There have been a lot of integration in all directions, that is, both vertical and horizontal. Manufacturers have moved forward to be retailers, whilst at the same time taking over, merging with other businesses and venturing into new businesses. Seed companies have merged, creating stronger businesses and benefiting from each other's strengths and opportunities, as a strategy to survive the economic environment. These and other private sector companies focus on crops and products that

have high returns and will only venture into forage seed if they find it profitable. Traders, wholesalers and retailers also follow suit to survive in the business environment.

2.11.4 Traders and marketers

Furthermore, wholesalers have been observed to operate in urban centres as they focus on bulk material (USAID, 2008) whilst traders and retailers go the extra mile to be in touch with the farmers in their localities. However, not much information is available on how much private seed companies and seed stockists are involved in forage seed marketing (Wanyama *et al.*, 2011).

2.11.5 Consumers

Seed is utilised by farmers as an input to produce the crop or multiply seed. Livestock farmers are also seed consumers as they plant to produce feed. Good quality seed will ensure production of good quality livestock feed. Farmers need to access seed or planting material as and when they require it. Robust infrastructure development and support services should be in place for this to happen (Adejobi and Kassli, 2013). As consumers of seed, farmers need quality seed which will produce a good crop and expected yields.

2.11.6 Research and extension services (including development partners)

Extension services, research, NGOs and private should have the mandate to venture new areas and bridge the gap between favourable and unfavourable environments and increase geographical coverage (Aw-Hassan *et al.*, 2008). Uzomma and Qijie (2013) and Tsado, Ojo and Ajayi (2014) also assert that more trainings should be conducted for farmers so that they adopt technologies and the more the extension agents in an area, the more farmers are served. However, extension agents and research institutes in most African countries lack resources to reach out to many farmers.

Non-governmental organisations have the potential to improve adoption of improved forage varieties and produce more seed as they develop the strategies and implementable modalities in their development work (Beyene, 2010). Service providers should be able to capacitate and enhance farmers' skills for improved market participation and negotiate better prices (Beyene, 2010).

2.12 Gender in value chains

Gender in this study refers to socially constructed differences between males and females (Kabeer, 2005), also power and relation dynamics that make men and women interact (Laven, 2009). It also includes behaviour, character and roles that set apart men and women in a society in relation to power between the two. These characteristics can change overtime depending on cultural practices, beliefs and norms, also technological advancement and economic environment. In some instances, gender is misunderstood to mean sex. However these two are different as gender refers to socially constructed differences between men and women whereas sex refers to the biological differences (Sanga, 2008).

It has been shown through gender studies and agriculture policies that there is efficient utilisation of resources and livelihoods for rural women, men and children when there is integration of gender in agricultural value chains. It allows men and women to have equal opportunities to participate in development activities. This is beside the fact that culturally and socially acceptable gender roles have a great influence on division of labour within the household and in agricultural value chains (Karamba and Winters, 2015). Challenges do occur where culture plays a pivotal role in determining gender roles and access to resources. To this end, gender mainstreaming is crucial in ensuring adoption of forage seed production interventions.

In smallholders, decision making is mainly dominated by men even when the resource is being used by women and youth (Adétonah, Coulibaly, Ahoyo, Sessou, Dembélé, Huat, Houssou, Vodouhe, and Loko, 2015). Most of labour in agricultural production depends on women and this is a measure to ensure household food security (Oxfam, 2010; Oyugi, Amudavi, Nandi and Ombati, 2014). Increasing access to resources by women participation increases productivity and resultant income (Oxfam, 2010). Also an evaluation of the input subsidy program in Malawi indicated that participation increases productivity although it was not clear whether the participation of both men and women would increase productivity (Karamba, 2013). It may be that increases in productivity were a result of gendered discrimination. It is now important to consider gender inclusion when developing planning and management activities (Almaz, 2000; FAO, 2011), as this would increase yields by an estimated 20.0-30.0 %, thus reducing undernourished people. Only a small proportion of women are big entrepreneurs and earn big from participating in markets. Most women remain doing the little business and are labourers or unpaid family farm workers although contributing significantly to time, innovations, knowledge and skills (Rubin and Manfre, 2014). Considerations need to be taken into account for access to resources and participation in value chains. The idea should not be to give handouts but move towards entrepreneurship and self-sustenance of interventions. Policy measures such as land rights and cultural beliefs influence decision making on forages seed production and marketing by women and men. Interventions that focus on deriving

benefits from markets only without considering gender associated social and cultural dynamics may be bias towards one group of people, usually men.

2.13 Inclusion of smallholders in seed value chains

The value chain looks at all the processes, players along the value chain and their relationships along the value chain. Key activities, key partners, key resources and cost structure create value on the production side, whilst customer relationships, customer segments and distribution channels create value on the marketing side.

Smallholder farmers are faced with a number of challenges in progressing from being subsistence farmers to being commercially oriented. These challenges include limited production and marketing information, limited resources to venture into commercial production, limited access to inputs (planting materials, livestock breeds and associated veterinary drugs), poorly managed farmer organisations, low production levels that do not attract large buyers and poorly developed infrastructure. The farmers also face challenges with value chain players who operate at a different level than them, have larger product volumes, large value transactions, have a higher negotiating platform and better knowledgeable about how the market is organised (Wiggins *et al.*, 2011). Companies prefer to deal with large farmers and organizations that have non-farm assets, have irrigation facilities and produce large volumes (Shenggen *et al.*, 2013). They have little support from the government, although they support in food security (Sperling and Maguire, 2010). This scenario leaves the smallholder farmers facing challenges that include transaction costs, limited knowledge, limited market intelligence, low negotiating platform, low product volumes and quality, among others. Farmers are utilizers as well as producers of seed and they can be easily integrated into the value chains. They play a pivotal role in the production and supply of seed (Hare *et al.*, 2013) produced from their small pieces of land and from crops meant for feed and food or cover crops.

Inclusion interventions endeavour to address some of these challenges faced by smallholders (Shepherd, 2016). Unfortunately, agribusiness development is viewed as not inherently pro-poor, thus there is need to stress the importance of inclusiveness so that the poor can also benefit. Private sector view smallholders as risky and therefore, shun away from dealing with them. There is need for government to support the private sector so that they (private institutions) can involve the smallholders in sustainable participation in value chains (FAO, 2012). Smallholder farmers have the perception that value creation can offer options to upgrade them in an environment where many inclusive value chains aim to develop the whole value chain.

To ensure success in value chains that involve smallholder farmers, it is vital to ensure that all farmers are aware of what happens along the value chains, the risks involved and that they agree to what they are getting

themselves into and they participate freely. On the other hand, failures can be associated with ignorance, lack of information and transparency, inadequate funding and lack of commitment from stakeholders.

A number of strategies have been proposed for the inclusion of smallholder farmers in meaningful business models with the aim of creating value out of their activities (Guidi, 2011; Chapoto, Mabiso and Bonsu, 2013; Zhou, Minde and Mtigwe, 2013). Key considerations for success have been noted these include the driving forces for inclusivity, policies, processes involved, farmers' socio-economic environments and benefits to be derived from such involvement. From such strategies, models have been developed that take into account smallholder farmers' capabilities, environmental circumstances and potential to benefit the farming activity. Farmers have been involved in production of crops that are easy to market and have high value (FAO, 2015; Shepherd, 2016) through approaches that include out grower schemes, contract farming and joint ventures and these have yielded various levels of success (Zhou *et al*., 2013). Contract farming has had varying levels of success among smallholder farmers for the different farming enterprises including crop seed production. Such engagements have not resulted in improvement in farmers' livelihoods (Mwambi, Oduol, Mshenga and Saidi, 2016), as there are other factors that need to be addressed such as policies and conditions governing the contracts. Various other authors (Wiggins, Argwings-Kodhek, Leavy and Poulton, 2011; Hartwich, 2012; FAO, 2013; Briones, 2014; Wiggins and Keats, 2014; Thorpe and Maestre, 2015) have suggested approaches to engage smallholder farmers in value chains.

These include:-

- *Lead-buyer approach* – an organization sources produce from farmers for the market with support from development agencies for technical advice and provision of inputs (Hartwich, 2012).
- *Contracting* - a firm engages smallholder farmers to produce a crop with specifications of quality and forward price (FAO, 2013; Briones, 2014; Wiggins and Keats, 2014). Input scheme maybe included in the contract. However, success of the contract depends on both parties adhering to the terms and conditions and meeting contractual obligations if they are favourable.
- *Farmer groups and cooperatives* – Farmers are engaged in groups or cooperatives and all members are equally liable to meeting the conditions (Wiggins and Keats, 2014). This reduces transaction costs and information flow is easy, although group dynamics may derail all efforts of the group.
- *Public-private-producer-partnerships* – this involves agreements reached between business entities and government to fund and support production by farmers, thus there is sharing of experiences, risks and responsibilities among the partners (Thorpe and Maestre, 2015).

Lundy *et al*. (2012) also mention that engaging smallholder farmers in sustainable inclusive markets involves different strategies that include:-

- Producer-driven - these are mainly composed of farmer producer groups, producer associations. Farmers benefit as stable relationships are developed with buyers, traders and processors, thus assuring them of stable markets and income generation. However, for smallholders, such models are mostly initiated by development organisations with support of donor agencies and their sustainability is dependent on continued support and participation of farmers.

- Lead firm (Market-driven) approach - is a model where buyer looks for products from producers and sets standards and quantities to buy. In this model, the market is assured and this may also involve contract farming where buyer and producer agree on terms and conditions in the contract. However, there are instances where producers may practice side marketing, especially when they feel the contract prices are lower than elsewhere, when in dire need of cash or when terms and conditions are not clearly explained.

- Intermediary-driven - is a model where traders, wholesalers or processors have an upper hand in transactions and help to ease transactions costs for both producers and buyers. Middlemen also help to convey important information between the parties. Such a model is important where the market is price sensitive. However, in most cases, smallholder farmers tend to benefit less as a result of factors that include limited knowledge on market requirements and standards, transactions involved, low product volumes and less organised groups.

- The ethical agent model - The agent has an oversight role, that is, plays a mediation role by engaging both the producer and the buyer along the value chain. The ethical agent should employ innovative approaches to stakeholder engagement and creating a conducive environment for dialogue and resolving any conflicts among value chain actors for the benefit of all. However, such roles may be costly and both producers and buyers may not be able to take up these initiative, thus leaving this to development agencies who may also be limited in reach. Also exit strategies by the agent need to be set clearly for the initiatives to be sustainable.

For any of these to be successful, farmers need to be prepared to do business and participate in the value chains. This is in the form of capacity building, creating an enabling environment and support services with well-established communication systems that are easy to understand (da Silva, Baker, Shepherd, Jenane, 2009). Ability to succeed is dependent on transaction costs, resource endowment level, decision making, economic, social, political shocks and access to services (Anand and Sisay, 2011). In engaging smallholder farmers, participatory approach and trust, among other factors, are paramount, coupled with accountability, transparency and sharing of risks (Guidi, 2011), thus creating a shared value among stakeholders (Porter and Kramer, 2011).

Capacity development, infrastructure and other resources are essential to ensure adoption, improved production and change in practices by smallholder farmers (Alemu, 2012; Alemu, 2015; Welu, 2015). It is important that farmers participate in markets as this enables them realise income and gain employment (Ngqangweni, 2000).

However, gaps still exist which raise questions as to why smallholder farmers still do not participate that much in value chains. Wuepper and Sauer (2016) mention that besides offering technical advice to farmers, extension and other advisors should also be involved in social networks and raising the aspirations of the farmers to succeed in farming. Mwambi *et al*., (2016) also argue that such engagements are enterprise dependent, besides resources that the farmers has access to, as different operational modalities have to be formulated to benefit all parties.

However, smallholder farmers are limited as they cannot meet market standards in both quantity and quality even though Guidi, (2011) hypothesises that participation of smallholder farmers in agriculture-related value chains can reduce poverty and improve livelihoods. Inclusion of smallholder farmers along value chains is not a one size fits all. Strategies employed need to consider a number of factors including the resources, capabilities the farmer and external support to be offered. Besides low production capacity, limited access to resources and credit, they are faced with social factors within their communities, some of them that hinder improvement in production (FAO, 2013; Sjauw-Koen-Fa, Blok, and Omta, 2016). For sustainable economic development to have a positive impact, rural farmers should be involved at every point along the pathway. This will involve setting up supporting structures in the form of policies that consider rural development and full participation of rural farmers, financial services, technologies and an enabling environment (Shenggen *et al.*, 2013).

In developing a business model, Osterwalder (2010), advocates for the Business Model Canvas (BMC) which has nine building blocks which include key partners, key activities, value proposition, customer relationship, key resources, distribution channels used in the value chain, customer segmentation, cost structure and how revenue is generated within the business. This requires understanding of the whole value chain, actors present and their roles, supply processes, and existing threats and opportunities (Lilleso *et al.,* 2011; Wanyama *et al*., 2011; Welu, 2015). Only after this can a relevant model be developed that applies to that specific customer and relevant support services offered. The BMC is suitable to development of forage seed business models as the sector is unique, enterprise is not like the usual food crops and market particular customers (Figure 2.4). Of particular to note is where the smallholder farmers are involved who depend on ward-based extension services and that of development organisations. Nurturing of seed producers maybe intense and might take longer than anticipated in the initial instance.

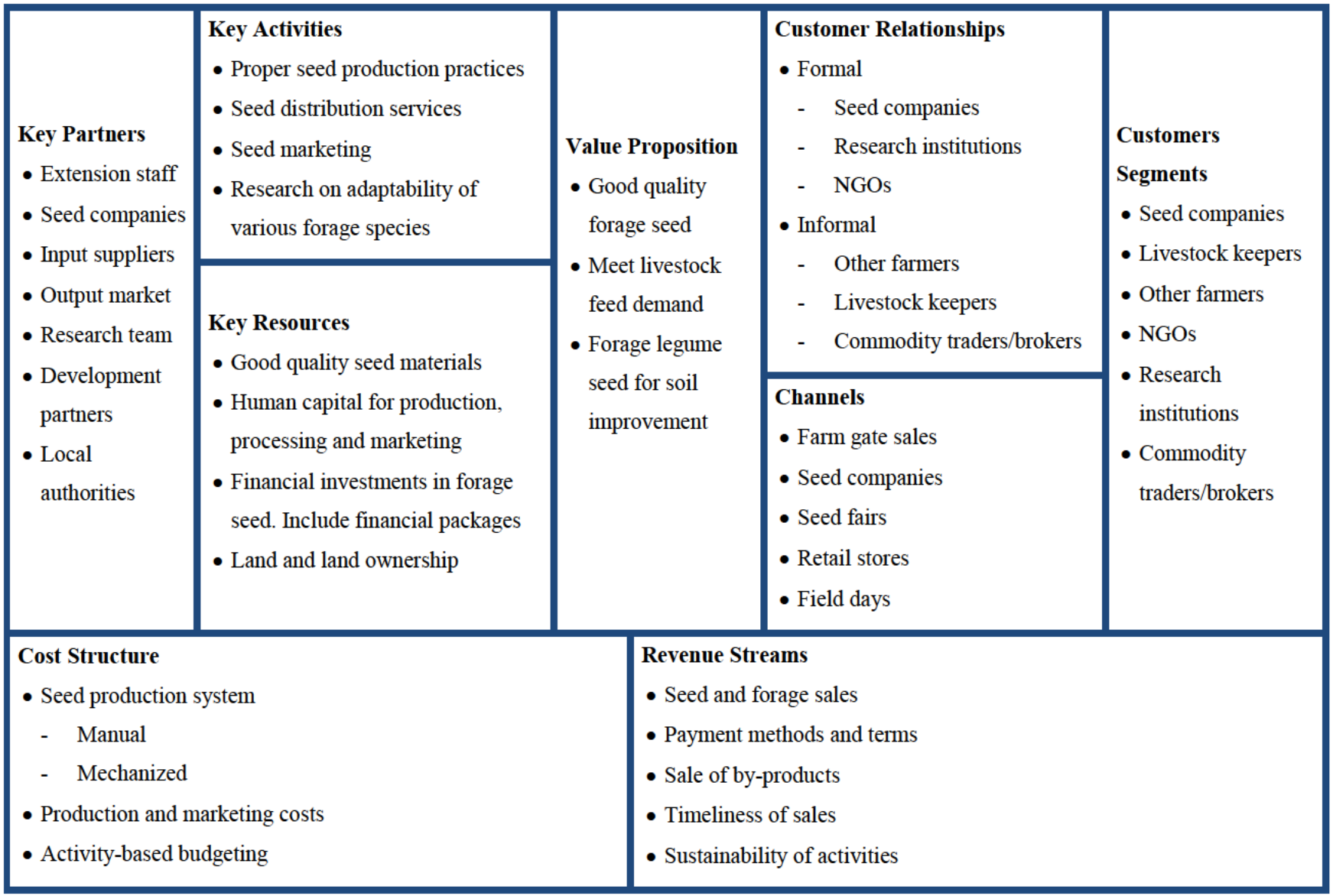


Figure 2.4: Business Model Canvas for forage seed production and marketing. Adapted from Osterwalder, (2010)

2.14 Value chain approach as an analytical tool in forage seed systems

The value chain approach developed by Porter (1985) presents the values that are created along the production processes and these are of benefit to the customer. A firm uses various strategies to create competitive advantage through developing tactical and functional level strategies to support the business. The approach by Porter has provided insights into processes and stakeholders involved along the way. Popularity on the use of the value chain approach has increased over the years as it outlines and clarifies relationships among stakeholders (Quisumbing, Meinzen-Dick, Raney, Croppenstedt, Behrman, Peterman, 2014). This has provided insights into policy and implementation plans have been developed and linkages between local and global markets highlighted for the benefit of the poor communities. Activities can be grouped and make it clear in understanding the organization's competitive position. Also strong relationships need to exist among players along the value chain for the approach to be relevant (Hollensen, 2015).

Whilst the approach has enabled the identification of activities and prioritized them, a number of scholars have criticised the value chain approach. Meaton, Abebe and Wood (2013) observed that the value chain approach is a long term investment that requires expertise in development initiatives. Also the value chain has paid little or no attention to social and environmental aspects of an organization along the value chain, thus focussing only on economic sustainability (Fearne, Martinez and Dent, 2012). This is despite the fact that the value chain is able to identify interventions that would benefit the poor (Mitchell and Coles, 2011). The value chain analysis approach has a limitation of not being able to critically analyse and prioritise strategies so that impacts can be assessed. Attention has not been paid to the impact of interventions over time especially to a single aspect of the value chain (Lee, Padmanabhan and Whang, 1997). The value chain needs to reveal these micro-interventions for a positive impact on market participation of the poor.
Another challenge highlighted by Fayet and Vermeulen (2012) is that it lacks market links, enhancing efficiency and providing support especially at community level where there is diversity of activities and income sources. There is need for a balanced intervention to ensure sustainability and accrual of other benefits.

2.15 Empirical evidence on value chain analysis of seed in smallholder systems

Lugusa, Wasonga, Elhadi and Crane, (2016) in a study on value chain analysis of grass seeds in Baringo County, Kenya, showed that the main stages in the value chain are production, processing, marketing and consumption. Farmers accessed seed from two major organisations Kerio Valley Development Authority

(KVDA) and Rehabilitation of Arid Environments (RAE) Trust. These also offered ploughing services at fees ranging between US$28.09 and US$61.80 per 0.4 ha on the agreement that farmers would sell seed to them after harvesting. The KVDA and REA bought grass seed from farmers at US$2.81 and US$1.69 kg^{-1} respectively and these prices were lower than that offered by independent buyers (US$3.09). This meant that farmers would favour selling to the independent buyers. The study also revealed that there were several marketing channels that existed, that is farmer to farmer; farmers and traders within the county; farmers, traders and NGOs; and farmers, traders and other producers outside Baringo County.

Ricciardi, (2015), in a study in Ghana focussing on access to seed by farmers through social seed networks revealed that farmers who are centrally located within a community have more access to seed, even of improved varieties. The tendency will be that other farmers close to those in central position may also have access to seed whilst those living far away do not. On the other hand it is discussed that the centrally positioned farmers can control distribution and access of seed by other farmers. The study further revealed that on gender, it was the males who had more access to seed. This might imply that even for forage seed, the same scenario will result only males having control and access to seed at the expense of female farmers, who are mostly involved in home-related chores. The input supply chain of seed will be skewed towards males than being balanced between males and females. This might not end at seed supply or producer level only, but throughout the value chain.

SNV/Kenya Netherlands Development Organisation, (2013) implementing a project on "Kenya Market-led Dairy Programme" (KMDP) conducted a study on fodder seeds in Kenya. During the study, it was noted that there are limitations in scope and heavily fragmented, despite the fact that there was vast growth in the dairy sector in the country. There were 21 seed companies in the country but the majority focussed on vegetable and other horticultural seeds. The seed companies distribute seed of both grasses and legumes and these are sold at various prices but legume seed had higher prices than grass seed. Along the seed supply chain, there are gaps identified between the period when seed is produced or multiplied in the field to the time when it is marketed. Producers sell directly to the market who is either individual buyers or other producers without the seed going through quality standards checking.

Wanyama *et al.*, (2011) in their study of forage seed supply chain in Kenya, revealed that forage seed supply to producers along the value chain depends on factors including the area planted by farmers. In the study, it was noted that forage seed supply was low as farmers planted small areas, thus forcing stockists to keep small quantities of seed for sale. This is despite the fact that there has been an increase in supply of forage seed to stockists from an average of 99 kg to an average of 139 kg $year^{-1}$ from 2006 to 2009 respectively.

2.16 Chapter summary

Literature has highlighted the importance of livestock, especially ruminants among farmers in Zimbabwe. To support the productivity of such livestock, a review of literature was conducted on the need for adequate feed supply, which is usually the major challenge to improve livestock productivity. In this regard, supply of quality forage seed will ensure availability of good quality and adequate seed. The chapter has looked at the various views on livestock and forage seed, and highlighted issues that are pertinent to the success of forage seed production. From the discussion, it can be inferred that there is need to produce feed for livestock and for this to happen, forage seed should be available. Forage seed production and marketing enterprises have been side-lined by private companies in preference for food crop seeds, coupled with the set-up of the seed industry in the country. There is need to resuscitate or reconstitute a Pasture Seed Growers Association, which can oversee the production and supply of forage seed to farmers in the country.

The chapter explains how the seed industry is organised in Zimbabwe and also notes that the pasture seed organisation which once assisted with availing forage seed to the farming community is now non-existent. Seed value chains have identified farmers, input suppliers, seed companies and support service providers such as extension agents as the main actors and these play various roles at the different levels.

Formal and informal seed systems exist, with the most predominant being the informal system. This results in unaccountability of valuable seed types including that of neglected species. This is a result of less importance being accorded to forage seeds. A review is also conducted on gender issues and how they relate of forage seed production and marketing. This is important as in most smallholder systems, women play a significant role in agricultural activities and the conservation of plant biodiversity. Gender issues and how they relate to forage seed production and marketing are discussed. Roles and responsibilities differ for the various tasks and gender.

Inclusion of smallholder farmers in value chains requires a deeper understanding of their environment, challenges they face and opportunities that exist. This means there is no one size fits all package for engaging with the smallholder farmers. Literature has revealed that, although they can be involved in forage seed production, smallholder farmers need strong support services and initial start-up seed for forages, besides knowledge and other resources. The seed value chains, how they are organised, actors involved and approaches that can be developed to address inclusivity of smallholder farmers in seed businesses. The study highlights the use of modelling approaches such as the SEM to analyse and have a better understanding of the relationships within the forage seed production processes that make farmers adopt and

participate in forages seed markets, Social Network Analysis for actors along the value chain and Gross Margin analysis for incomes among others.

CHAPTER 3. METHODOLOGY

3.1 Introduction

This chapter mainly focuses on the methodologies used to conduct the study. The chapter starts with an understanding of the research design, description of study sites, including presentation of site map, climate and vegetation and agricultural activities being undertaken. It further elaborates the types and sources of data, data collection methods used. Tools developed to collect data are presented as annexes at the end of the document. The chapter concludes with a description of data analysis approaches adopted and a chapter summary.

3.2 Research Design

Research design was defined by Saunders, Lewis and Thornhill, (2012) as constituting what a researcher would do to answer research questions. Creswell (2014) mentions that one needs to understand what data needs to be collected and how it will be analysed in order to employ a correct research design. From the above, it can be seen that research design is all about a plan for selection of sources and types of information, which are used to answer the research question.

Creswell (2014) mentions that there are three main research designs from which a researcher can choose to conduct a scientific research, namely, qualitative, quantitative or mixed methods. The approach to be chosen is decided by the information required, the specific study's research problem and accompanying questions.

3.2.1 Qualitative research

Taylor, Bogdan and DeVault, (2015) argues that qualitative research focuses on the social process and how individuals shape and give meaning to the social world. Emphasis is on processes and meanings that are not measured in terms of quantity, amount, intensity or frequency. Much information can be gathered using the qualitative approach. Creswell, (2014) further argues that the approach is nonlinear and messy, as it is based on natural responses which are not pre-determined. Four stages have been identified in qualitative research: data collection, where correct and accurate data should be collected, guided by research questions for the study. Data can be collected through focus group discussions, interviews and making use of diaries.

The next stage is data organisation which involves an understanding of what data has been collected, also linking it to its sources. Data management, which is considered the core of qualitative analysis, involves classifying data into categories and themes with similar meanings (Ary, Jacobs, Sorensen and Walker, 2014). Besides manual coding, computer packages such as QSR NVivo can be used to organise such data. After data management, there is need to make sense out of the data, that is, data interpretation and reporting, management and analysis. Since qualitative research can provide a better understanding of the phenomenon under investigation and the problem can be understood within the context (Carswell, 2014), the approach partially suits the research to be undertaken. The researcher needs to ensure that there is consistence in data collection so as to reduce researcher bias and other interpretations can be generalised to the larger population.

3.2.2 Quantitative research

According to Creswell (2014), quantitative research refers to all data that involves numerical data or contains data that could be usefully quantified to help answer the research questions. It is based on meanings derived from numbers. Denzin and Lincoln (1994) assert that quantitative studies emphasise on the measurement and analysis of causal relationships between variables and not processes. That is why researchers in this area prefer the use of deductive, hypothesis testing methodologies. Formulating research questions, objectives and hypotheses are part and parcel of the quantitative research method. The approach is useful in supporting and illustrating the quantitative data obtained from an experiment or survey.

3.2.3 Mixed methods

A more integrated approach (validation design model) is the use of mixed methods research design where a combination of both qualitative and quantitative methods are employed (Creswell, 2014). Whilst quantitative design makes use of close-ended responses in instruments such as questionnaires, qualitative design focuses on open-ended responses, that is, answers which are not predetermined. It also serves as a checkpoint for the accuracy of qualitative or quantitative data collected. Such a design helps the researcher to validate quantitative data and gain more insights into the study being conducted (Figure 3.1). The method analyses both qualitative and quantitative data from a single study that is investigating the similar underlying phenomenon. However, the researcher needs to be well versed with qualitative and quantitative designs in order to be able to handle and employ the mixed method design (Creswell, 2014).

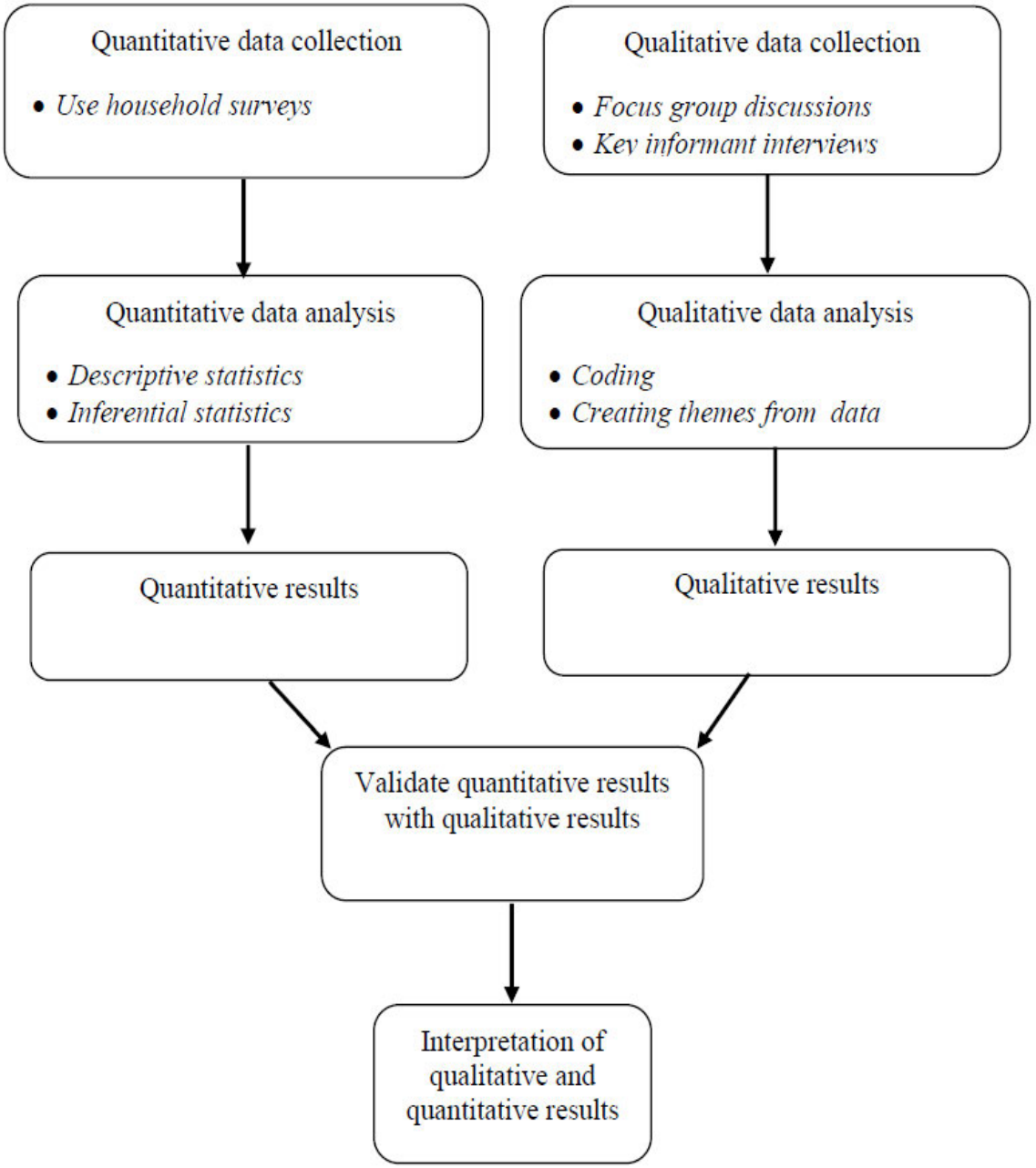


Figure 3.1: Validation research design model. Source: Adapted from Creswell (2014)

In using mixed methods, the primary goal is to confirm/triangulate, explore, explain, compliment and test data (Small, 2011 and Creswell, 2014). Using triangulation makes quantitative and qualitative data collected and its contribution more robust and have more meaning.

The mixed method was selected for the study so as to better understand the research problem since the study involved both positivist (objective, sampling and numerical data) and post positivist (subjective, verbal and

case data) enquiry. Also the study involved gathering views and opinions from sample respondents participating in discussions and interviews besides the individual responses from structured questionnaires.

3.3 Study site

3.3.1 Description of site

The study was conducted in two districts, Goromonzi (0310 29' E; 0170 29' S) and Murewa (0310 35' E; 0170 48' S), located in Mashonaland East Province of Zimbabwe (Figures 3.2 and 3.3). Figure 3.2 shows location of the district on the country map, whilst Figure 3.3 shows where the sampled household were concentrated in the selected wards. The two districts have a total population of 418,954 inhabitants (223,879 inhabitants in Goromonzi and 195,085 inhabitants in Murewa). Women constitute 51.4 % of the population, with each household having an average of 4.1 members. Population density is 89.3 person square km^{-1} (Goromonzi) and 56.1 person square km^{-1} (Murewa). This is against a national average of 33.0 person square km^{-1} (ZimSTAT, 2013).

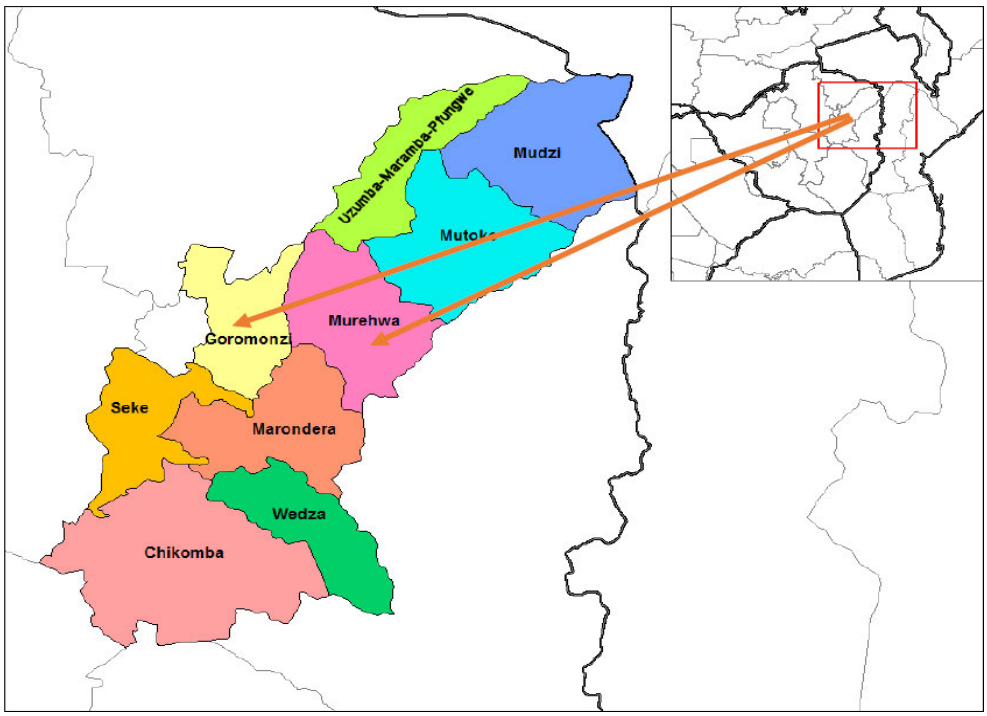


Figure 3.2: Map of Zimbabwe indicating the location of study area: Source: https://upload.wikimedia.org/wikipedia/commons/thumb/6/6f/Mashonaland_East_districts.png

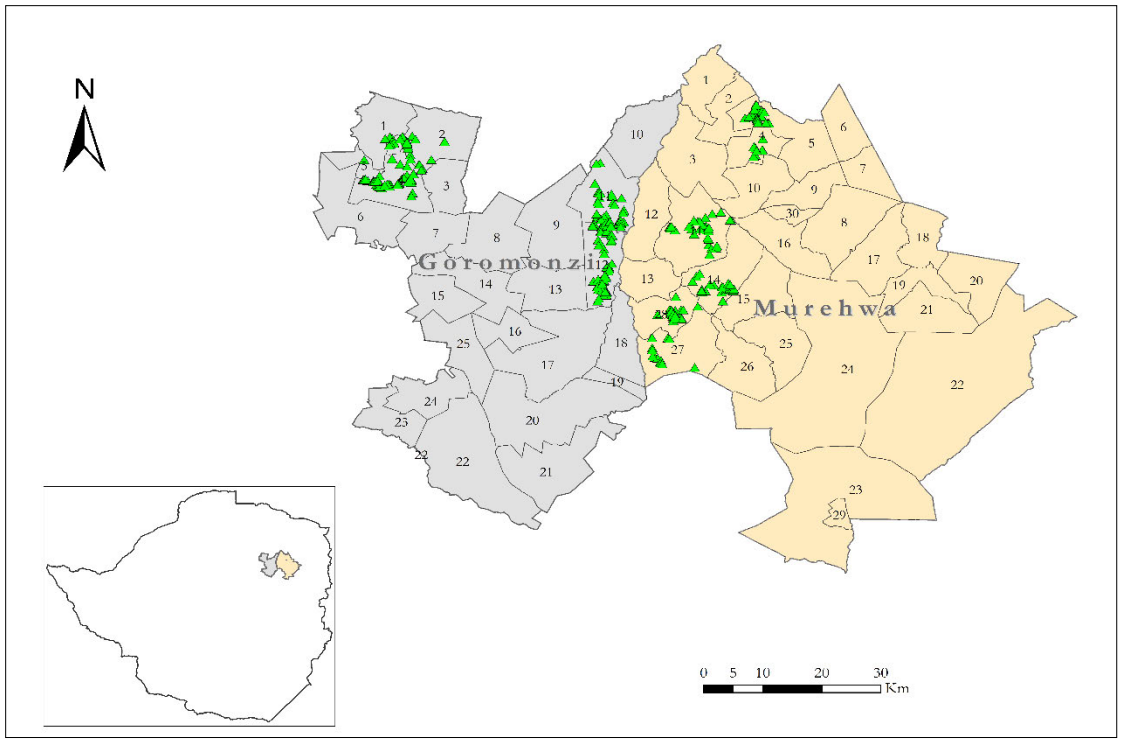


Figure 3.3: Location of study area with concentration of household survey (Source: Author)

3.3.2 Climate and vegetation

The elevation of the area ranges between 1,000 and 1,500 metres above sea level (masl). The districts fall in agro-ecological region II which receives an annual rainfall of about 750-1,000 mm between November and March/April each year while the remainder of the months are dry (Mutambara, Dube and Mvumi, 2012). Temperatures average a maximum of 25 ^{0}C and a minimum of 10 ^{0}C.

The region is characterised by rock outcrops of granitic and dolerite origin which have influenced the soil types which are predominantly sandy to sandy-loams and are well drained and course grained and are deep to inherent low fertility (Marimira, 2010). Miombo vegetation cover is dominant and common tree species include *Brachystegia spiciformis* (Musasa), *Julbernadia globiflora* (Mutondo) and *Marinara curatellifolia* (Muhacha) and some savanna grassland. Most common grasses found in the area are *Themeda triandra, Sporobolas pyramidalis and Hyparrhenia fillipendula*.

3.3.3 Agricultural activities

Subsistence farming is practised on communal land in the study area and it is suitable for intensive crop and livestock production. Average land size per household is 1.4 hectares of which about 80.0 % is put under maize Mujeyi, Mutenje, Manyawu, Gwiriri and Chakoma, 2015. Major economic activities are centred on crop and livestock production. Major crop production activities include maize, groundnuts, tobacco, soya bean and horticulture. On livestock activities, farmers are engaged in beef, dairy cattle, goats, poultry, pigs and sheep. Subsistence farming is predominant in the area, with surplus being sold to surrounding markets.

3.4 Data types and Sources

Quantitative and qualitative primary data was collected using structured questionnaire administered through a household survey, focus group discussions using checklists and observation. The data collected included household characteristics, assets owned, crop and livestock production and marketing activities, information and training, labour roles, stakeholder information, challenges and opportunities that exist in the area. These data both generated reliable evidence through measurements and perceptions about a subject matter.

Primary sources included surveys of individual households in Goromonzi and Murewa districts, Focus Group Discussions (FGDs) with key people in the districts. These key people include village heads, agro dealers, transporters, traders, farmers' union representatives, extension staff and NGO area representatives. Interviews were of key informants who have more knowledge of the seed industry and these included representatives of seed houses and district authorities.

Such surveys make use of questionnaires which can be structured or unstructured. In the current study, structured questionnaires were developed and pre-tested for use on individual household members. The questionnaire containing information on Primary sources have the advantage that data is original, current and gives a realistic view about the study topic to the researcher. On the other hand primary data takes time and cost to collect, other responses may not be received and there is need to train data collectors. Primary data was obtained from individual households.

Secondary sources are prior research conducted by other researchers which might be directly related to current study. This can be within or outside the organisation and they give insights to the current research

problem. Secondary sources include literature, electronic databases, websites, reports and publications and books and the researcher has to do a lot of reading and comprehension of the content from the literature source. Secondary data for this study was obtained from the International Livestock Research Institute (ILRI) database, Zimbabwe Central Statistics Office (CSO), Zimbabwe Ministry of Agriculture, Mechanization and Irrigation Development (MoAMID) and its associated departments (AGRITEX and LPD), books, journals and annual reports (such as the "Second Crop and Livestock Assessment Report" from MoAMID). Separate checklists were used to guide FGDs and KIIs (Appendices 4 and 5). Secondary data sources are cheap, save time and give direction which the research should follow. However, it is not all secondary data that is relevant and this reduces accuracy of data in current study.

3.5 Sampling

3.5.1 Sampling techniques and procedure

Multi-stage sampling was employed to select the sample for this study. The first stage was purposive selection of Goromonzi and Murewa districts. This was done as fodder seed technologies were introduced and promoted in these areas. The sampling frame consisted of all the farm households in both districts. The sampling selection of sample farmer households was at 95.0 % Confidence Level. In stage two, wards within the districts were purposively selected with the assistance of ward-based extension staff, based on areas for forage seed production. A total of 10 wards were selected (5 from each district) for the study. Number of households within the ward was based on ward household population according to ZimSTAT (2013). In the third stage, random sampling was then used to select households for the household survey.

In the study, the target population was the smallholder farmers in Goromonzi and Murewa districts. As the study could not cover all farmers in the districts, a sample was selected for in-depth study. The sampling technique used was probability sampling as each member of the population had an equal chance of being selected into the sample.

Levy and Lemeshow (2013) define a sample as a small part or sub-set of anything selected from a population and designed to show characteristics of all other elements in the population. A good sample has to meet certain predetermined criteria and in the study, a sample was drawn from smallholder farmers in Goromonzi and Murewa districts. For example, if a sample is drawn from smallholder farmers and the attribute to be measured is normally associated with commercial farmers, then accuracy is compromised. However, sampling error can occur as a result of random fluctuations inherent in the sampling process. The

ultimate test of a sample design is its representativeness of the characteristics of the population it is supposed to represent (Singh and Masuku, 2014). The main idea behind sampling is to enable the drawing of conclusions on the entire population using selected elements of that population through in-depth studies of the sample.

The advantages of sampling are that it possesses the possibility of better viewing, more thorough investigation of missing, wrong or suspicious information, better supervision and better processing than is possible with complete coverage (Bryman and Bell, 2003). Quality of a study is often better with sampling than with dealing with a whole population such as in a population census, as a census more costs more. Sampling also provides much quicker results than does a census and therefore, is time saving. It is the only possible process when dealing with an infinite population. As described by Bryman and Bell, (2003); Singh and Masuku, (2014), sampling techniques are divided into random (probability) and judgemental (non-probability) sampling.

Simple random sampling – is a form of probability sampling method which involves random selection of elements from a population and it ensures that the probability of each case being selected from the population is known and is usually equal for all cases. Bryman and Bell, (2003); Singh and Masuku, (2014) define simple random sampling as each element of the population having an equal chance of being selected into the sample drawn. In the case of this research study, every element of the sample, that is, farmers, has an equal chance of being selected. This is because the method is easy to implement, can be easily understood and used, and the samples allow one to project sample results to the entire population.

Stratified sampling–this method of probability sampling involves dividing the entire population of elements into sub populations, called strata, then selecting elements separately from each subpopulation (Levy and Lemeshow, 2013; Singh and Masuku, 2014). The researcher controls sample size in strata, increased statistical efficiency, provides data to represent and analyse subgroups, enables use of different methods in strata. Increased error will result if subgroups were selected at different rates, expensive. This method is very useful especially when the population is large and several characteristics occur within that population.

Cluster sampling - This is a probability design where a sample of clusters is first selected and decide on which sampling units to include in the sample further study (Singh and Masuku, 2014)). The method provides unbiased estimate of population parameters. It is also economically more efficient than simple random and easy to do without a population list.

Purposive sampling - Palinkas, Horwitz, Green, Wisdom, Duan and Hoagwood (2015) mention that the principle of selection in this non-probability sampling is that respondents are selected as it is expected that they are representative of the population of interest and meet the specific needs of the research study. There is low likelihood that the sample will be representative enough. The method is mainly used in qualitative research and when dealing with very small samples such as in case study research and when one wishes to select cases that are particularly informative (Neuman, 2000).

3.5.2 Sample size determination

Epi Info 7.2.1.0, is a software package that was used to calculate sample size. Sample size was determined at 95.0 % Confidence Level with a 5.0 % Margin of Error 5.0 %. A total of 414 farm households were selected as the sample and used in the study from the two districts. Sample size per ward ranged between 26 and 57, with an average of about 41 households per ward (Table 3.1).

Table 3.1: Distribution of sample households in Goromonzi and Murewa districts

District	**Ward Identification Number**	**Household Sample size**	**Percent frequency (%)**
Goromonzi	2	39	9.4
	4	54	13.1
	5	26	6.3
	11	57	13.8
	12	54	13.0
Murewa	4	40	9.7
	11	36	8.7
	14	30	7.2
	27	30	7.2
	28	48	11.6
Total		**414**	**100**

A total of 4 FGDs were successfully conducted at 4 sites (2 in each of the districts) and participants comprised extension staff from LPD, AGRITEX and Veterinary Services Division, lead farmers, local agro dealers, NGO partners, and local leaders. Of the 55 participants to the FGDs, 56.4 % were females, whilst the balance were males. Table 3.2 shows the number of participants at each of the FGDs and where it was held in the respective districts. Attendance at FGDs, had more women than their male counterparts. LPD, AGRITEX and Veterinary Services Division are government departments responsible for the provision of extension services to farmers on livestock production, crops and animal health respectively. In every ward, each department is represented by an officer. NGOs also implemented agriculture related projects in the study area and they had a fair understanding of the communities and their livelihood activities. With four FGDs, the number was adequate and it enabled consolidated qualitative data and drew themes from it, making use of NVivo software package.

Table 3.2: Sites and participant composition for FGDs in Goromonzi and Murewa

District	**Site**	**Males**	**Females**	**Total**
Goromonzi	Showgrounds	6	6	12
	Chikwaka Milk Collection Centre	8	7	15
Murewa	Muchinjike School	6	9	15
	Mahohwa Business Centre	4	9	13
Total		**24**	**31**	**55**

For Key Informant Interviews, a total of five (representing 38.5 % of registered and participating companies) seed companies were selected using simple random sampling from the list that was availed by the Zimbabwe Seed Traders Association (ZSTA) where interviews were conducted. The companies have had years of operation in the seed industry ranging from 5 to 70. They also have a good national coverage, with two of the companies being represented internationally. Industry players (input suppliers and traders) who usually serve the farmers were also selected randomly to conduct interviews for an industry analysis. These include locally-based agro dealers and those located in the city and they interact with farmers for agricultural inputs supply and other household requirements. They have an average branch network of 2 across the country and have been in operation for an average of 12 years. Relevant heads of government department (research institutes, regulatory services-Seed Services, Extension Services-AGRITEX and LPD Divisions) were also interviewed during the study. These are public institutions that depend solely on the fiscus for their operations and service delivery.

3.6 Data collection

A combination of qualitative and quantitative system analytical methods was used to address the main objective. Data was collected from farmers in Goromonzi and Murewa districts of Zimbabwe.

3.6.1 Quantitative data collection

Survey tool for interviews in quantitative research employed to gather data from farmers was a household questionnaire (Appendix 3) with structured questions. Closed ended questions in the questionnaire were developed and assigned numerical values and this enabled data analysis using mathematical methods, such as SPSS 21. Data collected included household information on age, assets owned, crop and livestock production and associated costs that were used to determine Gross Margins and conducting sensitivity analysis.

3.6.2 Qualitative data collection

The researcher developed the FGD Guide (Appendix 4) and facilitated all FGDs with the assistance of local extension staff during the discussions. Two extension officers assisted with taking notes and making observations during discussions in addition to making notes on flip charts. The guide consisted of a checklist of questions set for discussions related to the subject of forage seed production as a business among smallholder farmers. Discussions were held with local farmer groups, extension staff and development organizations. In Goromonzi and Murewa districts, a total of four FGDs (two in each district) with 8 to 12 participants at each discussion were conducted to gather data on general experiences and opinions from the group. FDGs were employed to reveal revenue streams from forage seed business within the smallholder farming system and this would assist in determining Gross Margins. FGDs were also used to triangulate and crosscheck data availed by respondents in individual interviews and reports from the study areas.

For industry players, a Key Informant Guide (Appendix 5) was employed as a tool for in-depth interviews for organizations including relevant government departments. Key Informants were staff with more knowledge of the subject within the organizations. A checklist was developed to ensure or guide that all aspects required in the study are captured during the Key Informant Interviews (KIIs). Questions asked were on nature of business, main customers, opinion on engaging with smallholder farmers, stakeholders involved, opportunities that exist in forage seed production, challenges involved, what strategies are required and who should be involved.

3.6.3 Logistics for fieldwork and management of data

When data collection tools were ready, the researcher ensured that ethical clearance had been obtained from the university. In the study sites, permission was granted by the Ministry of Agriculture, Mechanization and Irrigation Development (MoAMID), which is the ministry responsible for all agricultural activities (Appendix 7). Besides that, the International Livestock Research Institute (ILRI) also granted permission for the researcher to conduct the study at its project sites and using that data. ILRI also has an interest in the outcome of the study for research purposes. Therefore, transport, salaries, use of office and computers and storage database were all financed by ILRI.

Ethical considerations are important as they involve the respondent's rights. The researcher prepared consent forms (Appendix 6) that were completed by each respondent before the interview was conducted, a copy of which remained with the respondent. This explained the that the respondent was free to respond to questions and at any given time, the respondent advise that he/she was not able to respond and the interview would be terminated. Also the consent form assured the respondent of privacy and anonymity to the individual and that there was no harassment involved in conducting the interview. Mack, Woodsong, MacQueen, Guest and Namey (2005) mention that it is important to disclose the purpose of the study to the respondent. The researcher ensured that only adults were involved in responding to questions during the household survey. In FGDs and KIIs, these involved adults only. For household surveys, the questionnaires were administered in a language the respondent was comfortable with, thus English or Shona (local language). Respondents were also encouraged to raise any concerns on the study, of which contact details where to direct concerns was on the consent form. Travelling to study sites to collect data involved leaving for the field in the morning, coming back at sunset. The sites are located outside Harare, the capital city of Zimbabwe and the furthest distance travelled during the study was about 150 km (one-way). Household data was collected over a period of two weeks during the month of March. The month of March did not coincide with the period when farmers were in the fields. They had completed most of the field work taking place during that period, therefore there was no disturbance on their farming activities.

FGDs were also conducted on a different date from the household interviews to reduce contamination of data collected. Participants were advised well before the discussion so that they were aware of what was going to happen. Appointments with Key Informants were made through e-mails, followed by telephone and they gladly responded on convenient dates and times for the interviews.

3.7 Data analysis

3.7.1 Descriptive statistics

In descriptive analysis, the frequency distribution, percentages, mean, and standard deviation was calculated. The frequency distribution was utilized to determine the participants' current socio-demographic information by providing frequency, percentage, valid percentage, and cumulative data. The mean and standard deviations was used to describe the data collected with regard to each item or measurement or question rating.

Descriptive analysis of household characteristics and socio-economic data involved the use of frequencies, ratios, mean, range, standard deviation, percentages and variances. A forage seed sector analysis was conducted by assessing the current forage seed production systems in Zimbabwe. A statistical package, NVivo 10 was employed to analyse qualitative data gathered from survey, focus group discussions and key informant interviews. This was to organize and interpret interviews conducted during the study. The descriptive tool was also used to describe actors along the forage seed value chain and their roles. To be able to identify the various actors along the forage seed value chain and explain their networks and relationships, UCINET 10, was used.

3.7.2 Inferential statistics

In order to answer the study research questions, Structural Equation Modelling (SEM) was applied to examine the causal relationships and mediating or moderating factors affecting forage production adoption and competitiveness among smallholder farmers in Zimbabwe. The model concept is derived from literature, hence relationships were synthesized from literature and then developed into a model to be confirmed by data using SEM. The literature reviewed highlighted that forage production increases livestock productivity especially during the dry season (Madzonga and Mogotsi, 2014; Assefa, Ano, Aba and Ebrahim, 2015; Lugusa *et al.*, 2016). Pasture production programs to support livestock productivity have been less successful with germ plasm unavailability as one of the reasons both on formal and informal input markets in the country (Mapiye *et al.*, 2006; Beshir, 2014). Smallholder farmers' (producers) decisions to venture into forage seed business are limited by lack of business skills and its ability to improve their livelihood.

Structural Equation Modelling is a second generation multivariate data analysis method used in tackling research problem to treat unobservable, hard to measure latent variables (Wong, 2013). The Model is a statistical modelling technique which looks at relationships that are complicated in nature, that is, between one or more dependent variables (MacCallum and Austin, 2000; Schumacker and Lomax, 2010). Various other authors have defined SEM as follows:-

- Hoyle, (2012) also mentions that SEM is a statistical modelling tool used to analyse data variables that are correlated and is sometimes called causal or latent variable modelling.
- A causal inference methodology using a set of qualitative causal hypotheses or causal relationships in non-experimental designs to produce a set of logical model implications, numeric estimates so that data will support level of model implications, (Little, 2013).
- Is a statistical methodology that involves the analysis of a structural theory by way of causal processes and structural relations among variables (Byrne, 2016). It is a confirmatory rather than an exploratory appproach to data analysis.

All the definitions point to the fact that there is analysis of observable and latent variables through the use of software programs that confirm existence of relationships that are complex in nature. Thus the methodology tests the relationships that exists among variables which can be measured or are latent variables (those variables not measured directly but through their effects which are the indicators). The four models encountered in SEM include path analysis, confirmatory factor analysis (CFA), latent variable structural model and growth curve model.

Structural equation modelling involves three different scenarios in relation to models or parameters: “under-identified”, “just-identified”, and “over-identified”. An “under-identified” model’s number of parameters is more than the number of variances and covariance. In this case, the model cannot be interpreted. A “just-identified” model’s number of known parameters equals the number of unknown parameters, having 0 degree of freedom and always fitting perfectly to the data (Zhang, 2017). One factor solution with these indicators is the just-identified model, meaning the evaluation of goodness-of-fit cannot be calculated. However, the factor loading can still be evaluated (Brown, 2006; Fan, Chen, Shirkey *et al.*, 2016). Although this model is not scientifically interesting, as the hypothesized model always fits the sample data, it is still applicable to estimate the values of the coefficients for the paths and hypothesis testing. An “over-identified” model, contrary to the “under-identified” model, has a number of variances and covariance greater than the number of parameters.

The advantage of applying SEM is that it allows examination of the correlations between several dependent and independent variables simultaneously, and the determination of the factor structure of different populations (Reisinger and Mavondo, 2007). The SEM technique is also a powerful tool in assessing and modifying a proposed theoretical model for further theoretical development. Generally speaking, a complete SEM model contains two parts: a structural model conceptualization, and a measurement model conceptualization. The structural model conceptualization relates latent variables to one another. The measurement model relates measured variables to latent variables (Hiranpong, Decharin, Thawesaengskulthai, 2016).

In SEM, the measurement model needs to be specified prior to testing the relationship between constructs in the structural model. The procedure of specifying the measurement model is known as a confirmatory factor analysis (CFA). The primary function of the CFA is to explore the relationship between the latent variables and the observed variables. In other words, the CFA is applied after the exploratory factor analysis (EFA), and used to test whether measures of a construct are consistent with a researcher's understanding of the nature of that construct (or factor). When conducting the EFA, an examination of the loading of the variable on the factors identifies the character of the underlying dimension. The CFA, on the other hand, regards each (latent) variable as an indicator and highlights their correlation with observed variables (Marsh, Morin, Parker and Kaur, 2013). An appropriate measurement model has to satisfy two criteria. The first is that each of the observed variables can effectively measure the latent variables. Secondly, the structured loading of a single observed variable is not allowed to be significant with other latent variables. In other words, the factor loading between the latent variable and observed variable should be between 0.30 and 0.95. The composite reliability (CR) should be at least above 0.60 (Hair, 1998) and the average of the variance extracted (AVE) should also be above 0.5 to ensure the convergent validity of the latent variables.

SEM has the advantage that one is able to understand complex relationships among the variables being studied. It is considered to lie between analysis of variance (ANOVA) and factor analysis, thus it performs ANOVA on factors. In order for one to be able to conduct SEM, one should understand the basis of ANOVA and factor analysis. In structured equation modelling, interactions that are complex are first translated into a network of directional paths linking variables and later evaluated against multivariate data (Keith, 2015). In order to understand structural equation modelling, it is best to present the variables in a path diagram, then a set of matrix equations is developed to represent the statistical model. In figure 3.4, arrows with one head indicate causal relationships where the arrow head is pointing, whereas double headed arrows indicate correlation. This means that for a farmer to adopt forage seed production, it is assumed that this depends on knowledge on forages, one has land and other assets, potential income to be derived from forages, forage

seed production information is available and being a member of a farmer organisation. On the other hand, participation in markets also depends on farmer having access to land and own some assets such as ploughs and cultivators. Access to information motivates farmers to participate in markets. If there is increased income, there is more need to produce more products for the market. Furthermore, incomes from the agricultural activities are dependent on improved crop varieties with high yield and better quality products that will result in better prices.

Though multiple regression is commonly used to identify the relationship between dependent variable and independent variables, it cannot fully give answers to this objective because of the following reasons:-

- Multiple regression predicts value of a single dependent observing variable by knowing the score of other independent observing variables.
- Multiple regression cannot be used if there exists a mediating variable between the dependent variable and the independent variable(s).
- Multiple regression cannot be carried out if the dependent variable is not an observed variable.

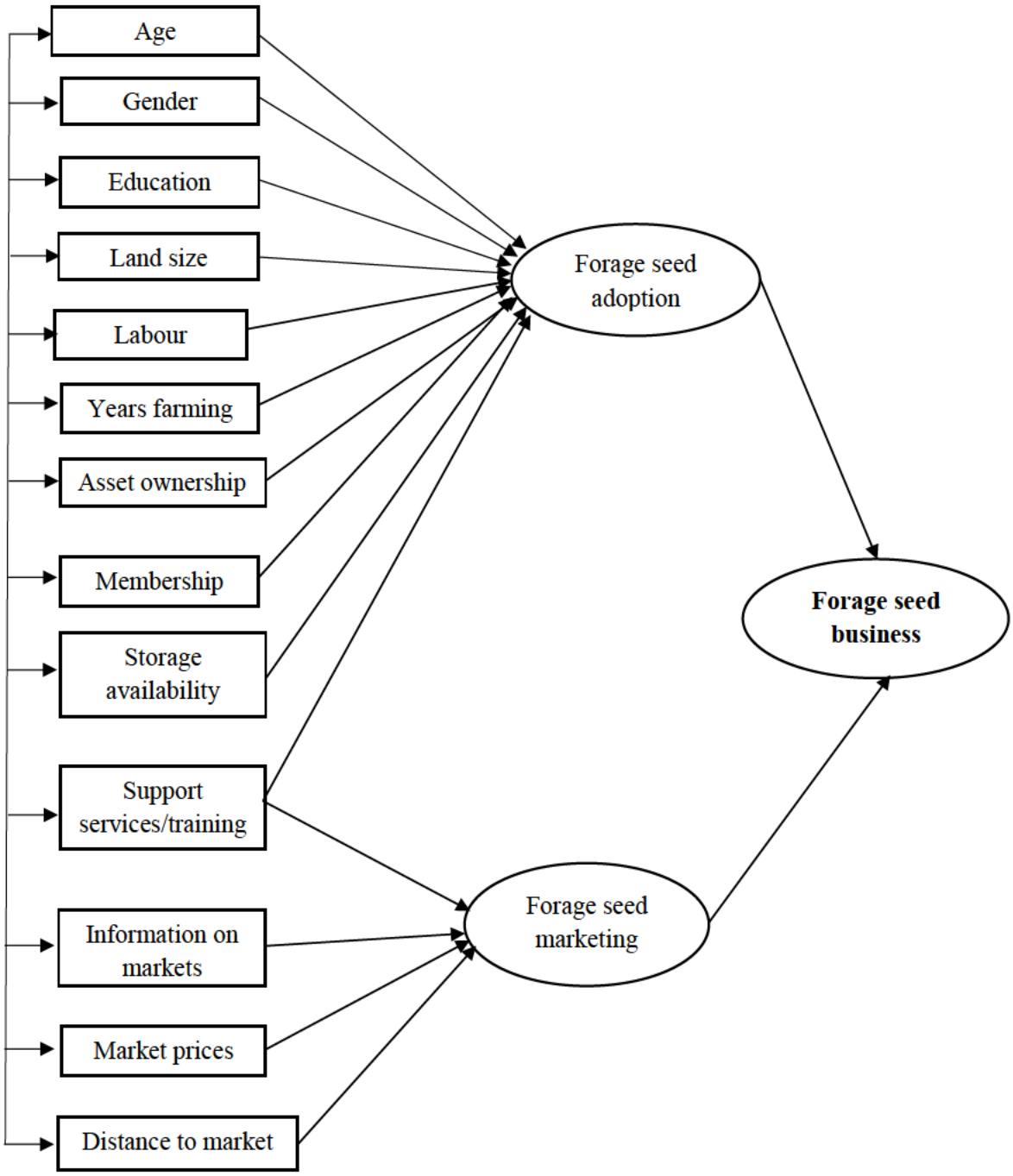


Figure 3.4: Conceptual framework for structural equation modelling (Source: Developed by Researcher).

Structural Equation Modelling (SEM) was therefore selected for data analysis to investigate factors affecting the establishment of forage seed business among smallholder farming communities. SEM combines the logic of multiple regression and path analysis with a single data analytical framework and therefore can cater for the presence of a mediating variable in between exogenous (independent) variables and endogenous (dependent) variables (Cheng, 2001). The model combines direct and indirect effects. SEM involved the conceptualisation of the causal relationship, the construction of the path diagram, the model specification and identification, the evaluation of the model, the comparison of models and model improvement.

For data analysis, structural equation modelling (SEM) using software package STATA was employed in the study as the technique can provide estimates that explain latent variables with their indicators whilst at the same time the relationship that exists between exogenous and endogenous latent variables (Tomarken and Waller, 2005). The final path diagram for the estimated SEM model from the study is presented in Figure 4.1. The structural equation model (SEM) was used with observed and latent variables to test the conceptual model and assess the strength of the research hypotheses, namely the effects of the demographic, access to information through extension, and membership to farmer organisations and endowments. Each variable might influence behaviour and intentions both directly or indirectly. Questions from the household survey questionnaire were used in this SEM analysis. These included close-ended questions on socio-economic characteristics (education of household head, sources of income, age of household head, gender of household head), information sources (membership to farmer organisations, access to production and marketing information on fodder through extension, distance to nearest markets), resource endowments by household (land size owned, tropical livestock units (TLU), assets owned, availability of seed storage facilities) and knowledge on farming (farm experience).

Model conceptualisation was done based on literature review. The hypothesised relationships among the factors were generated. The developed theoretical framework of the model was then illustrated through the construction of a path diagram. A path diagram graphically represents relationships among factors. In the conceptual model (Figure 3.4), focus is on exploring the relationship between competitiveness variables.

Description of variables

The identification of the variables was based on studies conducted by other researchers using similar variables. The factors which comprise forage seed production, forage seed marketing and competitive

forage seed business and associated variables that were considered for the construction of the hypothesized model are shown in Table 3.3.

Table 3.3: Factors and variables used in the model and related studies on the variables

Factor	Items/variables	Studies that have used variables
Forage seed production	Inputs availability; gender; level of education; land size; labour; years farming; asset ownership; membership to an organisation; storage available; support services	Shelton *et al.*, 2005; Ndou, 2012; Manyeki *et al.*, 2013; Ramirez, 2013; Beshir, 2014; Welu, 2015; Awotide *et al.*, 2016.
Forage seed marketing	Market prices; market information; distance to market	Lilleso *et al.*, 2011; Wanyama *et al.*, 2011; Singh, Singh, Jha, Singh and Singh, 2012; Hare *et al.*, 2013; Munyaka *et al.*, 2017;
Competitive forage seed business	Seed production; forage Seed marketing	Wanyama *et al.*, 2011; Welu, 2015; Lugusa *et al.*, 2016; Munyaka *et al.*, 2017

Dependent variables/factors

It is assumed that there are a number of correlated dependent variables (Table 3.3) that affect the main dependent variable of forage seed business. These include adoption of forage seed technologies, production of quality seed and seed marketing.

Forage seed business - There is a box in the model, depicting the forage seed business. This depends on adoption of forage technologies and existence of markets that smallholder farmers can access.

Forage seed production - is a dummy dependent variable assigned 1 for adopters and 0 for non-adopters in the model. Information on forage production and marketing is important as it assists a farmer to make informed decisions on farming enterprises.

Forage seed marketing - This variable depends on factors such as market information, quality of the seed, prices offered at the market and which market. Different kinds of forage seed markets exist and they include seed companies, individual livestock farmers, farmer seed producers and crop farmers who intend to improve soil fertility.

Independent variables

The model assumes that for farmers to adopt forage seed production and marketing, they are influenced by factors including age, gender, education level, size of labour within the household, land size, asset ownership, membership to an organisation, of seed storage availability and information on markets and prices of products. Table 3.4 shows the descriptions for the different variables for gender, education level, membership to organisation, availability of seed storage facility, training services and market information, and source of information.

Table 3.4: Descriptions of variables used in the model

Variable	**Variable description**
Age of household head	
Gender	0=female; 1=male
Education level	1=never been to school; 2=primary; 3=secondary; 4=tertiary
Household labour size	
Land size	
Asset ownership	
Membership to organisation	0=no; 1=yes
Seed storage availability	0=no; 1=yes
Support/ training services	0=no; 1=yes
Market information on fodder	0=no; 1=yes
Source of information on market prices	1=Private company; 2= NGOs; 3=Government institution; 4=Farmer group; 5=Trade association; 6=Other farmers
Distance to market	

Age of household head (Age) – As members of the household grow older and spend more time at the farm, they gain experience more farming experience. This will have a positive effect on participation in seed

technologies. Young farmers have more chances of becoming more experienced with time through exposure and trainings.

Gender of household head (Gender) – This is a dummy variable which has a value of 0 if female and 1 if male. It is anticipated that males have more access to resources than their female counterparts, therefore, are expected participate more in forage seed production technologies. Women's knowledge of forage seed production will enhance their participation at markets and this will contribute to more women empowerment, decision making, asset endowment and resultant household income.

Level of education of household head (Education) – Education level has been observed to positively influence farmers to participate in seed technologies (Manyeki, Kubasu, Kirwa and Mnene, 2013). It measures the extent to which farmers have reached level of education. As farmers gain more knowledge, they readily understand what is involved and thereby accepting adopting improved practices. The variable is measured as a categorical variable in level of education.

Household labour size (Labour size) – This continuous variable indicates the number of members present within the household who can provides labour. It is assumed that the more the members, the more is labour available for farming activities. Seed production is a specialized activity and more labour will be required, especially at crop management and seed cleaning stages.

Land ownership (Landsize) – More land for farming activities relates to participation of farmers in seed business. Smallholder farmers give priority to maize production to meet household food security. If more land is at available, they make decisions to embark on forage seed production.

Asset ownership (Asset ownership) – The more the assets the more readily farmers adopt improved farming practices. Farmers would also want to use their own resources for production. This includes ownership of farm implements, motor vehicles and scotch carts for transport.

Membership to farmer's organisation (Membership) – A dummy variable denoted by 1 as yes when a farmer is a member and 0 for no when a farmer does not belong to any farmer organisation. Participation of farmers in a farmer organisation can positively influence adoption of forage seed technologies (Ramirez, 2013; Tolno, Kobayashi, Ichizen, Esham, and Balde, 2015).

Seed storage availability (Storage availability) – The way seed is stored after harvesting and after threshing and during marketing affects its quality. Smallholder farmers usually lack improved storage facilities and end up storing seed in environments like kitchens and outside where it is subjected to unfavourable weather conditions and pests. This categorical variable is influenced by the quality of storage facilities that the farmer has.

Access to extension support services/training (Support/training services) – Visits by extension staff positively influences farmers to participate in seed business as technical advice is offered during these visits and farmers' questions are readily answered. The more the visits, the more farmers participate. During these visits, quality standards of seed crops are monitored to ensure quality seed is produced. Trainings are positively correlated to adoption of forage seed technologies and they also offer confidence to farmers. Type and relevance of trainings offered is expected to positively influence farmers to produce forage seed as they will have gained knowledge on management practices. In this study it is a dummy variable where 1 is a yes and 0 is a no.

Source of information on markets (Markets) – probability of adopting and participating in seed business is increased as farmers are more informed and are able to make informed decisions on seed businesses. Access to information influences farmers to participate at markets.

Source of information on market prices (Prices) – when better prices are offered at the market, farmers will adopt seed technologies and participate more at the market. Prices affect supply and demand of forage seed on the market. Where better prices are paid, this motivates farmers to produce seed and send produce to that market, if they meet the quality standards required.

Distance to market (Market distance) – This is measured in kilometers away from the homestead. Shorter distances encourage farmers to visit the market place to access inputs and deliver goods for sale. The shorter the distance, the more farmers will participate at the market.

Even though SEM has been regarded as fit for latent growth modeling, handling data missing variables, it has its own limitations. This makes use of various alternative approaches and one has to be clear as to which approach to employ (Jenatabadi, Babashamsi, Khajeheian and Amiri, 2016) for the intended results. The modelling method requires large samples and does not discard outliers which may lead to pronounced Type I Error and other systematic errors. Model also requires an experienced researcher in modelling in order to avoid mistakes (Nachtigall, Kroehne, Funke and Steyer, 2003).

Data analysis for descriptive and inferential statistics was proposed as illustrated in the procedure. The procedure starts description analysis and the normal distribution test. This is followed by identifying and dropping off of those items that are not significant. There is then need to conduct test for reliability followed by exploratory factor analysis and finalizing the questionnaire (Figure 3.5).

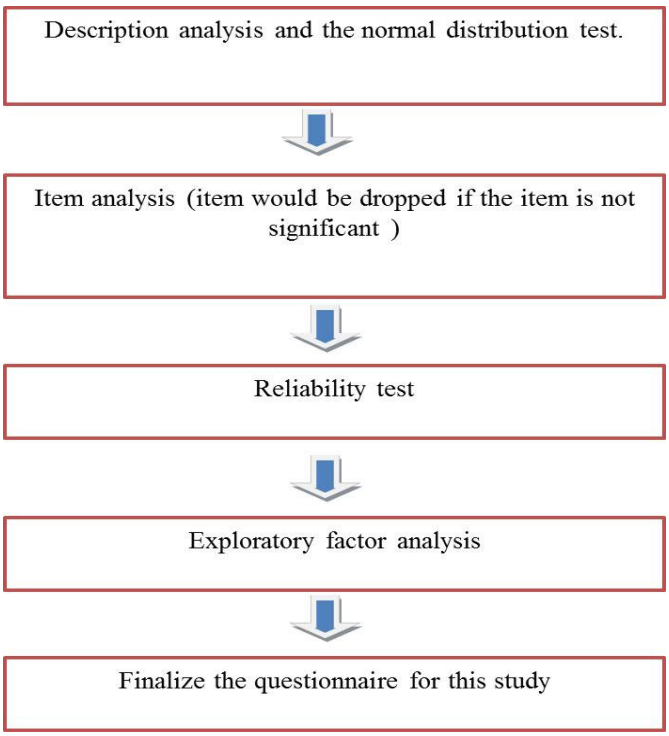


Figure 3.5: The data analysis procedure. Source: Developed by Researcher

3.7.3 Profitability of forage seed using Gross Margin analysis

Promotion of seed production and dissemination has been found to encourage diffusion of common beans (Rubyogo, Sperling, Muthoni and Buruchara, 2010) although it is still to be established if a smallholder farmer can generate income when such an enterprise is undertaken on a commercial basis.

Gross Margins (GM) for the different crops grown in the study sites were derived by determining the difference between income realised and production costs. GM is used to estimate likely return on an enterprise and it assists in decision making on which enterprise to pursue. The higher the gross margin, the better paying the enterprise is. It was important for the farmer to establish whether it was worthwhile venturing into forage seed production and marketing, besides the usual crop and livestock production. The

variables that affected production and decision making were estimated and analyzed using the dependent and independent variables.

.

$$GM_x = \sum_{i=1}^{n} TFI_i - \sum_{i=1}^{n} TVC_i$$

Where

GMx is Gross Margin (x = Crop type (Maize, Mucuna, lablab, cowpea))

$\sum_{i=1}^{n} TI_i$ is summation of the Total Income (TI) for each crop (i = 1; 2; 3)

Gross total income is the product of the price of the output and the yield.

$\sum_{i=1}^{n} TVC_i$ is summation of the Total Variable Costs (TVC) for each crop (i = 1; 2; 3)

The cost of an input is the product of its price and the quantity of the input required for a given area.

3.7.4 Sensitivity analysis

Sensitivity analysis was used to explain the likely changes in yield of maize with the introduction of forage crops and seed production.Smallholder farming systems, which are normally rain-fed dependent, place high priority on food security. Thus integrated approaches need to be developed so that the smallholder farmers are able to be resilient against any negative shocks such as droughts, floods and market price disparities. Thus sensitivity approaches comes into play that deal with agricultural yields and assist the farmer to make informed decisions on what enterprises to venture into. Sensitivity analysis helped to explain if a farmer has to venture into forage seed production or continue with field crops in terms of income generated from the interventions.

3.7.5 Value Chain Analysis

As processes take place along the value chain, different transactions occur, relationships build at various level and for different purposes among actors. The analysis of forage seed value chain highlights the need for improvement in quality of forage seed produced, including feed availability, improved coordination among value chain actors and their involvement. To this end, the steps followed in analyzing the forage seed value chain included the following:-

- Characterising forage seed production among the smallholder farmers, that is, mapping the value chain and highlighting the processes that take place. Data was collected through household surveys, FGDs and KIIs, besides secondary data from reports, books and published papers. Value chain mapping, the first stage in value chain analysis, would enhance understanding of the various actors along the forage seed value chain, their roles and benefits derived. The approaches employed in the study are Social Network Analysis (SNA) and analysis of challenges and opportunities.
- The analysis also identified challenges along the forage seed value chain and opportunities that exist to improve forage seed business and income among smallholder farmers. In order to understand the seed industry and activities that take place, it is necessary to review factors both within and beyond the control of the organisation that influence its economic activities and decision making through the use of value chain analysis (Clavel, 2014; Tej kiran and Sultry, 2014). A value chain analysis helped to explain the factors that affect performance of the seed industry in Zimbabwe. This analysis was performed on the producers who are the farmers, that is, analysing strengths and weaknesses within their sphere of influence and the those factors that are beyond their control.
- Identifying and describing the value chain actors and the different roles they are playing. This also assists in identifying gaps and areas that need to be strengthened to improve value chain actor involvement and value addition.

Value chains are important for smallholders as motivates to improve on production and quality, engage different stakeholders and has the potential to generate income for the farmers. When smallholder farmers are empowered and capacitated, especially by producer organisations coupled with relevant and adaptable innovations, they can become locally and globally competitive. Smallholder farmers need to understand and meet market requirements (product quality and trade requirements) for them to fully benefit in participating in value chains.

The quantitative data was entered and analysed using the Statistical Package for Social Sciences (SPSS) Version 21 to reveal trends that explained findings. A summary of approaches used for each objectives are presented in Table 3.5.

Table 3.5: Objectives and analysis approaches employed

Objective		Research question	Analysis method
Primary	Develop a model for forage seed business in smallholder systems that enhances competitiveness	What model can be developed for forage seed business in smallholder systems that enhances competitiveness?	Structural Equation Modelling (SEM);
Specific objective 1	Characterize current forage seed systems in Zimbabwe;	What are the current forage seed production systems available in Zimbabwe?	Descriptive statistics (Frequencies; Trends); Inferential statistics; Profitability-Gross margin analysis; Sensitivity analysis; NVivo
Specific objective 2	Identify challenges and opportunities in smallholder forage seed production and marketing;	What are the challenges and opportunities that exist in forage seed business management in smallholder systems?	Frequencies; NVivo; challenges and opportunities; SWOT Analysis; value chain analysis
Specific objective 3	Characterize forage value chain players and their roles in forage seed systems;	Who are the players in forage seed value chains and what are their roles?	Value chain approach; Actor analysis (UCINET)
Specific objective 4	Suggest options for enhancing competitiveness of forage seed production as a business in smallholder systems of Zimbabwe.	What strategies can be developed that can enhance competitiveness of forage seed production in smallholder systems?	Gross Margin analysis; Sensitivity analysis, Structural Equation Modelling; Swot analysis

3.8 Chapter summary

The chapter has highlighted methodology used for the study. Mixed methods research design were employed, where data was collected using both quantitative and qualitative approaches, making use of household surveys, Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). Study area used was where forage seed production technologies were promoted. Multistage sampling techniques was employed to select the sample from the study area, starting from the districts to the wards. In each of the 10 wards, household sample determination was through probability sampling and identification of sample households was through the assistance of ward based extension staff.

Methods for data analysis included SPSS to reveal frequencies and trends on descriptive statistics. Other approaches employed included Structural Equation Modelling (SEM) for direct and latent (dependent and independent) variable, SWOT analysis, value chain analysis, actor analysis using UCINET for Social Network Analysis (SNA) and business model approaches. The SEM approach looks at relationships among variables which can be measured or are latent variables. All these, together with discussions and observations were used to consolidate, verify and cross check validity of data collected.

CHAPTER 4. RESEARCH FINDINGS ON OBJECTIVE 1

4.1 Introduction

This chapter of the thesis presents results and discussion of major findings of the household characteristics. It highlights and analyses general household characteristics in terms of age, gender, level of education, land sizes for production, asset ownership, farming activities, main sources of income for the farmers, decision making within the household and gender roles and responsibilities. The chapter also describes the forage seed value chain and processes involved.

This is at the backdrop of the fact that the seed industry in Zimbabwe was started in the 1940's by some farmers' associations with support from government (Havazvidi and Tattersfield, 2006). Crop seeds were promoted by private companies whilst forage seed was under the mandate of national research stations which fall under the Ministry of Agriculture. Seed systems for field crops are organised where private seed companies multiply, package and market the different varieties. In promoting forage seed production, there may be lessons to be learnt from the study area, farmers in those communities and stakeholders involved in livestock, forages and forage seed production. Adaptable and relevant interventions could then be formulated for the area.

4.2 Characteristics of sampled household

From the surveyed households, the highest frequency (13.8 %) of respondents was from Goromonzi ward 11, followed by wards 4 (13.1 %) and 12 (13.0 %) in the same district, whilst the least frequency (6.3 %) was in Goromonzi ward 5. In Goromonzi there are more households compared to Murewa and this may have resulted in more responses from Goromonzi than Murewa. In FGDs, there were 55 participants from the four sites where the FGDs were conducted, with an average of about 14 participants per FGD. The number of participants for the FGDs falls within the recommended for such discussions (Stewart and Shamdasani, 1990). It is important to study these characteristics as they have an effect on how household members make decisions at household level (Chege, Lemba, Semenye and Muindi, 2016). Explanatory variables of adoption of fodder as a business are divided into three constructs, that is, farmers' characteristics, household endowments and information sources (Table 4.1).

Table 4.1: Household characteristics of sample households in Goromonzi and Murewa

Household Characteristics	Males (281 respondents)		Females (133 respondents)		All respondents (414)		
	Mean	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Sig. diff**
Age of Head of Household	54.39	±14.863	56.14	±11.537	54.95	±13.891	0.231
Household membership size	5.36	±2.393	4.95	±2.096	5.23	±2.307	0.090*
Household labour size	3.62	±1.848	3.26	±1.683	3.50	±1.802	0.060*
Years in farming	20.21	±12.662	21.53	±12.235	20.63	±12.527	0.318
Homestead area (ha)	0.40	±0.604	0.29	±0.332	0.36	±0.534	0.052*
Field crop area (ha)	1.45	±1.116	1.32	±1.082	1.41	±1.106	0.269
Paddock area (ha)	0.12	±0.375	0.11	±0.534	0.12	±0.432	0.764
Garden (ha)	0.28	±0.350	0.24	±0.379	0.27	±0.359	0.250
Other area (ha)	0.07	±0.408	0.02	±0.195	0.05	±0.354	0.258
Total area (ha)	2.33	±1.752	1.99	±1.604	2.22	±1.711	0.057*
	Response	**Count (281)**	**Count (133)**				
Level of education	Never	9	4				
	Primary level	75	65				
	Secondary level	170	59				
	Tertiary level	28	5				

Significant * at 1%.

This shows that females in female headed households were much older than the males. The smallholder population at study sites show that there is a more mature generation. More than two thirds of the household heads were older than 40 years. There is a small percentage (less than 10 %) of the younger generation. The average age of the head of household is within the economically productive age as outlined by Mandara, (1998) although carry-over of farming knowledge and activities might be jeopardised in the area (Anderson, Marita and Musiime, 2016).

Marital status - On marital status, the highest percentage (70.8 %) of household heads are married, followed by 24.4 % of household heads who are widowed and the least being heads of households that are single (2.2 %) as shown in Figure 4.1.

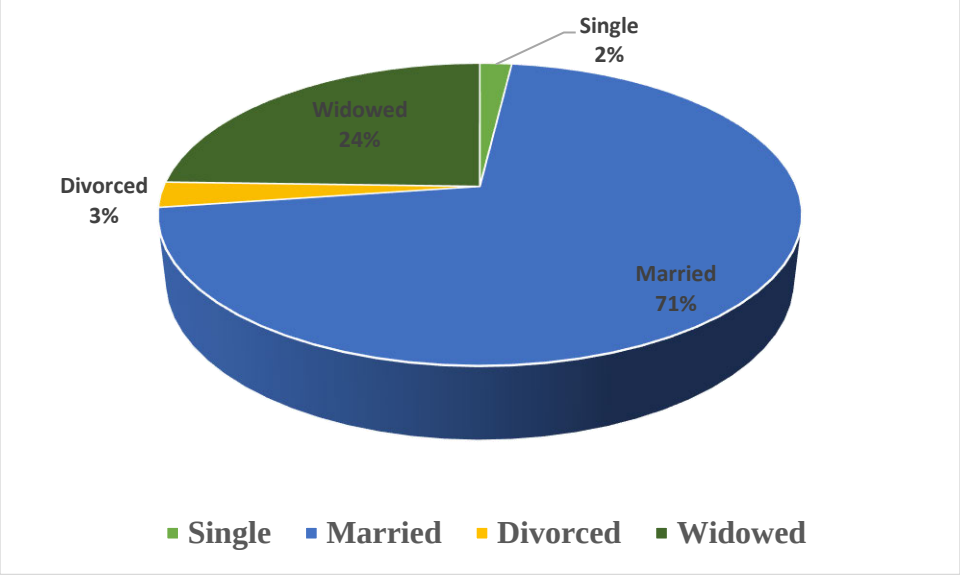


Figure 4.1: Marital status of head of household. Source: Developed from research results

Head of household's educational level - Of the sampled households, 3.1 % have never been to school, whilst 33.8 %, 55.3 % and 8.0 % reached primary, secondary and tertiary levels respectively. There were less females compared to males at each level of education. Results also indicated that of all male head of households, 60.5 % reached secondary level, whilst 10 % reached as far as tertiary level (getting to university level and gaining professional qualifications). Only 3.2 % of males had never been to school. On the other hand, the highest percentage (48.9 %) of female head of households reached as far as primary level only, with the rest having not been to school (3.0 %), 44.4 % reached secondary level and 3.8 % reached tertiary level. Results showed that less females reached secondary compared to the males. Males reached secondary education level, which is higher than that reached by their female counterparts. Females

continue to face challenges in accessing education facilities at higher levels despite the fact that strides have been made worldwide to increase female enrolment in educational institutions (UNESCO, 2012). Jayachandran, (2014) attributes this to socio-cultural factors, besides the economic environment faced by the societies especially in the developing world.

Some researchers, Wafula, Oduol, Oluoch-Kosura, Muriuki, Okello, Mowo (2015) and Okello, Zhou, Kwikiriza, Ogutu, Barker, Schulte-Geldermann, Atieno and Ahmed (2016) found age of household head (agehh) having significant effect on the adoption of new technologies. Young people have more probability of becoming aware of production and marketing of fodder seed, and take up the technology as a business. Fetien Abay *et al.*, 2009 noted that young farmers have the chance to be educated and be exposed to new technology.

Manyeki, Kubasu, Kirwa and Mnene, (2013), in their study revealed that higher educational level will lead to incease in adoption of technologies. However, this is not consistent with some studies by Jera and Ajayi, (2008) and Beshir, (2014) where farmer's level of education did not have a significant effect on adoption of forages.Innovations and new technologies are better adopted by farmers who have the ability to see the embedded benefits to be attained (Murage *et al.*, 2012; Manyeki, Kubasu, Kirwa and Mnene, 2013).

Household size - Results indicated that there is an average of 5 members in each household, whilst an average of 3 members are able to provide labour within the household. Household membership and labour availability within the household for both male and female headed households is significant ($p<0.1$). ZimStat (2013) revealed that the average national household size for the same area is 4.2. Results from the study are higher as the sites are highly populated and may be a result of an increase over time since the last census. When labour is available, especially within the household, then farmers can venture into more agricultural activities, explore new technologies and on bigger land sizes (Beshir, 2014). This might be a result of the need for more labour. However, gender and type of work to be done also influence labour availability within the household of many rural farmers. There are certain roles that are assigned to specific gender within the households and this will affect labour availability (Mandara, 1998; Chingarande and Kandiwa, 2015).

Farming experience - Results for both male and female headed households indicated that they have an average of 20 years of farming experience, which shows they have gained some experience in crop and livestock farming activities. More years of farming experience have been found to influence adoption of technologies (Manyeki *et al.*, 2013). An experienced farmer who is resource endowed and with a higher

income from agriculture and a large household labour size with access to information through membership to other farmer organisations, found it easier to invest in the fodder seed business.

Land holding - The average farm size per household is 2.2 ha. Males own more land than females, thus some of land ownership increases adoption of new farming practices and technologies (Manyeki *et al.*, 2013). Also the World Bank (2000), in its report revealed that in Sub-Saharan Africa, women do not have rights to land, only through their husbands if they are still in marriage. However, some of these challenges being faced by women have now been addressed through different fora and policy amendments in the different countries (Jost, Kyazze, Naab, Neelormi, Kinyangi, Zougmore, *et al.*, 2016).Economic factors such as size of land owned by household and the total number of livestock units owned by the households have the strongest influence on adoption of fodder seed business. Total land area was also significantly ($p<0.1$) different between male and female headed households. In the smallholder sector, land size indicates a sign of wealth and status within the community. Smallholder agriculture dominates in the study sites with dryland crop production and horticulture as main agricultural activities. Livestock activities are present although not as pronounced as crops.

Sixty-three percent of the total land area was allocated to field crops, 16.0 % to homestead, 12.0 % to garden, 5.0 % to paddocks and 2.0 % to other (for example orchards and gumtree plantations). It is normal practice among smallholder farmers to allocate more land to crop production as they want to produce food to meet household food security. Farm size of household (landsz) measured in hectares will also affect land committed to a new crop in relation to food crops and cash crops already grown by the household. Farm land size positively influence adoption especially in the early stages. This is because those farmers with limited land size are not likely willing to experiment with new technologies on their small pieces of land, especially when they are uncertain of the likely outcomes or benefits associated with them.

Asset ownership - Responses indicated that more than 50.0 % of the households own at least a wheelbarrow, plough, knapsack sprayer, bicycle and 2 mobile phones. Less than 20.0 % own a car, tractor or motorbike (Figure 4.3). Owning assets that are related to agricultural activities has been found to positively influence adoption of technologies, including forage seed production (Ramirez, 2013; Tolno, Kobayashi, Beshir, 2014; Ichizen, Esham, and Balde, 2015).

Assets ownership measured by asset index is expected to positively affect decision to engage in forage seed marketing because farmers with farming implements such as ploughs can timeously till land and have higher productivity levels. Over 50.0 % of the sampled households own a wheel barrow, mobile phone,

plough, knapsack sprayer and a bicycle. These are important basic assets for farmers to be able to carry out farming activities and only when carrying out specific activities will they require specialised equipment. On the other hand, less than 15.0 % of respondents own a car, motorbike or tractor (Figure 4.2).

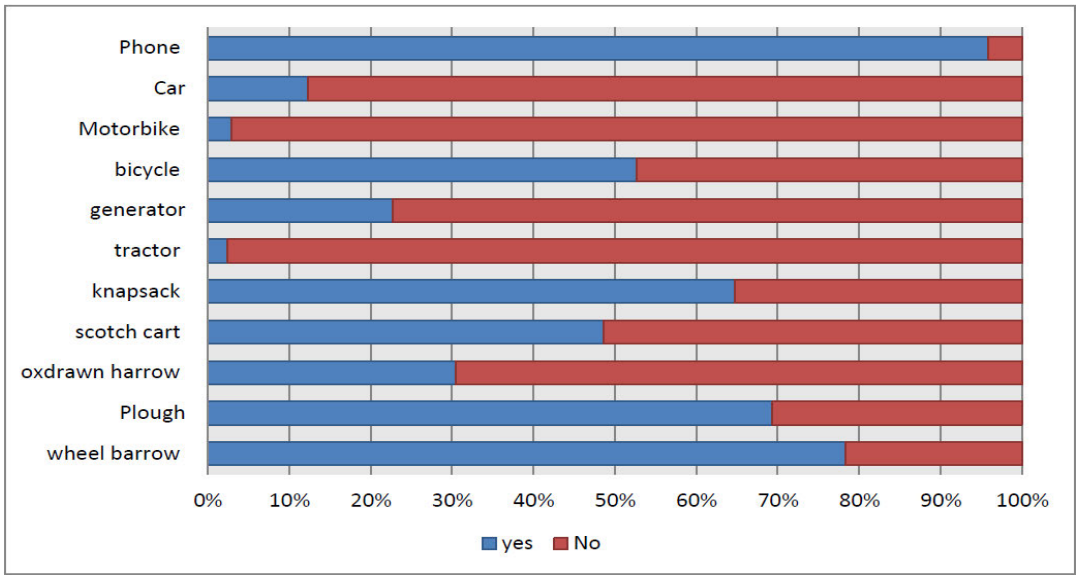


Figure 4.2: Percentage (%) of households indicating different assets owned in Goromonzi and Murewa

Membership to an organisation – Sixty-three percent of the households are not members of any farmer organisation. FGDs also revealed that a greater number of households are not members. Reasons cited during FGDs include farmer organisations are not visible within the communities, there are subscription fees paid and farmers cannot afford these, also there is not much benefit being a member besides information. However, some studies have revealed that when farmers become members of organisations, they tend to benefit much (Manyeki *et al.*, 2013; Fon, 2015).

Access to technological information through membership to farmer organisations is also very important as farmers are persuaded to adopt based on the benefits and costs of each technology and can thus make informed decisions. Training in fodder seed production enables households to increase knowledge and skill on seed production and marketing.

4.3 Farming activities

Records indicated that rainfall is received between end of October and April, with the rest of the months being dry. The seasons are defined as rainy season (November to April), where rains are received and planting of summer crops occurs, and the dry season which occurs between May and October. The dry season is in two parts, cold dry season (May to August) and warm dry season (September to November). The area receive an average of 800 mm annual rainfall (Figure 4.3). During the past three growing seasons (2012-13 to 2014-15), more rainfall was received during 2013-14 season.

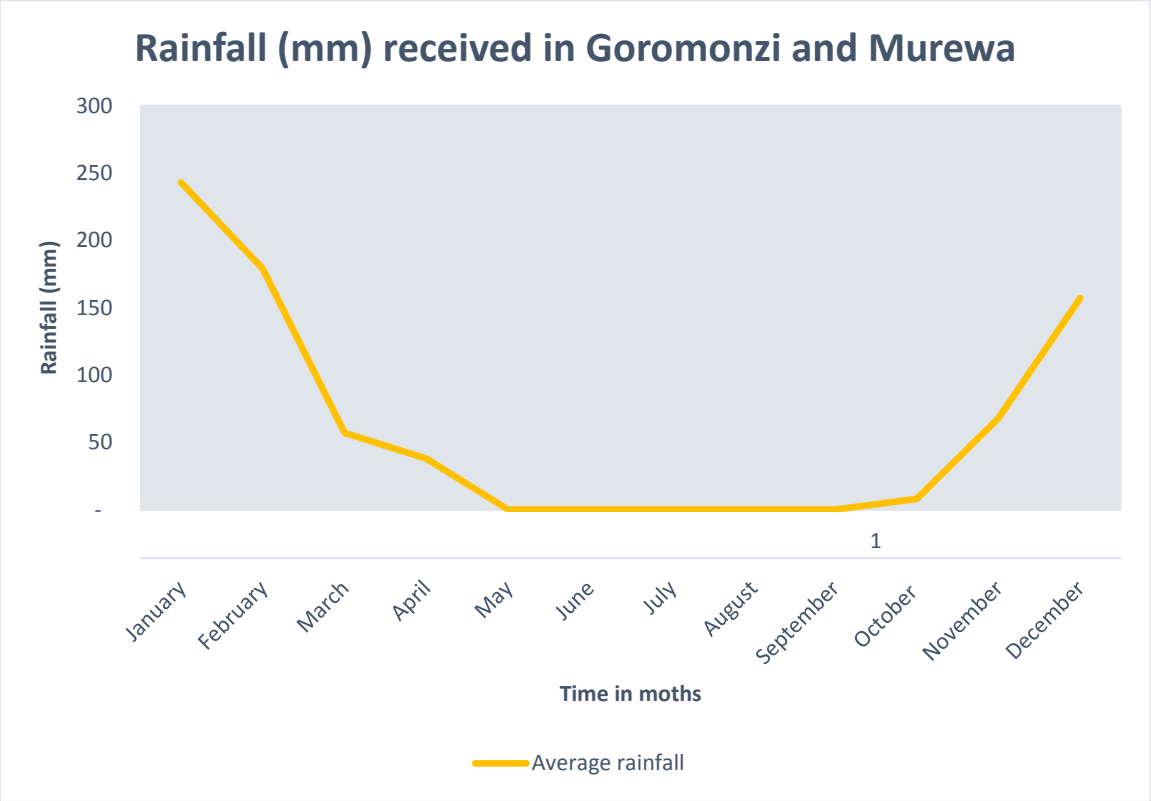


Figure 4.3: Average rainfall (mm) received in the past three farming seasons (2012-13 to 2014-15)

4.3.1 Crop production system

In Goromonzi and Murewa farmers practice mixed farming, where they grow crops and keep livestock at the same time and these activities are integrated. This is characteristic of smallholder farming systems (Gollin, 2014). Crops manure and draught power from livestock, whilst livestock benefit feed from the crops in the form of conserved fodder, grazing and crop residues. Smallholder farmers in the area owned

an average of 2.2 ha, of which 1.4 ha is cultivated and the rest is for homestead, garden and grazing area. Of the cropping area in the past three cropping seasons (2012-13 to 2014-15), 41.0 % was put to maize production, followed by mucuna forage crop, groundnuts, with the least being fodder trees (Figure 4.4).

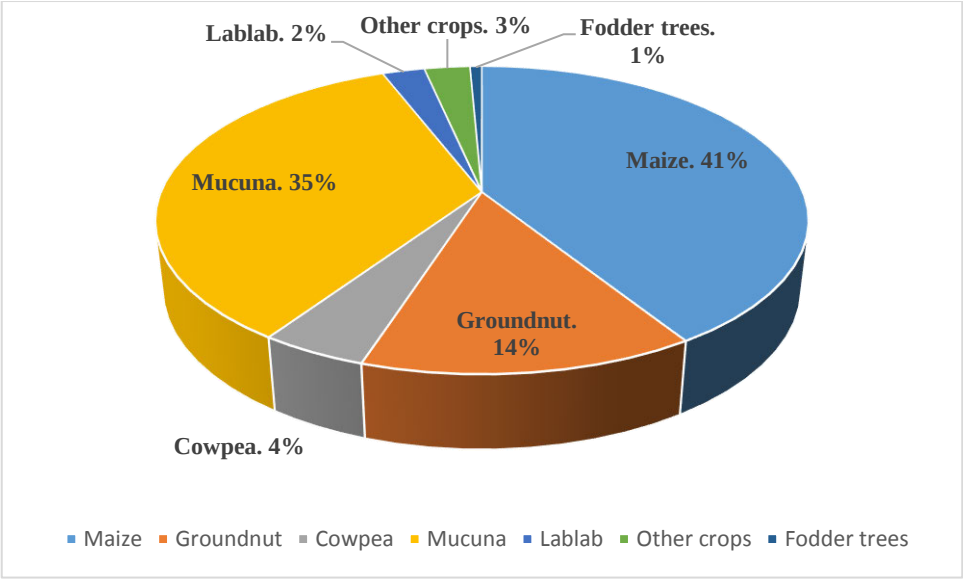


Figure 4.4: Percentage (%) area cultivated different crops

The livelihoods of farmers in Goromonzi and Murewa mainly depended on field crops produced in the growing season. Crops are dominated by maize, groundnuts, cowpea, sweet potatoes and millets. Farmers also included forage crops such as mucuna and lablab in cropping programs for the purposes of producing livestock feed, seed production and soil improvement. On forage crops, they are mucuna and lablab. Seed of maize is usually sourced from the shops whilst that of groundnuts and cowpeas is from retained crops seed. Forages showed potential in cropping systems as shown by the proportion of land area allocated to forage crops. Seed of Mucuna and lablab, which are the most prominent forage crops, is accessed from NGOs.

4.3.1.1 Input supply

From the study, it was revealed that farmers use seed of major crops from different sources, mostly retained, bought-in and input programs, besides sharing with neighbours. However, for forage seed, since it was revealed that seed is scarce, NGOs are the main source, as shown in Table 4.2. Besides that, farmers also use retained forage seed or source from neighbours.

Research findings indicate that forage seed sources are non-existent. Seed companies mainly focus on food crop seeds such as maize, groundnut, cowpea and soya bean. Forage seed is mainly sourced from outside the country. Also when sold, it is on the informal market. Farmers exchange the seed amongst themselves. This tends to compromise the quality of the seeds. Unlike other crop seeds that are available from retail shops and at agro dealer level, forage seeds are not available. Few seeds can be sourced from national research station, but production is low due to limited resources. Private seed companies have no focus in improving self-pollinating varieties and those that are vegetative propagated. Farmers often collect such seed material and keep for use in future growing seasons and this results in the crop seeds becoming non profitable for the operations of the seed companies (Guei *et al.*, 2011).

Table 4.2: Sources of crop seeds for smallholder farmers in Goromonzi and Murewa

	CROP				
Seed source	**Maize**	**Groundnut**	**Cowpea**	**Mucuna**	**Lablab**
Retained	3	1	1	2	3
Bought-in	1	2	3	4	2
NGO	4	-	2	1	1
Neighbour	5	4	4	3	3
Input program	2	3	6	6	-
Research organisation	6	-	5	5	-

Key: numbers in table refer to priority of seed source. 1=highest priority; 6=lowest priority

Maize seed is mostly bought-in and to a lesser extent received from input programs. Farmers use retained seed, besides receiving it from NGOs. Main source of forage seed is from NGOs, implying that the seed is still very scarce. For forage seed to be accessed by farmers, there needs to be developed interventions that support such niche and unique markets (FAO and ICRISAT, 2015). Demand for forage seed is on the increase in the area and other parts of the country as farmers now put more emphasis on improving livestock production by providing quality feed, improve crop production through crop rotations and soil moisture conservation, besides diversification of livelihood activities to spread risks.

Generally the quantity of fertiliser applied per crop per season has reduced over the seasons (Table 4.3), except for groundnut where there was an increase in both basal and nitrogen based fertiliser. Farmers also used more basal and top dressing fertiliser on maize crop more than on any other crop. This reflects some knowledge that the farmers have on the need to apply fertilisers on cereal crops than legumes. Also maize is the staple food crop and farmers grow to meet household food security. The decrease in use of fertilisers could be a result of economic hardships as farmers indicated that crop inputs are now expensive and beyond their reach. This creates opportunities for use of forage legumes in cropping systems and production of forage seed at the same time for sustainability of legume usage. In smallholder systems, use of manure on field crops, including forages cannot be emphasised and farmers would benefit from. Use of manure in combination with fertilisers improves the soil fertility and crop production (Rusinamodzi, Dahlin and Corbeels, 2016; Zingore 2016). Production and sale of forage seed would enhance incomes and farmers will be able to procure more fertilisers for their crops. Fertilisers provide nutrients for the crops planted and as such need to be available in adequate quantities and at the correct time of plant establishment and growth. However, dressing of legume seed with rhizobia enhances nitrogen fixation, which helps in reducing application of top dressing fertiliser to the subsequent crop. Forage legumes such as mucuna are known to provide as much as 50-70 kg N ha^{-1}, to subsequent maize crop (Mhlanga *et al.*, 2015).

Table 4.3: Area planted and quantities of basal and top dressing fertilisers applied per crop per growing season in Goromonzi and Murewa.

	Average area planted (ha)	**Basal fertiliser applied kg/season**			**Top dressing fertiliser applied kg/season**		
Crop type		**2012/13 season**	**2013/14 season**	**2014/15 season**	**2012/13 season**	**2013/14 season**	**2014/15 season**
Maize	0.56	122.8	122.5	117.1	122.8	121.1	120.2
Groundnut	0.19	34.7	42.1	73.1	28.9	39.7	84.3
Cowpea	0.06	39.5	36.7	27.0	46.2	22.5	17.6
Mucuna	0.47	37.6	29.1	23.0	35.5	24.9	20.0
Lablab	0.03	47.0	31.4	30.0	26.9	26.0	23.9

Farmers access seed and other crop inputs from suppliers within their localities or when not available locally, outside the wards. Inputs accessed outside the wards also incur transportation costs, for example, a 50 kg bag of basal fertiliser costing between US$30.00 and US$33.00, would incur an extra US$2.00 for

transport to farmers' homestead using public transport. This is beside bus fares that the farmer has to meet to source such inputs. If this bag was to be sourced from the local retail shops, it would cost US$35.00 on average. Input suppliers also mentioned that because of the current economic environment which is unfavourable for business success or growth, they do not have credit facilities for smallholder farmers as their operations are high risk, hence selling their products on cash basis. This also enables the input suppliers to get inputs from their own suppliers and restock.

Farmers in the area also access inputs from seed companies or development organisations under different arrangements. Contract farming is common and known in the study area for the production of cowpea, sugar beans, soya beans, and tobacco. Other arrangements revealed are joint ventures, farmer-owned businesses, out grower schemes and tenant farming, shown in Figure 4.5. Discussions with participants at FGDs revealed that these arrangements are in a variety of ways including informal, semi-formal and formal. In informal arrangements, agreements are concluded mostly by word of mouth and there is nothing written down to bind any partner to the agreement. In this way, both farmers and buyers have leeway not to honour the agreement. Farmers can side market, also buyers can buy from somewhere else other than to this farmer(s).

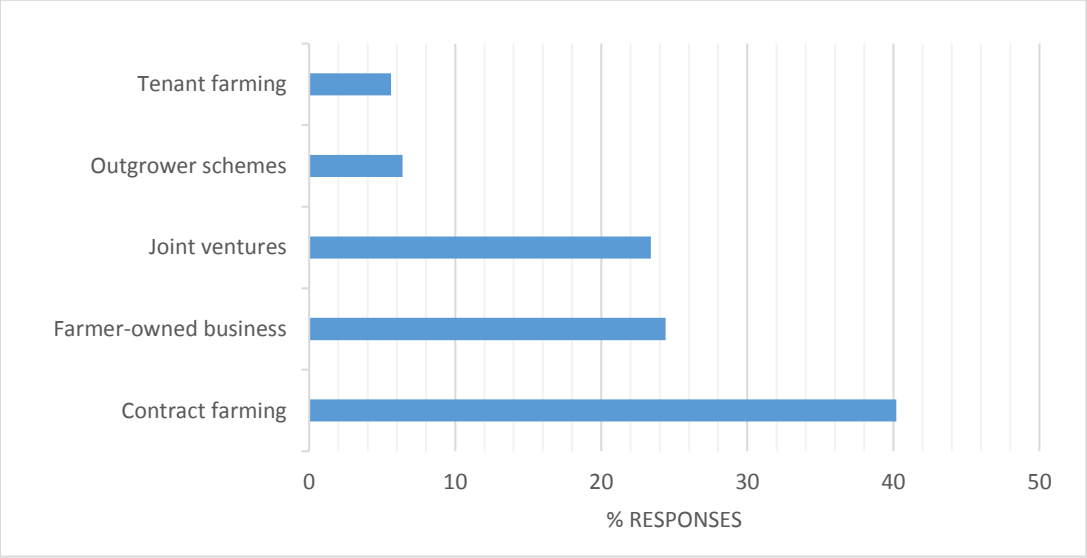


Figure 4.5: Household responses on preferred forage seed production arrangements

Under these business models, farmers enter into agreements with the other party who may be the contractor or trader and agree to terms and conditions, including pricing and marketing of the product. These various interactions of the models are further explained by the figure 4.6. Besides the five distinct models outlined

above, a farmer uses more than one to access inputs, technical support and use as marketing channel. Farmers do this to guard against risks of crop failure and hope to realise better prices at alternative markets (FAO, 2013; Odunze, van Niekerk and Ndlovu, 2014).

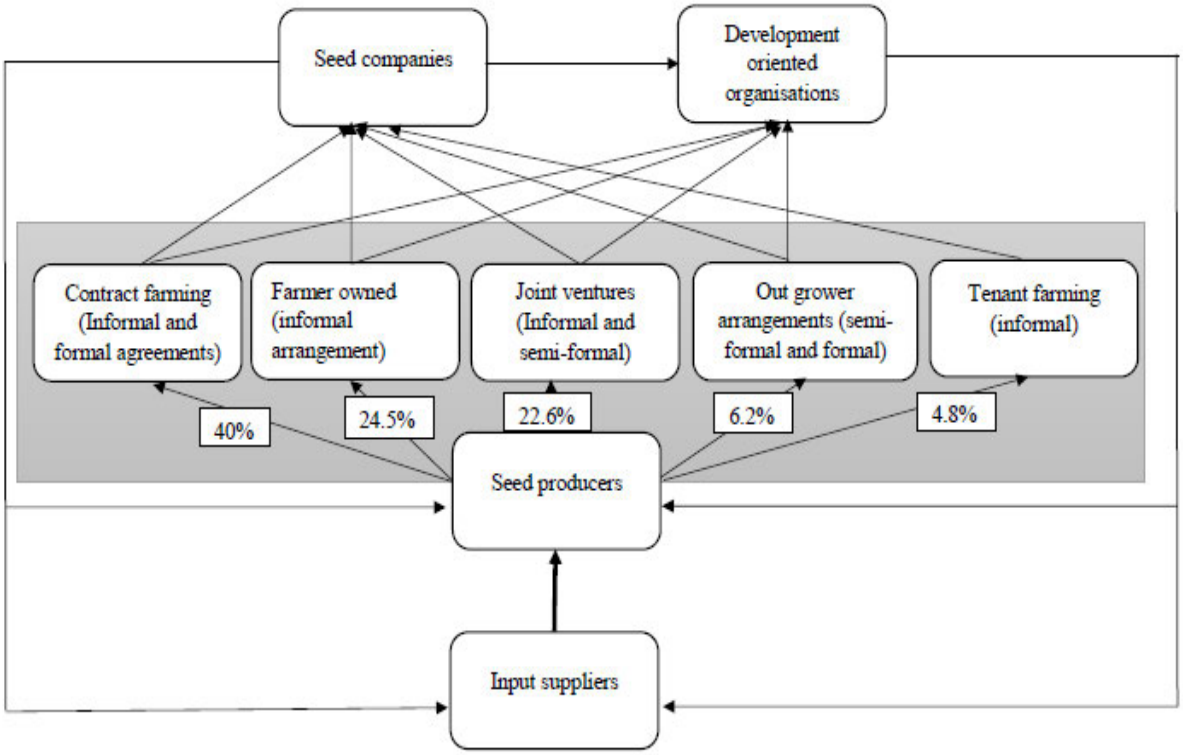


Figure 4.6: Business models in forage seed production

The study revealed that on options of how they would prefer to produce forage seed, households (about 40.0 %) would prefer contract farming (Figure 4.6). This is followed by farmers having their own seed production business (24.5 %), joint ventures (22.6 %), with the least preferred model being tenant farming (4.8 %). This can be explained by the fact that farmers have been involved in contract farming besides owning those businesses and joint ventures before on some crops and seeds such as cowpea, sugar bean, vegetable seeds and flower seeds. To a lesser extent farmers have been engaged in out-grower schemes and tenant farming. This, respondents have attributed to contract farming having been promoted by a number of organisations, including those for development. Unlike in the out grower schemes that were more focused on high value crops and livestock on commercial production, like within the sugar industry in Southern Zimbabwe and Horticulture and Poultry Producers' Associations.

There are many variations in contracting farmers, even though according to Prowse (2012), it is:-
"a contractual arrangement for a fixed term between a farmer and a firm, agreed verbally or in writing before production begins, which provides material or financial resources to the farmer and specifies one or more product or process requirements for agricultural production on land owned or controlled by the farmer, which gives the firm legal title to (most of) the crop".
The best preferred is contract farming in which the variations highlighted by farmers include with and without input support. This also depends on that terms and conditions are clearly spelt out and farmers are assured of a market. Companies have engaged farmers in pre-financing, where the company provides all or part of the inputs required, including provision of funds to meet labour costs. On the other hand, farmers have been assured of a market when they sell their produce, even when in situations where they have not been assisted with inputs. In a contract, although quantities do matter, farmers are mainly interested in the price that will be paid by the buyer and this usually forms the basis of discussion between the parties to a contract. Other aspects that form part of the terms and conditions of the contract which were highlighted included monitoring of field activities, technical support and the delivery of seed and payment terms.

Contract arrangements have had the option of farmers getting technical support from the contracting companies. When selling produce, the contractor deducts all costs incurred and the farmer gets the balance. These have also been promoted in Zimbabwe and received much attention, especially after the Land Reform Program, as a way to boost production and contribution to the growth of the economy. This form of contracting has also drawn new skills and finance and helped to build relationships within the sector (Scoones, 2012). Contractual arrangement also present challenges to farmers who depend on rainfall for producing seed. When the crop fails, farmers lose out, especially if they were on input schemes. Seed companies may fail to pay farmers on time or not at all, citing poor quality seed.

FGD participants identified important aspects that they considered important in business models that involve a platform for learning and knowledge sharing through activities like field days, farmer field schools, exchange visits, trainings and field demonstrations. Secondly, there should be an element of trust among the players involved along the value chain.

Farmers have the perception that they can be cheated. This is especially when nothing is explained to them about what will happening or what they will benefit from an activity. They would gladly participate in an activity without benefit but with full explanation of what is happening. Another aspect is that of feedback and reflection, whether positive or negative. This will give farmers a mind-set of being innovative and think

of strategies to overcome challenges and improve on interventions. Relationships and collaboration are also important aspects in business models that involve smallholder farmers as these help in have collective thinking and increase bargaining power. There is also a silent need to protect the private sector as engaging smallholder farmers is continuously becoming high risk, owing to side marketing. Farmers need a constant emphasis on holding true to their contractual obligations, as this has a bearing on the sustainability of the business model.

Under the arrangements, famers have the option to be supplied with all or part inputs, or even no inputs at all as shown in Figure 4.7. The inputs which may be in the form of seeds, fertilisers, chemicals, packaging material and tools, may also be subsidised or not. If supplied with inputs, related costs will be deducted on payment for products that would have been delivered. Development organisations also supply seed and other inputs either a free issues or subsidised where farmers pay a prescribed fee to access these during the implementation of specified project interventions. Free input deliveries have been effective during humanitarian situations. However, such initiatives have been criticised for promoting dependency syndrome among the beneficiaries (Govere, Foti, Mutandwa, Mashingaidze and Bhebhe, 2009). In cases where farmers contribute to access these inputs, market players including input manufacturers and agro dealers have been involved and this has been found to be sustainable (Mutami, 2015).

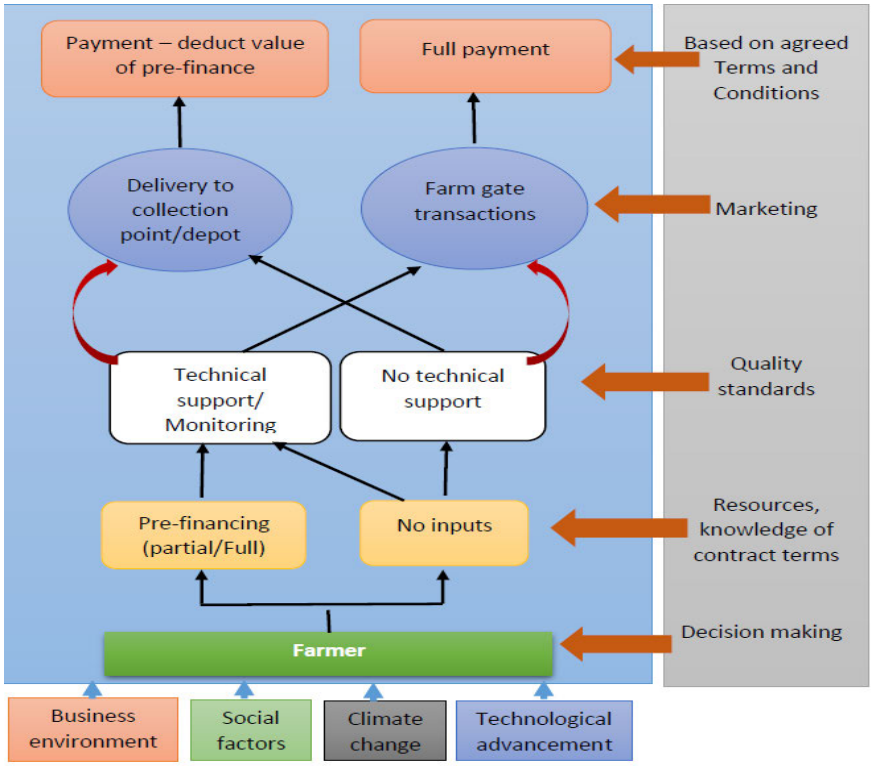


Figure 4.7: Processes and support offered in forage seed business ventures

From survey results, indications are that farmers who are contracted to produce seed in Goromonzi and Murewa districts do that in a number of ways and under various conditions (Figure 4.8). Input supplies are not in adequate supply, especially forage seed, besides being irregular in supply and priced beyond the reach of farmers. Production environment is beyond the control of the producer as factors are enshrined in economic, technological, political and social constructs. Also farmer's decision making is affected by these factors. The market conditions are predetermined and inaccessible to the ordinary smallholder farmer who might have the will and motivation to embark on forage seed production.

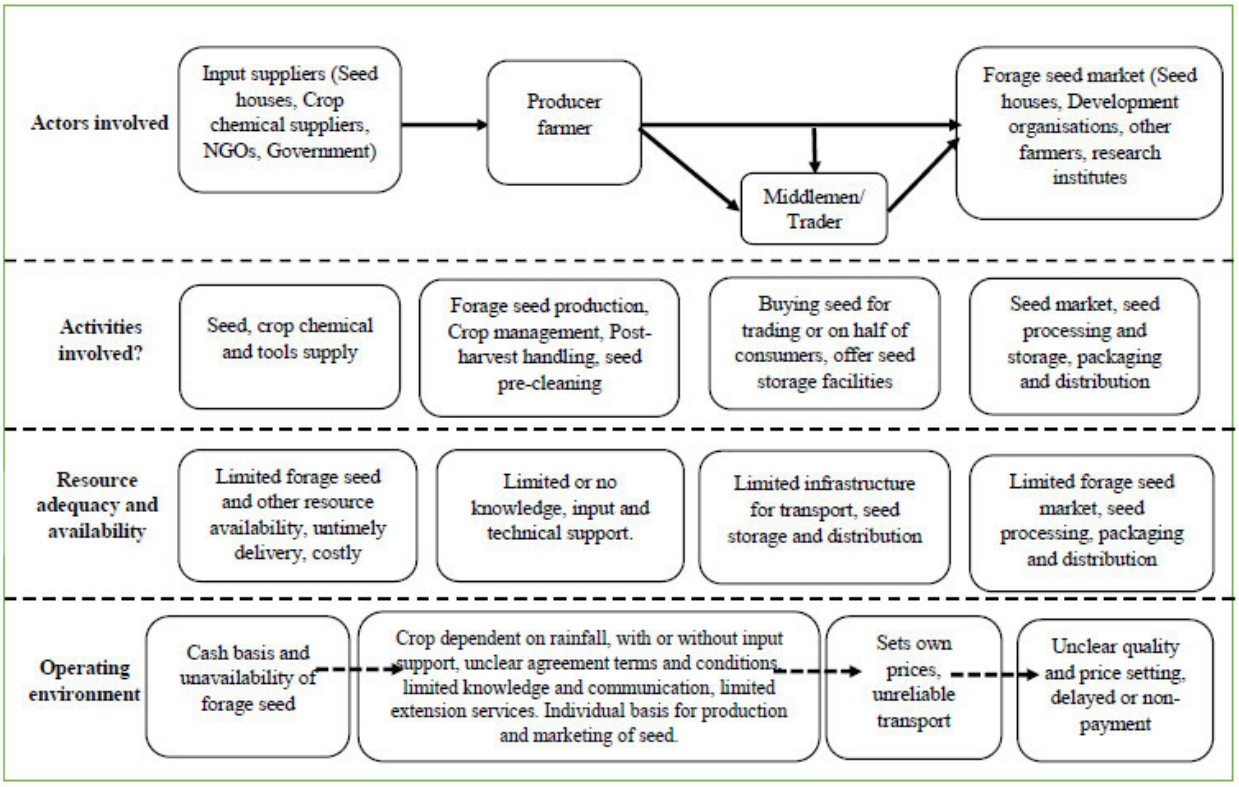


Figure 4.8: Current seed production arrangements in Goromonzi and Murewa districts

There are different types or variations that can occur to contract models and these include informal contracts, to intermediary, then multipartite. The contractual arrangements can change their form depending on circumstances like market prices, quantities and quality required and terms and conditions of the contract. For success to happen at each level causal factors need to be critically examined and those that seem to cause negative change are addressed, even though GIZ, (2013) assumes that changes follow from informal contracts, to intermediary, to multipartite, then to centralised and finally to nucleus state.

4.3.1.2 Production processes

In Zimbabwe, production of forage seed has been through government research institutions, NARES, besides other organisations including the International Centre for Research in Agro forestry (ICRAF), the Dairy Development Program (DDP), development organisations and private seed companies. NARES has focussed on biomass yield of forages and no efforts have been made to involve smallholders in seed production. Most of the improved cultivars have been imported, then screened and evaluated by the NARES for adaptability, disease and pest tolerance, biomass production and utilisation. Seed companies that have ventured into forage seed multiplication and marketing have included seed perceived to be of economic value such as *Sorghum bicolor* (forage sorghum), *Medicago sativa* (lucerne), *Zea mays* (maize) and *Oryza sativa* (oats). These forage crops were produced at the seed companies' research stations as the companies considered it costly to contract farmers to produce. Seed quality was guaranteed through inspections with the assistance of Seed Services, a government institute with the mandate to effect and reinforce seed regulations.

Smallholder farmers in the study area depend on rainfall, which is received between late November and March of each year for agricultural production. This exposes the farmer to risks associated with infrequent and inadequate water for crop production, especially during drought seasons, resulting in crop failure. As farmers take priority in food crop production, they will only venture into forage seed production when land, inputs and if they foresee some benefits from such enterprises.

Farmers use own resources for land preparation and crop management. For those who do not have draught power, they practice conservation agriculture by making basins using hand hoes or hire draught power for a fee. Farmers in the study area plant most crops at the start of the rainy season (November – December period) and maize crop has priority to ensure household food sufficiency. On this forage seed crops are low priority as farmers mentioned that these crops, especially mucuna and lablab are relatively new crops in the area and they would not want to take risks in case the venture fails. Results also indicate that that 71.0 % of the survey households have not been involved in forage production. Of these, 35.0 % were households that were female headed. For those households that have produced forages before, the majority (75.0 %) were male headed.

Crop management involves weeding, pest and disease control, post-harvest handling and storage. Crops that require more labour are not favoured. Forage seed crops that have been taken up since being promoted are cowpea, mucuna and lablab and among these mucuna is perceived as being low on labour requirement.

Labour is mainly sourced from within the household. Results show that about 3 members of the household are available to do work. Farmers hire more people to provide labour only when there is more work to be done.

Seed is harvested when ripe and stored in stacks before threshing and packaging it. Pods of the promoted forages do shatter when left in the open and exposed to heat. Thus farmers leave pods to be heated by the sun to enhance shattering and this helps in the threshing process. Afterwards the seed is stored in bags in the granary together with other crop seeds and grain.

Results from the household survey revealed that farmers are the ones involved in the establishment and management of seed crops at their homesteads. If one enters into a contract, there is an option for receiving inputs or not from the contracting company or organisation and these inputs include fertiliser, crop chemicals, small tools and equipment like knapsack sprayers. These costs will then be recovered by the contracting company or organisation at time of payment for seed sold. These results were also highlighted by participants at FGDs in the study area. Farmers may opt not to receive input support and by this, they are still obliged to sell to the contractor although they have the leeway to sell to other markets of choice even though they were contracted to a certain organisation. Discussions in FGDs revealed that farmers will side market the seed to other lucrative markets offering higher prices and the payment is made on delivery or does not take long.

Most contract arrangement in the study area are organised and operated by seed companies and development organisations. The seed companies contract the seed for multiplication and then certification before selling on the market, whilst development organisations contract for distribution to beneficiaries of projects being implemented in other districts. Before entering into the contract, the contractor (seed company or development organisation) shares a draft contract with terms and conditions and if farmer agrees, then signing of the contract follows.

Farmer-owned businesses had the second highest response rate (24.5 %) following contract farming. Under this arrangement, farmers pull their resources together to the extent that they send their produce to the market together. They highlighted that they only have such arrangement with other farmers whom they trust and have a common understanding. The arrangement can even go to the extent of having an Internal Saving and Lending (ISAL) Club where they contribute an agreed amount every month and members can borrow for specified use and payment terms. These businesses are said to facilitate transactions, negotiations and access to resources.

During household survey and FGDs discussions, joint ventures were also highlighted where farmers enter into joint ownership of the business enterprise. This usually happens with family members where one members is formally employed and has regular income. On the other hand the other member is the one who is on the ground running the business. They agree on terms and sharing of profits. Although the one supervising the activities makes on-sight decisions, the absentee owner also has equal saying on what is happening and decision making in the business.

Percentage responses for out grower schemes and tenant farming were not as common as the other three already mentioned, they had less than 10.0 % responses. Responses showed that when a farmer does require more fields outside his or her homestead, one talks to the one with unutilized fields and the owner of the field can always reclaim it whenever he or she wants.
FGDs also revealed that the terms and conditions of some of these arrangements are not clear, mostly concerning issues to do with the following:-

- Field supervision;
- Seed quality standards required;
- How prices are set and selling price of seed;
- Payment arrangements for seed delivered;
- Buyers not honouring their obligations of buying all seed and not paying for all seed bought;
- Language used in the contract document.

This is beside the fact that farmers are interested in the arrangements and they are assured of a market for their produce, also there is diversification of farming activities and guarding against risks, among other benefits. Farmers accuse contractors of not being transparent when they enter into contracts with them without giving full information on their provisions. At times what is explained to them is not what is referred to in the contract and often there is misinterpretation of the terms and conditions.

4.3.1.3 Trading and marketing

Although from the study, middlemen have not been very prominent, in 3 of the 4 FGDs conducted, it was highlighted that middlemen or commodity brokers sometimes feature in their communities looking for produce for resale at other markets. The commodity brokers or traders move around looking for any produce, including forage seed for resale or for value addition. Participants at FGDs also indicated that in such instances, they do not hesitate to sell to these middlemen since they pay cash on delivery of the

produce, irrespective of whether it is a fair deal or not. This usually happens when farmers are in dire need of cash to pay for goods and services rendered.

Major types of markets that are in the study area for forage seed and are associated with contract farming include seed companies and development organisations. These organisations buy seed from farmers after harvesting and seed is then cleaned. The prices are mainly determined by the buyers and farmers do not have much say on this. Farmers also have experience in being contracted for other crop seeds besides forages. However farmers have also witnessed instances where contractors have disappeared soon after collecting produce or farmers have delivered to the organisation's collection point. Farmers are then not paid or they are paid prices that were not agreed at the signing of the contract. On the other hand, from KIIs involving seed companies and development organisations, they highlighted that quality of seed produced is poor and does not warrant buying at high prices as the organisations will make losses when they sell to other consumers. Farmers complained of lack of effective communication between the buyers of seed and themselves.

Some companies have not been trustworthy as after collecting all produce they fail to pay farmers. Therefore, more innovative and adaptable schemes need to be developed that are relevant to smallholder farmer conditions. There is need for policies on contracts to be put in place that will create a conducive environment that will protect the smallholder farmers from abuse by companies. Simultaneously the models need to address high default rates by the farmers, as side marketing has become the norm under contracted production. This has led to the private sector introducing a bit more stringent measures that can sometimes affect the entry level for the smallholder farmers. Also forage seed need to be included in cropping programs by farmers so that farmers can diversify their farming activities and spread risk. NGOs usually promote models that involve providing technical assistance and improving market linkages. However, farmer organisations offer opportunities for collective marketing (even to high value markets), negotiating better prices and have the capacity to advocate for better services.

Different views have given on the benefits of contract farming to smallholder farmers even though the practice is widespread in Africa and other developing countries (Odunze, van Niekerk and Ndlovu, 2014; Parirenyatwa and Mago, 2014). Farmers can benefit by having access to both local and international markets through contract farming (Schipmann and Qaim, 2011). This is besides other authors' view that contract farming is ripping off farmers, especially by large companies who have higher bargaining power (Singh, 2002).

There are smallholder farmers who are into seed production already and are selling informally to other farmers within and outside their communities. A seed company got interested in buying some of the forage seed for the export market. Thus farmers agreed to enter into contracts with the seed company. The seed company provided forage seed and in exceptional cases, offered fertilisers on credit. Farmers were excited with this arrangement as they indicated that the forage market was assured. The value of the inputs advanced would then be deducted from the gross income that the farmer was supposed to be paid by the seed company.

4.3.1.4 Discussions on forage seed value chains with farmers

Four FGDs were conducted using the FGD guide and responses were captured, coded and analysed using a software package NVivo 10. The software package was used in order to explain perception and any reasoning on forage seed production and marketing. Word cloud (Figure 4.9) and word tree (Figure 4.10) were used to analyse responses on forage seed value chains. Word cloud explains through frequencies that a word is mentioned. Word cloud is used to rank word responses from group discussions and interviews and the more the word is mentioned or appears during the discussions, the larger it becomes on the word cloud and the more important that word is. Word tree also indicates the most prominent words and there are more words linked to the prominent word which indicate relationships on themes and subject matter. These visual representations assist to explain through identification of common and prominent words and communicate important points and themes. An analysis of FGDs conducted, revealed that farmers and forages were mentioned quite often during discussions (Figure 4.9).

These words were the most prominent words mentioned, which might imply that they are also important in the study area. Other words that featured were organisation, production; smallholder and business which are important word for the study. Farmers were indicating that they were interested in venturing into the business of producing forage if there was money at the end of the day and being organised in groups would be beneficial. Other important words highlighted during discussions included extension engagement, challenges associated with forage seed production and training of farmers that is required to capacitate them. Also the word tree was produced to explain the importance of forage as the central word in the tree together with related branch network (Figure 4.10). Seed was a branch of forage and produced more other branches.

Despite the importance and value created on use of word cloud, it has its shortfalls. It is believed that the use of word cloud can potentially distract the researcher from identifying and understanding the major themes from the study. Therefore, it is prudent that it is used with care and findings viewed with analytic lenses (Sandfort, and Quick, 2017).

Figure 4.9: Word cloud for forage seed production and marketing. **Source**: Developed from study results by researcher

On the word tree, the word forage is very prominent and has many other sub-branches on seed, production and business. All these sub-branches explain the link and associative subjects that forage has. On the left side of the word forage, there are issues to do with the forage processes, factors affecting and creating competitiveness, what, how and when among others. They are variables and responses concerning forages. On the right side, there are more branches with defined sub-branches that create themes such as seed and seed production, seed business, knowledge on forage seed and seed quality. All these words on the word tree highlight themes and words one should consider when venturing into forage seed production and marketing. Just like the word cloud, the tree word also needs to be interpreted as output only indicates what was mentioned. In the study, this was then followed with explanations from discussions with group participants.

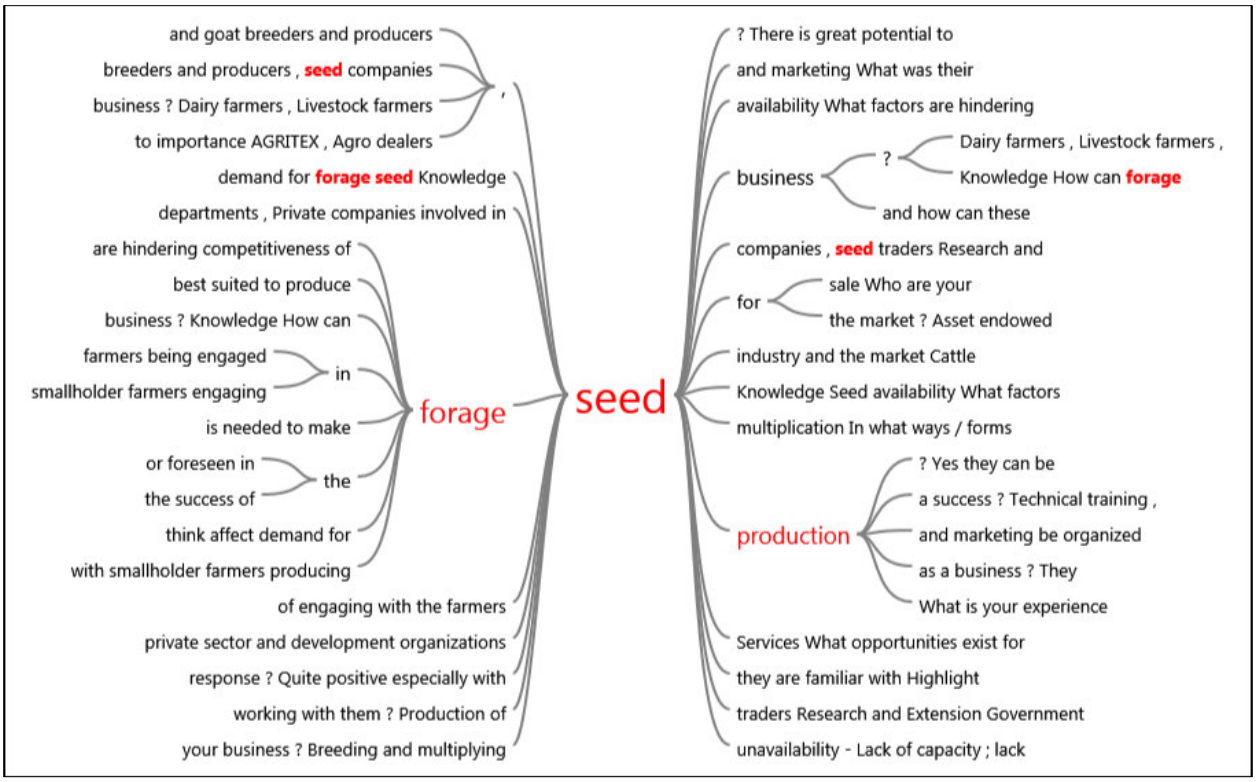


Figure 4.10: Word tree for forage seed. **Source**: Developed from research results by researcher

4.3.1.5 Forage seed value chain for Goromonzi and Murewa

The forage seed production process, which used to be conducted by seed companies and NARES, is no longer happening although demand for seed is increasing.

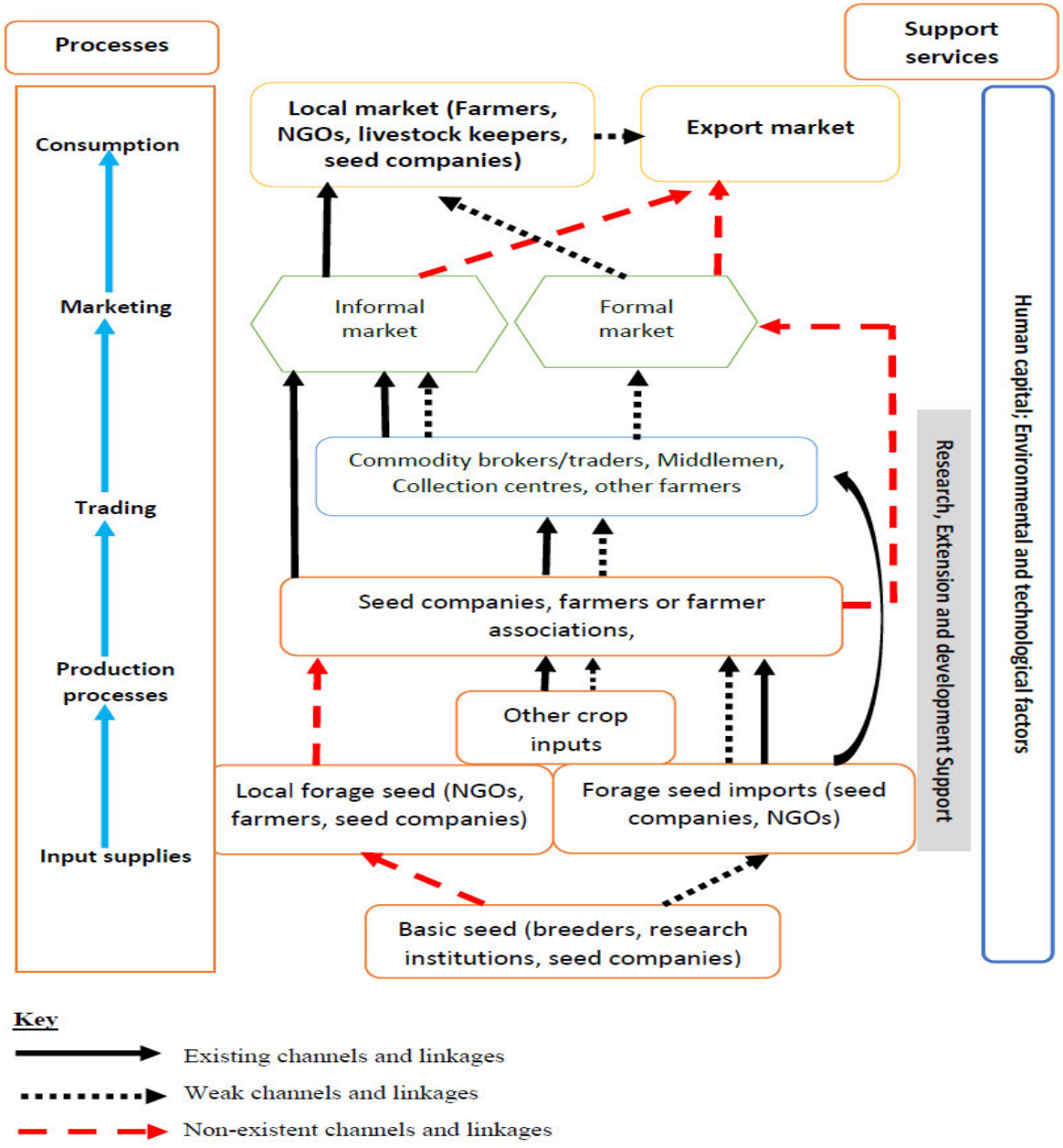


Figure 4.11: Forage seed value chain map of Goromonzi and Murewa. **Source:** Own sketch based on survey results and discussions

Existing channels and linkages are between farmers themselves, farmers and seed houses or traders, farmers and NGOs, and farmers and NARES. At the same time, other linkages are not well pronounced or established. The value map also shows some non-existent linkages between seed breeders and farmers, farmers and seed houses, farmers and the market. This is because of lack of adequate information and adequate knowledge on what is involved by the farmers. Without the information, one cannot share

anything with others and this includes extension staffs that are always on the ground with the farmers. The current forage seed value chain for Goromonzi and Murewa is indicated in Figure 4.11.

These channels and linkages involve how the value chain actors are connected to the various processes and to other actors, what information or knowledge is shared amongst them, using what mode of communication and to what extent the linkages stretch. Also the different level that are used for communication and what effect they have on decision making within and outside the value chain actors' sphere of influence. Informal seed system is very much pronounced for farmers to access and market seeds to other farmers and to NGOs. This now requires the participation of smallholder farmers in forage seed production. This also implies the importance of the informal seed system in seed security especially for smallholder farmers (Ravinder, Sujathamma, Vishnuvardhan, Ranga and Srinivas, 2015).

Farmers have been using the informal seed system since time immemorial, mainly to meet food security. This mainly involved planting of preferred food crop seeds, harvesting of selected seed heads or grain and saving it as seed for planting in the next planting season. The importance of this system within the smallholder sector cannot be overemphasised and has been documented (McGuire, 2005). It has advantages that include, assurance of seed availability to most farmers, broader accessibility by a large number of farmers within and beyond the community, mostly the underprivileged, affordable (even sharing of seed among farmers). Export of forage seed is virtually non-existent and the type of production and marketing channels also determine possibilities of any export market. In this study it was revealed that farmers just produce for local consumption as no one has attempted to look for export market for forage seed.

4.3.2 Livestock Production System

Livestock species are dominated by cattle, goats, poultry, sheep and pigs and the purpose of keeping these include draught power and milk (cattle only), manure and meat. Among ruminants, cattle and goats are the most widely kept livestock, then followed by sheep. Results indicated that respondents own poultry more than any other type of livestock and at least an oxen, a cow and goats (Table 4.4). Other poultry species were ducks, guinea-fowls and turkeys. On average, a household has 5 cattle, 4 goats, 75 poultry, 1 pig and no sheep. Livestock ownership is a sign of status within the community and is an asset which can be exchanged at any time when need arises and these are in agreement with Beshir (2013).

Table 4.4: Livestock ownership per household

Livestock type and class	Mean value	Std. Deviation
Bulls	0.25	±0.52
Oxen	1.38	±6.77
Steers	0.34	±0.77
Cows	1.63	±2.98
Heifers	0.71	±1.19
Calves	0.61	±2.29
Goat-buck	0.64	±1.88
Goat-doe	2.20	±13.76
Goat-kid	0.80	±2.48
Poultry – indigenous	15.53	±29.89
Poultry – Broiler	52.38	±386.01
Poultry – layers	6.12	±23.76
Poultry – other	0.63	±4.96
Pigs	0.81	±6.29
Sheep	0.30	±4.10

Figure 4.12 shows the average number of ruminant livestock per household over the last three years. Not every household has a bull. For breeding, cows and heifers are served by bulls owned by other households within the community. Owning livestock by smallholder farmers indicates wealth. Livestock have various roles within the household and they act as a source of wealth, manure, draught power, food within the household. They can be exchanged for cash or used as form of payment for good and services (including medical and school fees). Therefore, it is important that households have livestock as part of the farming activities.

Farmers are not used to cattle fattening for the market and livestock depend on grazing for the bulk of the feed which is in short supply especially during the dry season. Farmers consider livestock feed to be expensive and beyond their reach, leaving the livestock to survive on their own, besides low quality crop residues. Ruminants depend on natural grazing for the bulk of the feed supply (Topps and Oliver, 1993; Njarui, Gichangi, Gatheru, Nyambati, Ondiko, Njunie, Ndungu-Magiroi, Kiiya, Kute and Ayako, 2016). This is in the communal grazing areas where all ruminants graze and it is common land accessible to all livestock within the community. There is limited supplementary feeding that is practised by farmers.

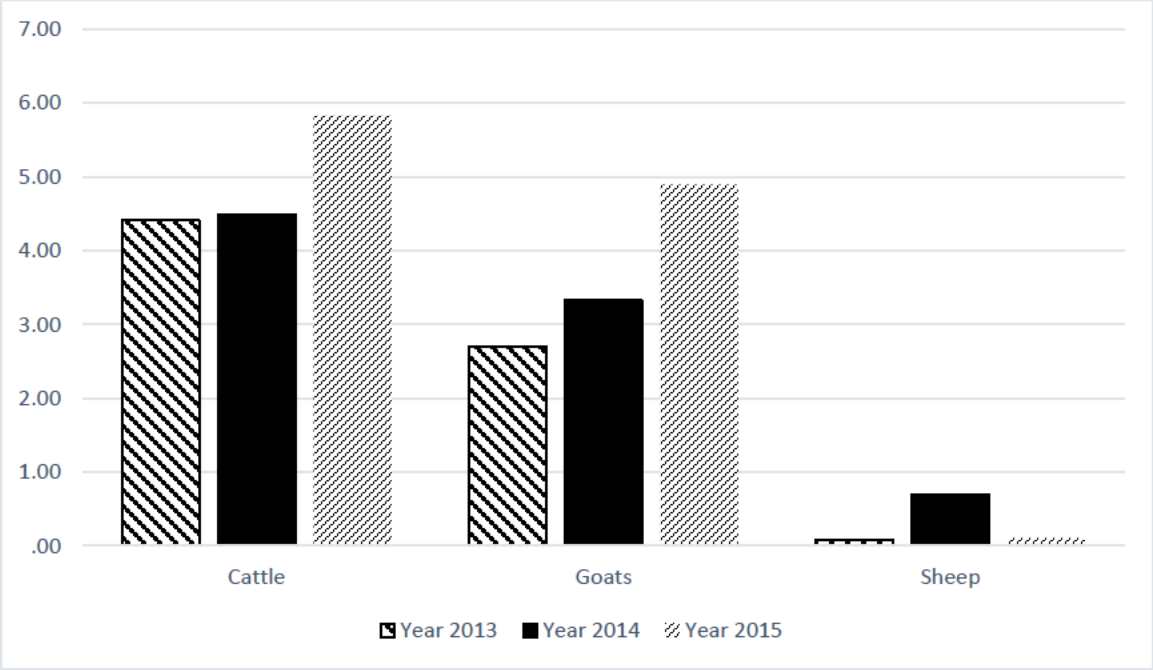


Figure 4.12: Ruminant livestock numbers per household

Adequate cattle feed is mostly available between January and June/July, whilst the other months, animals survive on dry unpalatable grass, if available at all (Figure 4.13). Throughout the year, grass is available although the quantity and nutritional quality differs. Other authors in prior studies highlighted that crude protein also declines, from as high as 12.0-15.0 % in early summer to about 2.0 % during the dry months (Topps and Oliver, 1993) and this is typical of the sites studied.

The study revealed that the major component of the feed is grass followed by crop residues which consists mainly of maize stover. Bought in feeds such as beef and dairy, concentrates constitute a small proportion as farmers are not in the practice of buying supplementary feed their livestock. They indicated that concentrates are too costly, beyond their During the dry season, cattle and goats survive on poor quality pasture from the common grazing lands and crop residues, resulting in deterioration in body condition. The critical months of feed shortages are September to November. Dry season feeds comprise mainly of crop residues (cereal and legume stover, dry grass, sweet potato vines, waste from horticulture. Supplementation of cattle is usually done using commercial feed although costs are beyond their reach.

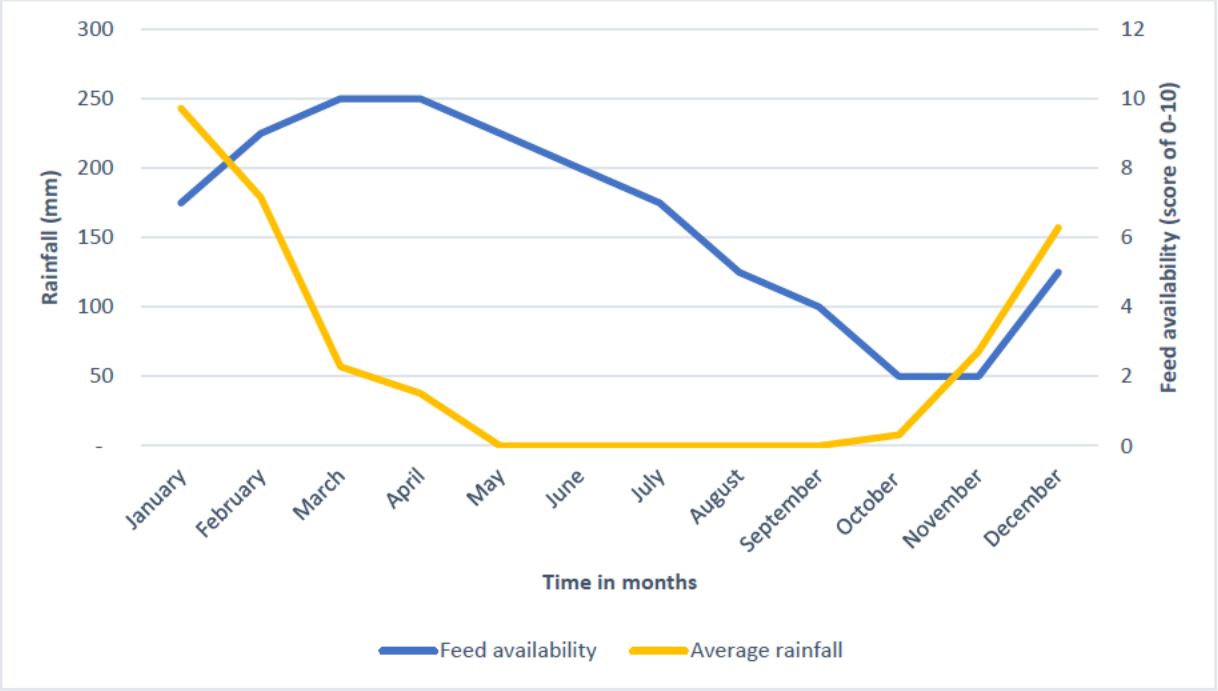


Figure 4.13: Feed availability in relation to rainfall received in Goromonzi and Murewa

4.3.3 Major income sources

Results indicated that sources of income included agricultural activities (cropping, livestock and horticulture), formal employment and other sources (remittances and off-farm activities). The highest income was generated from crops, contributing 44.6 %, followed by off-farm activities (26.2 %), livestock sales (13.4 %), employment (11.2 %), with the least being forage seed sales (0.3 %). Main crops sold include maize, groundnut and to a lesser extent soya bean and sweet potatoes. Horticultural produce also contributes to crop sales in the form of tomatoes, onions and other vegetables. Off farm activities included casual labour and selling of wild fruits, and other income included benefits such as disbursements from Social Welfare services and cash transfers. Over the past three seasons, farmers had not generated significant income from forage seed sales as the forage technology was being introduced in the area and seed was used to increase area under production (Table 4.5). Revenue from mucuna seed was realised through livestock sales as the seed was included in livestock feed rations. Cattle fed mucuna based diet for 56 days gain between 0.6 kg and 1.0 kg live weight animal^{-1} day^{-1} in Goromonzi district (Chakoma *et al.*, 2016).

Table 4.5: Total annual income (US$) generated from different activities from 2013 to 2015

Income source	**2013**	**2014**	**2015**	**Average Income generated**	**% contribution**
Crop sales	702	637	683	674	44.6
Forage seed sales	5	8	0	4	0.3
Livestock sales	260	261	88	203	13.4
Off farm activities	352	391	445	396	26.2
Formal employment	143	171	191	169	11.2
Remittances	40	43	47	43	2.9
Other income	21	33	14	23	1.5
Total annual income (US$)	**1,523**	**1,544**	**1,468**	**1,512**	
Average income month^{-1}	**127**	**129**	**122**	**126**	

4.3.4 Gender issues and forage seed value chains

From the household survey and FGDs conducted, the study revealed that men and women are responsible for activities of certain field crops and livestock within the household. For maize, which is the staple food and priority crop, both men and women do the crop management, except for land preparation, spraying and marketing where only men are involved. Women have difficulties with the heavy equipment that is used for land preparation (ploughs and direct seeders or ox-drawn planters) and when spraying using the knapsack sprayer which they consider heavy. The study also revealed that marketing of crops is mostly done by women, who are then assured of food security within the household before selling any excesses.

Both men and women consult each other and make joint decisions on cropping, except for groundnut where women decide on their own. Groundnut is perceived a women's crop and men are mainly involved in land preparation and spraying if there is a need. However the crop is a priority as it meets household needs for peanut butter when processed and cash income from sale of raw peanuts and peanut butter. These findings

show a high involvement of both men and women in agricultural activities, which is required for sustainable production and creates opportunities for forage seed production within such environments (Table 4.6).

Table 4.6: Gender roles and decision making for field crops

	Men and women's roles for field crops			**Men and women's decision making on field crop**		
Activity	**Maize**	**Groundnut**	**Cowpea**	**Maize**	**Groundnut**	**Cowpea**
Field selection	-	-	-	B	W	B
Land preparation	M	M	M	M	B	M
Planting	B	W	W	B	B	B
Fertiliser application	B	W	W	B	W	B
Weeding	B	W	W	B	W	B
Spraying	M	M	B	M	W	B
Harvesting and threshing	B	W	W	B	W	B
Marketing	W	W	W	B	W	B
Sourcing of inputs	M	W	B	B	W	B

M=men; W=women; B=both men and women

Men are involved in every activity on livestock production compared to women. On cattle, responsibilities are shared on feeding and milking. Women participate in herding and marketing of goats, feeding of all livestock and all other activities where poultry is involved. Marketing of cattle and small stock is male dominated. Table 4.7 shows that marketing of cattle and goats is the responsibility of men, whilst women participate in marketing of poultry and pigs although they are not involved in the sourcing of inputs for pigs. Women argued that this idea of men being involved in marketing and sourcing of inputs, compromises expenditure priorities as some income is diverted to non-essentials for the household. There is no herding of poultry and pigs, also no milking involved for goats, sheep, poultry and pigs. Discussions in focus group discussions also revealed that women have access to livestock like cattle but do not have decision making

powers when it comes to buying the stock or selling and this compromises any improvement initiatives. Such livestock are considered men's property and women become just custodians, except where women are heads of households (Quisumbing, Rubin, Manfre, Waithanji, van den Bold, Olney, Johnson and Meinzen-Dick, 2015).

Table 4.7: Gender roles for livestock activities

	Livestock species and gender roles			
Activity	**Cattle**	**Goats & sheep**	**Poultry**	**Pigs**
Herding	M	B	-	-
Feeding	B	B	B	B
Milking	B	-	-	-
Treating sick animals	M	M	B	M
Marketing/buying	M	M	B	B
Sourcing of inputs	M	B	B	M

M=men; W=women; B= both men and women; -=no gender role involved

The design and implementation of development in agriculture needs to recognize support for gender equality, especially when there is evidence to show that women can be very productive if they have access to assets and other required resources (Rubin and Manfre, 2014). In most cases, social contexts define roles and responsibilities for men and women, who to interact with and how assets and benefits are distributed.

Efforts to promote production of crops and livestock for a niche market have the potential to transform how men and women relate, behaviour and cultural practices change, coupled with creating awareness and support for gender equity in value chains (Rubin and Manfre, 2014). Training and support of farmer group organisations have positive benefits for women who participate in value chains and this promotes gender equity. Unfortunately a few studies have been conducted on the effects of assets distribution on gender equity and the impact on agricultural interventions. For agriculture production to improve, there is need to close the gender gap and let women have more access to resources. Value chain approaches need to take into consideration the participation of women in order to have positive impact on production. There is need

for effective and efficient agricultural policy frameworks and programs that will contribute to the investment and socio-economic development at local, national, regional and international level. This is because an understanding of women's participation in value chain development activities and what roles and responsibilities they have can have some impacts on their livelihoods.

4.4 Chapter summary

Results indicated that land size, asset ownership, tropical livestock units, sources of income and household labour size have a significant effect on the adoption of technologies. Other significant factors were farming experience and membership to a farmer organisation. Membership to an organisation had the chance to increase adoption and access to information, coupled with asset ownership in the form of mobile phones and access to extension services. The more livestock a farmer has, the more likely they adopt forage seed technologies as there will be need to produce feed for the livestock at low cost.

This study has revealed smallholder farmers in Goromonzi and Murewa are involved in both crops and livestock farming activities. These activities are important for the farmers as they derive various benefits from them including household food security and wealth status. Manure and draught power, pay for goods and services, and farmers generate income from the products. Farmers' level of education enables them to understand the need and importance for forages and to diversify farming activities. However, forage seed is scarce and there is need to develop interventions that enable farmers to access seed and generate income from sales. As farmers gain knowledge and acquire more assets, they will eventually increase production and participate in markets. More awareness has to be done to improve women's access to assets, decision making and participation in value chains.

Farmers are involved in both formal and informal seed systems especially when they access seed of their preferred crops. Major crops are grown for household consumption, only when there is excess can they sell. There is a feed gap during the dry season and interventions need to be developed that make up for livestock fodder. Livestock production is not for business purposes although if the practice is promoted, it will create demand for forage seed that will be used to produce the fodder for livestock. The concept of forage seed production requires demand-pull from the livestock sector, training and support on management practices of forage crops and market availability of forage seed.

Gender issues were also been discussed as they affect the different roles done by men and women within the household. This will in turn affect adoption of forage seed interventions. It is important to understand how gender issues are handled within a community so as to introduce relevant and adoptable innovations. FGDs also played a big role in triangulating what household survey revealed. These discussions were quite informative and enlightening especially considering that the aspect of forage seed business among smallholder farmers is a relatively new area. Smallholder farmers are used to practising field crop production for their own use and in most cases use indigenous knowledge to collect and store seed.

Based on focus group discussions and key informant interviews, business arrangements were identified to be suitable for forage seed value chains contract farming, farmer-owned business, joint ventures, out grower schemes and tenant farming. For individual households, those who had been involved in some form of arrangement to produce a crop for a company also highlighted the possibility of contract farming for forage seed production.

CHAPTER 5: RESEARCH FINDINGS ON OBJECTIVE 2

5.1 Introduction

Before developing strategies to improve and enhance production and marketing of forage seed within smallholder systems, it is important to understand challenges that are faced by the farmers in that respect. The chapter identifies the underlying challenges to forage seed production in the smallholder system and tries to explore opportunities that exist along the forage seed value chain in Zimbabwe. Primary data was collected through a household survey using a structured questionnaire, FGDs and KIIs. Secondary data was through reports from seed companies, Ministry of Agriculture and NARES reports, and livestock industry reports. Constraints that were identified through the household survey and FGDs directly relate to the smallholder farmers and their participation therein. Also included were other constraints that relate to the effectiveness and efficient functioning of the seed value chain.

5.2 Results and discussion

5.2.1 Challenges and opportunities in forage seed value chain

Smallholder farmers in the study area find it very difficult and challenging to actively participate in markets, including local markets. Results highlight that this is a result of several factors that include the limited availability of forage seed, other inputs which may be available but beyond their reach because of high costs; limited knowledge on forage seed production and marketing; unavailability of market for forage seed; limited access to resources such as land, labour and capital; unfavourable prices offered at the market and limited access to information on markets; limited resources for service providers such as extension staff; and unavailability of irrigation facilities. This is beside the fact that it has been noted (von Loeper, Musango, Brent and Drimie, 2016) that smallholder farmers could have the potential to increase food security in developing countries. They also suggest that to achieve this, there is need to develop relevant financial packages that attract and motivate players along the value chain to engage with and support smallholder farmers. These factors highlighted by the farmers are intertwined and are a result of other factors which are beyond the influence of the smallholder farmers, thus creating a complex system of challenges. Figure 5.1 below shows the complexities that smallholder farmers in the study area have to deal with in their endeavour to venture into forage seed business.

In looking at the business model, aspects looked at include contractual agreements, production practices, communication and knowledge exchange, market structure, access to resources, stakeholder engagement among the factors, clientele base, cost and pricing structures (Figure 5.1). Key partners are also important along the value chain and they include extension staff who offer technical advice and other information on general farming. These form key partners and in most cases they reside within the wards and are accessible to farmers. Local authorities are the District Administrators and Rural District Council (councillors, Chiefs, Headmen and village Heads) who have the mandate to oversee what happens within the communities and their welfare, including the observance of cultural norms. All other partners work within communities with the guidance of the local authorities.

The forage seed business is a niche segment of the market, thus it requires special attention and consideration for its success. It is also a high risk venture for most smallholder farmers due to high costs involved, limited expertise on production and marketing, underdeveloped forage markets. Costs associated with production and transactions have to be taken into account when considering venturing into the forage seed business as these have a significant effect on profitability. In developing countries, seed business depends on government research institutions for supply and this affects supply and availability of varieties including forages (Husmann, 2015).The major challenges encountered in forage seed supply are summarised in Table 5.1.

Table 5.1: Major challenges in forage seed supply

Challenges	**Frequency**	**%**
Seed unavailability	15.3	31.2
Lack of production knowledge	8	16.7
Lack of market	7	14.6
Land shortage	6.3	13.1
Unfavourable prices	4.5	9.4
Labour constraints	4.3	8.9
Lack of marketing knowledge	4	8.3
Total	**48**	**100**

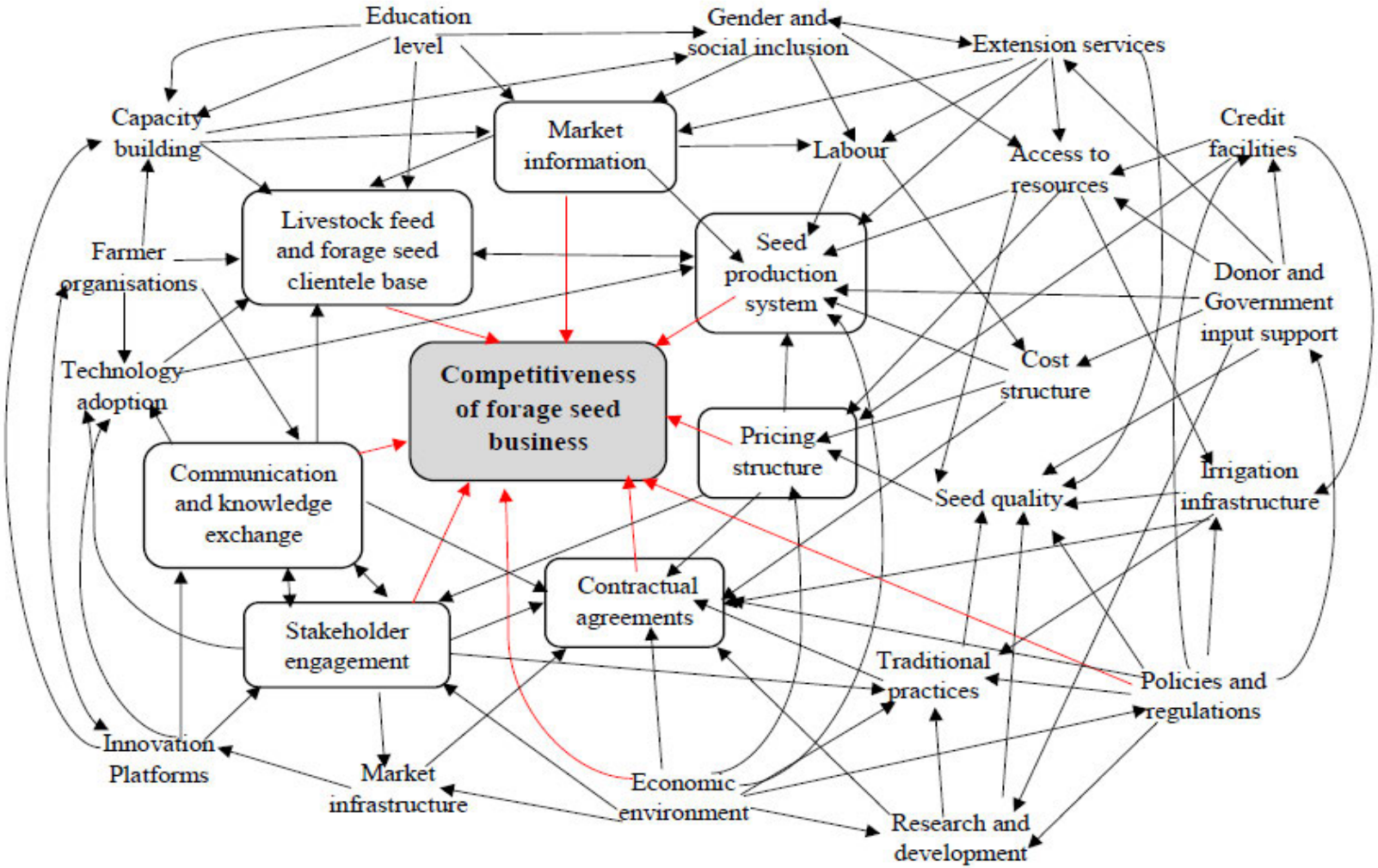


Figure 5.1.Complexities in forage seed production and marketing. **Source:** Researcher from study results

The challenges and opportunities highlighted in this chapter were expressed by the various players of the forage seed value chain. These include input suppliers, farmer producers and other market players who were Key Informants. A summary of challenges faced by farmers which were revealed during household surveys and FGDs.

5.2.1.1 Land availability

As highlighted earlier, 63.0 % of the land is allocated to crop production and priority is given to food crop production. Some 13.1 % of respondents indicated that there is shortage of land for forage seed production, and forage seed production will be conducted on left over land if it is ever available. There is evidence that there is rising population pressure in the rural areas and this is having a negative effect on farming systems (Jayne, Chamberlin and Headey, 2014). Therefore land has to be managed properly to keep it productive.

5.2.1.2 Seed and other inputs' supply

From the study, results indicated that farmers face some challenges in forage seed production. Seed is the start of plant life and to maintain genetic purity, quality seed has to be accessed (Alemu, 2012; Munyaka *et al*., 2015; Welu, 2015). A total of 31.2 % indicated unavailability of forage seed to enable them to venture into forage and seed production. This is besides the fact that 16.4 % of respondents indicated that they lack the knowledge of forage seed production. Also 9.4 % of respondents revealed that forage seed had unfavourable prices even if it was available. The development of a functional and efficient seed supply is important to enable input choices on seed and its adoption in the farming systems (Welu, 2015). To improve on this, breeders need to develop better yielding and well adapted varieties which will then be multiplied by seed companies for sale to the farmers.

About 8.9 % of respondents highlighted that labour availability was a challenge on forage seed enterprises. In the study area, maize production is a priority coupled with the fact that forage seeds are planted and harvested at the same time as maize. Gender roles also come into play as it was revealed that women do most of the work in the field and women attend to household chores.

Discussions during FGDs revealed that local seed companies have not been involved in forage seed production as they view it as an uneconomic business. This was further confirmed during interviews with Key Informants. These revelations are in agreement with Mapiye *et al*. (2006), Olawale and Tontsa (2015)

and Welu (2015) that farmers face challenges in accessing seed as a result of unavailability, unaffordable prices and lack of knowledge among other factors. They indicated that with the current economic environment and recurrent droughts, seed companies are obliged to produce food crop seeds as opposed to forage seed. In as much as other inputs are available, without quality seed, no successful forage production venture will materialize. In such scenarios, adoption is jeopardized and adoption levels fall. The unaffordability also applies to other crop inputs that include fertilisers, chemicals for weed, pest and disease control, inoculant and any other seed dressing. Farmers end up growing their crops without applying any basal or top dressing fertilisers on soils that are known to be inherently poor (Thompson and Purves, 1978; Nyamapfene, 1981), especially in Goromonzi and Murewa.

Not much research has been conducted on how smallholder farmers cope with the input supply markets and how sustainable they are for their environments (Bindu and Chigusiwa, 2013; Mutambara, 2016). This has led to the misunderstanding of the participation of smallholder farmers in input, output financial and other markets. In most cases, farmers participate as producers or consumers of market products. In other countries, these markets have contributed to poverty reduction and have helped sustain agricultural production (DFID, 2012). Development agencies have therefore developed interest to try and identify and address challenges currently preventing the development of agricultural input supply among smallholder farmers, especially in Africa (DFID, 2012; Magombeyi *et al*., 2012). In Africa, it is also viewed that agricultural markets do not develop due to inefficiencies within the system and this results in high market failures and smallholder farmers incur high transaction costs in order to access these markets.

Underdeveloped input supply and marketing has a significant impact on farmers' choices of inputs and technologies to adopt (Shiferaw and You, 2008). This also relates to forages, that when inputs are available, including seed, then farmers can easily adopt and start producing seed. If input prices are beyond the reach of farmers for items such as seed, farmers will not buy, resulting in non-use of these inputs. However, for smallholder farmers, input markets are sometimes missing, besides other resources such as labour, credit and output market, to support agricultural production, thus making it difficult for the farmers. Besides the issue of seed and other crop inputs, farmers also need knowledge, both on seed production, market prices and availability for them to be able to embark on and adopt new technologies. Opportunities arise in seed supply as there is demand for forages seed for the production of livestock feed. Also the growth in demand for livestock and livestock products creates avenues that can be explored in order to fulfill the gap of feed shortages.

Noted from the study is that there are arrangements existing such as contracts which offer inputs to farmers with the agreement that they will buy the product from farmers. However farmers feel these contractors buy products at lower prices or they disappear when time comes to buy products. Also they feel contracts suit contractors, not the farmers who would not have been involved in the drafting of their terms and conditions. On the other hand, contractors view smallholder farmers as untrustworthy, and incapable of honouring contracts. They accuse farmers of side marketing products when they will have agreed to terms and conditions in the initial instance, including on prices.

5.2.1.3 Production

Results indicate that the average land size that is arable is 1.4 ha, of which about 41.0 % is put to the main food crop, maize as shown in Table 4.2. The respondents also highlighted that land size has continued to decrease as land is being partitioned for human settlements, including grazing land and this is very significant in the study sites as more than 20.0 % of the land has been put to fodder production.

There is also limited knowledge on production of forages amongst the farmers. Training improves the level of understanding farmers have on agricultural practices and this improves production. Training has been seen to involve acquiring knowledge, information and skills and this leads to the development of attributes, behaviours and attitudes that increase output and competences. It is believed that in training, both the trainee and trainer should have a positive attitude towards the training itself so that they both get positive results and impacts from the training (Tsado, Ojo and Ajayi, 2014). Thus a conducive environment needs to be created that enables full participation of farmers and effective delivery of knowledge and information by the trainer.

Seed production requires technical knowhow and this aspect is limited among farmers in Goromonzi and Murewa, as evidenced by a response of 16.5 %. This relates to knowledge on management practices including selection of appropriate forage species suitable for the area and purpose, site selection, planting, fertiliser and chemical application and seed harvesting. Welu (2015) asserts that farmer organisations and training centres can play a big role in imparting knowledge to farmers. Women are usually ignored in communities and their inclusion in training in agricultural activities enhances their participation and resultant incomes within the household (Oumer, Tiruneh and Tizale, 2014). Participation of women in agricultural trainings gives positive results in improving livelihoods (Adétonah, Coulibaly, Ahoyo, Sessou, Dembélé, Huat, *et al.*, 2015; Pierce Colfer, Achdiawan, Roshetko, Mulyoutame, Yulian, *et al.*, 2015).

Farmers in Goromonzi and Murewa were producing forages for livestock feed, with some producing forage seed. Maize and groundnuts were the main field crops meant to meet household food security and only sold when there was excess. Maize stover was used for livestock feed whereas groundnut stover was put in kraal pens to increase manure quantities. Unavailability of forage seed, limited knowledge and lack of market for forage seed are among the factors limiting forage seed production.

Of the forage crops introduced in the area, farmers have expressed that mucuna is difficult to process. The dry pods are very hard and have itchy hairs (Kavitha and Thangamani, 2014). During processing, such that those with sensitive skin need to wear protective clothing. The best way to go round the constraint is to leave harvested pods in the sun so that they will shatter. One will need only to winnow the empty pods and chuff away.

Forage seed production involves a series of field activities that include land preparation, field management practices, harvesting, threshing and seed cleaning (Figure 5.2). The major challenge to increase forage seed production is limited access to quality seed of suitable and adaptable varieties, which results in yield reduction, food availability and lower farmers' incomes. Once seed is available together with other inputs, what follows is planting and crop management to ensure a good crop which is free from weeds, diseases and pests.

Good quality seed should be ensured so that it germinates, and is free of diseases and pests. The majority of the smallholder farmers are accessing seed of the few forage types available through NGOs. Other farmers end up sourcing seed from fellow farmers within the community as the forage seed is not available from the formal market (Poudel, Sthapit and Shrestha, 2015).

In seed production, once seed breeders develop new seed varieties, there is need to multiply the seed, certify it so that it can be accessible to other farmers who want to try it out in their fields. From a single seed, comes a single plant which will bear more seeds and from there, there is seed multiplication. Thus in many national seed systems, if seed production standards and procedures are not in place, there will be no progress in the advancement and availing of quality seed at the required time and in adequate quantities. In national seed systems, where there are many challenges outside the seed systems, they are faced with many bottlenecks in seed production interventions (Ravinder *et al.*, 2007).

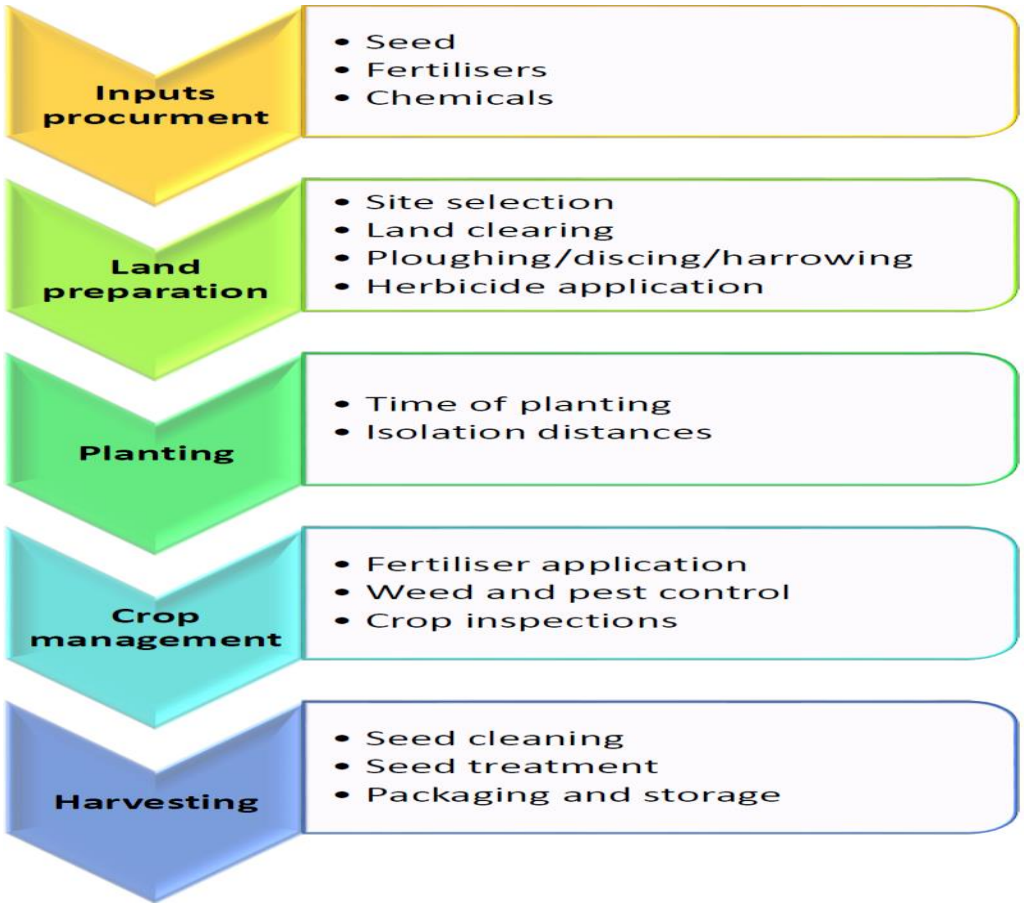


Figure 5.2: Farm level forage seed production processes. Source: Developed by researcher

Seed production also calls for the support of extension staff who are not familiar with the crops being promoted. Effective extension service is important in ensuring success in seed production initiatives (Welu, 2015). From the study, it was revealed that extension services exist and they are the main sources of information although coverage by extension staff is limited. Extension service lacks adequate resources to effectively offer their support to farmers. Extension service can have the knowledge but without the means to share that knowledge with farmers, there is no service delivery. Training of farmers by extension staff has been found to be effective in the adoption of technologies (Tsado, Ojo and Ajayi, 2014).

Farmers also highlighted the challenge they face with lablab seed production. They mentioned that the crop requires particular attention on pest and disease control. The crop is easily attacked by sap sucking pests on leaves during the vegetative stage, at flowering and at pod development stage. To this end, they requested that pasture seed breeders should consider breeding varieties that are resistant to insect and pest damage.

5.2.1.4 Trading and marketing

The study revealed that there is no clear market for forage seeds, whether on the formal or informal markets. This is besides the fact that markets exist for major field crops such as maize, groundnuts, cowpeas and these include the Grain Marketing Board (GMB), open markets in nearby Harare and Marondera, and farmer to farmer within the communities. Of the total respondents on constraints, 14.6 % mentioned that there is no market for forage seed (Table 5.1), whilst the rest had knowledge of seed companies being a formal market for such seed. The prices that are offered at the market are too low for the enterprise to be viable. Mucuna and lablab are sold at US$1.00 kg^{-1} and US$3.00 kg^{-1} respectively. Unlike the field crops, forages are less preferred than food crops at the market as buyers do not see any use for them.

It is believed that many farmers in Africa source their seed from previous season's savings, seed exchanges with other farmers, selection from own crop and grain crop, which is mainly the informal sector (Welu, 2015). Other farmers access seed through payment after providing casual labour to those with seed, whilst others do barter trade (Chakoma *et al.*, 2016). This has been seen to contribute almost 90.0-100.0 % of the seed supply among the farmers, although this depends on crop type. Even though the informal system has proved to be sustainable in a way, it has been rarely supported both technically and financially, which is not the case with the formal system.

It is important to note that the support that is given to farmers' practices in seed production practices and subsequent formation of community seed banks is instrumental to preservation of agro-biodiversity. The informal system is the source of forage seed supply in Zimbabwe, farmers share amongst themselves and NGOs are now into distribution of forage seed to farmers (CIAT, CRS, World Vision, Care, AGRITEX and CIMMYT, 2009). Some of the seed is not good quality and this affects farmers' yields and incomes, and may result in low agricultural productivity as farmers do not realise the real value of their seed and efforts, including the indigenous knowledge applied in such a system. There is need to develop a systematic way of identifying the high performing and preferred varieties and motivating farmers to use them. This involves full participation of farmers so that they are aware, appreciate and understand every stage of seed production. Developing a generic or one size fits all seed system does not give positive results (Mapiye *et al.*, 2006). Both the formal and informal seed systems need to co-exist as this ensure seed security for the benefit of smallholder farmers.

Informal systems are characterised by lack of clearly spelt out processes and they are prominent at community level. Negotiations of prices are a common feature. Packaging is not standard and in some

instances, a small container is used to measure from a bigger one or sack, thus also quality is not guaranteed. In such circumstances, farmers do not have a choice as they want the seed to plant in their fields. Only when a farmer has disposable income and remittances can purchases from the formal system take place. Informal seed supply systems mainly include farmers' own saved seed, community groups, community seed banks and growers associations and NGOs. Thus the strengths of the informal seed sector are that there is seed that farmers can produce, promoted seed is the one that can easily be produced and these are normally adaptable to local conditions and management. Also the seed is resistant to diseases and pests, including storage pests. However, there are limitations to the informal seed sector, some of which are the limited knowledge on quality seed production and varietal maintenance. There is limited room for improved varieties and no motivation to improve on the current ones. Also the varieties usually available are low yielding, low priced and this retards food security initiatives.

Well defined policies and implementation plans govern the operations of the formal seed system. There are aspects of quality seed production and storage, and this is combined with seed multiplication, quality control standards and supply mechanisms. The origin of the seed is known, including the breeders, its growth characteristics and how it performs in specific environments. During breeding, multiplication and certification stages, the seed including the seed crop are inspected by qualified personnel (Teddie and Grace, 2010; Amsalu, Victor, Bezabih, Fekadu, Tesfaye, Milkessa, 2014). In most developing countries, including Zimbabwe, it is the mandate of Seed Services, which falls under the Ministry of Agriculture. Seed supply in the formal seed sector is organised, from production to distribution. It is worth noting that in Zimbabwe there are more than 13 registered seed companies for multiplication and certification of seed. These companies operate as entities, joint ventures or subsidiaries of larger companies. Some of them also have licences to breed new varieties. However, their main focus is on food crops and this puts forages seed at a disadvantage as it is never prioritised.

The strengths of formal seed sector is that they guarantee quality seed which will germinate and produce healthy plants. The seed is of improved varieties and high yields can be expected. Much research will have been conducted on the seed crop to ensure varietal conformity and other growth characteristics. The formal seed sector also has shortfalls, and the unavailability of adequate quantities on time can be a challenge. Training of breeders and inspectors need to be in place for the systems to be credible. There should be adequate funding for the development of new varieties, screening and evaluation. Also some of the varieties might not be suited to the environment and farmer management practices.

In semi-formal seed system, much of the operations and its promotion is dependent on NGO support. This also includes community seed banks where a certain community can decide to produce seed of specific crops, share with other farmers or even sell to local community or outside. Farmers can also be into groups to form producer associations of certain crop seed. Seed distribution in such a sector is usually done by the farmers themselves, hold seed fairs to showcase and sell their seed to other farmers, or even by the NGOs who buy for other farmers and projects. Some of these semi-formal seed systems develop into fully fledged seed companies with time. Therefore, it is vital that seed systems progress from being informal, to semi-formal and to formal. All this is a process and does not happen overnight. It requires determination, understanding, transparency, financial discipline and motivation to be in it and an appreciation of the processes.

5.2.1.5 Consumption

From the study, results indicated that consumers of forage seed comprise other farmers (both smallholder and commercial) who want to produce forage seed, livestock keepers and feed producers. In Goromonzi and Murewa the demand for forage seed is very high. From the study, 51.0 % indicated that they are interested in venturing into forage seed production, even though they highlighted that they are not familiar, thus do not have experience in growing forage crops. Lablab was indicated as one of the forage seed they want to produce as there had been enquiries from seed houses wanting to buy in large quantities for the export market. Unfortunately the forage seed production system in the study sites is informal, resulting in very small quantities being produced. Within the forage seed value chain, consumers refer to seed companies, livestock keepers, NGOs, research institutions and other farmers who procure the seed for either multiplication and marketing or producing livestock feed from the forage crops.

Mucuna and lablab are not usually utilised as food within the study communities, even when mucuna has profuse seeding abilities. Mucuna also contains anti-nutritional factors (L-Dopa in mucuna) even though they have medicinal properties which are still to be fully explored and itchiness is felt when handling it. When used in ruminant feed rations, the legume is easily digested with no negative effects (Topps and Oliver, 1993). Therefore mucuna has been utilised for both the forage and grain in ruminant diets. Buwu (2014 and Mashanda (2014) have successfully included mucuna in beef and dairy respectively and produced positive results on the performance of animals. With the shortage of livestock grazing associated with the increase in livestock numbers and degraded grazing lands, it becomes imperative for livestock keepers to venture into viable fodder production. Delgado (1999) also mentions that barriers should be

removed that prevent consumers access to preferred products on the market. The infrastructure should be in place and this requires both government and private sector support.

There is also lack of adequate information about the use of these forage seeds and the forages themselves. There could be vast potential in the use of forage seeds and the forages as feed. Some work that has been conducted on utilisation of forage seeds such as mucuna has had low adoption by the smallholder farmers (Vadivel, Pugalenthi, Doss and Parimelazhagan, 2011; Gusha *et al.*, 2015). Farmers have cited inadequate information, extension staff also have limited knowledge, lack of supporting reading material in the form of pamphlets, briefs and training manual in local languages.

5.2.1.6 Support services

With regard to the provision of extension services on forage seed production, discussion from FGDs indicated that extension services lack mobility which hinders its effectiveness. The majority (about 65.0 %) of these farmers stay far away from where the local extension staff resides within the ward, therefore, they do not usually meet with them on a regular basis. Extension staff needs to have refresher courses on forage production so they can effectively deliver services to farmers. Seed production, thus requires very effective extension support service and routine monitoring to ensure harvest of quality seed. Farmers need training on aspects of seed production, especially in informal systems so that they grasp the concepts and adopt improved practices such as seed selection, harvesting and storage. These practices have benefits of reducing seed losses and ensuring availability of seed for planting in next season and access of quality seed by other farmers.

Seed production in smallholder systems requires effective extension, as the later plays an important role in farmer training, thus establishing a solid foundation for quality seed production. In high risk areas like smallholder systems, where farming activities are rainfall dependent, yield stability is more important and there is better adoption of extension recommendations with set criteria for a seed system. Research and extension service should be effective and be part of other forms of support like inputs and credit offered to farmers in seed production (Welu, 2015). In many cases, national seed systems are faced with many bottlenecks and fail to fulfil the interests of the farmers.

There are no private companies that offer extension on forage seed production in the study sites and this presents a big challenge for the farmers. Private sector companies are more concerned with profit making, therefore, do not consider it necessary to support smallholder farmers at no cost. Institutional support,

training and capacity building, quality standards, linkages to markets, have a positive impact on forage production and strengthen forage seed value chains.

5.2.1.7 Information and communication

Without communication, there is no building of relationships, knowledge exchange, sharing and no access to information. Even when one visits the NARES who used to conduct research on these crop species information is limited. There is also new research staff who are still to gain experience in forage seed value chains. From the study it was revealed that information on forage seed production and marketing is very limited. As highlighted in chapter 4, Figure 4.12, on the current value chain map, there are some channels and linkages that are weak, whilst others are non-existent. This coupled with challenges associated with lack of information and knowledge highlighted during the study presents challenges on information channels, quality of information, source and recipients of messages being conveyed and purposes the messages should serve. Forage seed production presents challenges in that there is no adequate information that is being passed on to the farmers, even when they request for it. This is compounded by the fact that extension staff, whom the farmers expect to have that information, do not have it. Tsado *et al*. (2014) alluded to the fact that if ToTs are important so that extension staff are able to cascade what they will have been taught to the rest of farmers. Such programs were also supported by Uzonna and Qijie (2013) and Beshir (2014) that even women participation would improve and positively affect livelihoods. Therefore, collaborative linkages need to be developed, fostered and strengthened between farmers, researchers, private sector, development organisations, agro-enterprises and the rest of the value chin actors. Further constraints and possible solutions were identified and are presented in figure 5.3.

Factors that affect forage seed demand were ranked according to their importance. For forages to have high demand, the study revealed that farmers need to have knowledge of the forages, how to produce and utilize them. Trainings and support services have to be put in place to support marketing efforts and access. Tekalign, (2014) suggests the need for strenthening the support for private institutions who are into forage seed production to ensure sustainability of the enterprises. This is because there are few institutions that are interested in venturing into forage seed business. Analysis of the farm level subsector of the forage value chain is important in order to develop sustainable strategies and adaptabble interventions. This was done using the SWOT analysis and Table 5.2 shows some of the strentghs, weaknesses, threats and opprotunities identified.

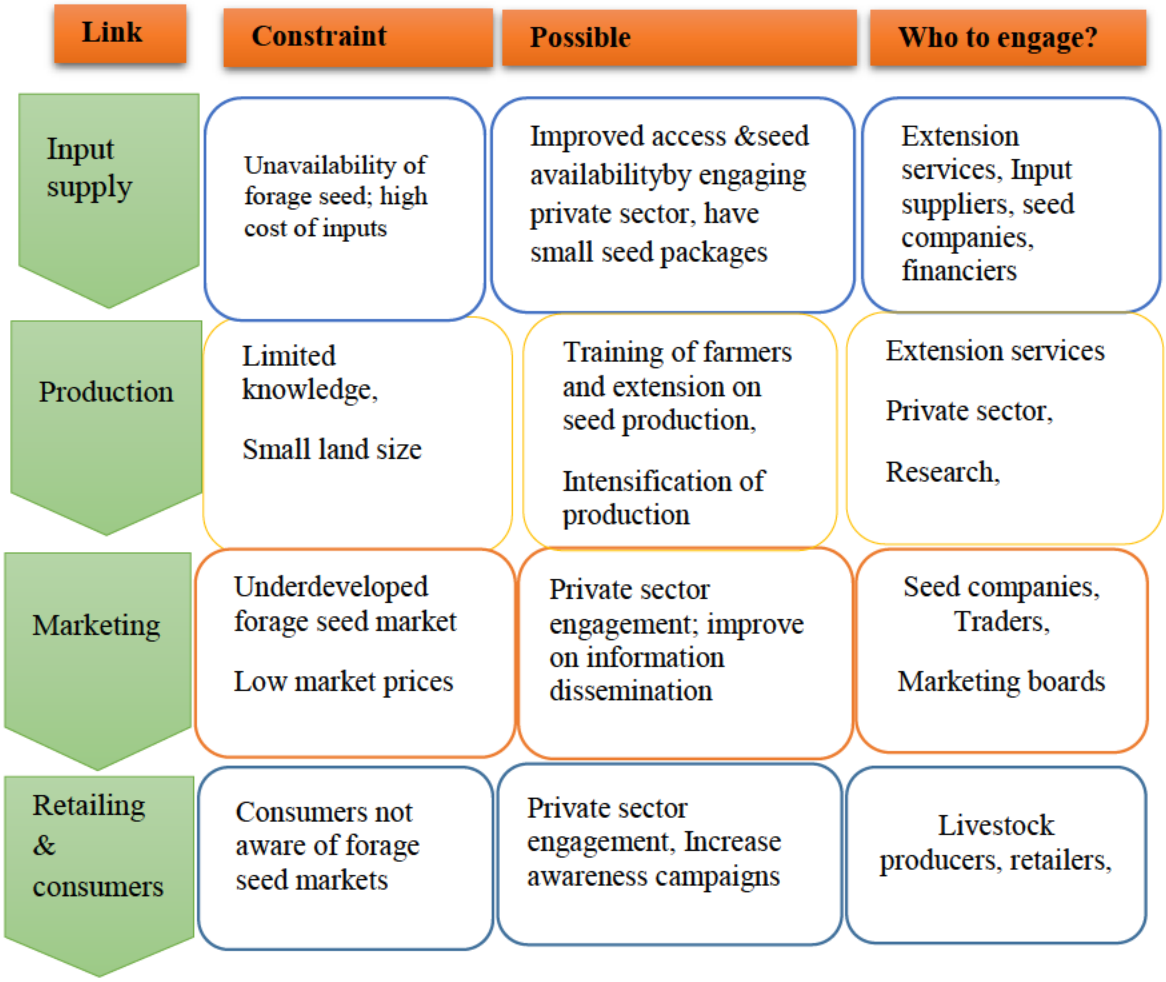


Figure 5.3: Constraints and possible interventions along the forage seed value chain. Source: Developed by researcher

The main strengths inherent within the sector include the fact that there is a growing demand for livestock and livestock associated products, thus requiring increased feed for the livestock. Farmers are diversifying farming activities to include livestock, with associated knowledge demand. This is evidenced by the number of livestock being slaughtered through the formal sector being greater than that of the informal (MoAMID, 2015). Various organisations are now into livestock related interventions at different levels. New forage varieties are being bred which are suited to the climate in Zimbabwe. There are agro-ecological zones suited for the production of a wide variety of forage species, such as Lablab and Mucuna which are suited for drier areas, whilst the likes of Lucerne favour higher rainfall areas.

The seed business requires high technical expertise which is high risk and requiring extra care for crop management and storage (Jones, 2014; Coomes *et al.,* 2015). Some forage species are propagated vegetatively and this reduces trading opportunities which is possible with seed material.

Opportunities outside the forage seed value chain exist with great potential as there is a growing market for forage seed, academia and other farmer trainings are including aspects of forage seed production. There are several benefits to be derived from forages including environmental restoration through vegetation cover for erosion, control and moisture retention, soil nutrient status improvement through biological nitrogen fixation by legumes (Ali, Jan and Abbas, 2015; Mhlanga *et al.,* 2015). Mucuna and lablab have been used as green manure cover crops (GMCC), in addition to these crops being utilised as livestock feed.

However, climate variability negatively affects crop production, besides the threats of disease and pest out breaks. Economic environment also has also a negative impact on success of the forage seed sector as prices become unstable and may result in the seed business being uneconomic. Constraints and possible interventions are provided along with the specific functions of the value chain namely input supply, production, marketing, processing and consumption.

Table 5.2: SWOT analysis for forage seed value chain.

Strengths	**Weaknesses**
• Growing demand for animal products also associated with expanding populations and improved nutrition • Growing livestock sector that requires forages • Various agro-ecological zones suited for production of a wide variety of forage species • Zimbabwe has strong collaboration with international research organizations with expertise in forages • Various NGOs and other development organisations now involved in livestock, including fodder production	• NARES not adequately resourced to quickly screen and evaluate new forage species • Reduced demand of forages especially those of a perennial nature (not required annually) • Some forages are of a vegetative nature, thus reducing trading opportunities which can be done with seeds • High risk and establishment costs, making the business less viable • Technical expertise is high, thus making forage seed business high risk and requiring extra care for crop management and storage losses

• Eager and enthusiastic farmers who are willing to learn new ideas and technologies in agricultural production	
Opportunities	**Threats**
• Extension services include livestock production and development, thus covering aspects of forage production • Growing fodder and seed market, especially at farmer level • Academic and farmer training institutions now incorporating curricula on fodder production • Planting forages helps in environmental reclamation through soil cover, soil improvement (structure and nutrient content)	• Climate change, erratic rainfall and floods, negatively affecting crop performance and yields • Disease and pest attack, e.g., armyworm. • Unfavourable economic environment, unstable prices • Technological advancement and farmers failing to keep pace

Source: Developed by researcher

Forage seed production under a project being implemented in the area has witnessed significant price variances ranging between US$0.50 kg^{-1} and US$5.00 kg^{-1} for lablab seed.

A summary of challenges and opportunities in the forage seed value chain is presented below:-
Challenges in forage seed value chain:-

- Limited knowledge on forage seed production. As a new crop, forages are not well known in the area, thus lack of knowledge prevents farmers from venturing into the business.
- Lack of established markets for forage seed. Farmers fear that with the absence of a well-established market, they will not be able to sell the seed, more so prices are not known.
- Limited knowledge on livestock feeding. Since the forages grown from the seed will be for livestock, there is need to have knowledge on how to feed the forages to livestock.
- Market price for forages is not standard or well set. Every seller is charging own price.

- Smallholder farmers perceive that the capital outlay for forage seed production is beyond their reach. This is coupled with the fact that there is limited knowledge on aspects of forage seed production.
- Unpredictable rainfall and recurrent droughts are a cause for concern and deter farmers from venturing in forage seed production. Most smallholder farmers depend on rainfall for cropping, thus agricultural activities are dry land based. This creates challenges beyond the reach of the farmer. Crop establishment can be good and then the crops are affected by the mid-season droughts such that they never reach maturity stage or that the seed will not develop fully.
- Forage crops are not a priority crop on the farmer' list and this creates challenges when such crops are introduced in an area. Farmers prefer crops that have a direct benefit to household food security. Only when there are early adopters of technologies can such crops be grown.
- Smallholder farmers in the area have a challenge of small land area and this land would be allocated to food crop production.
- Diseases and pests present challenges as farmers do not normally use chemicals for their control. Therefore, it will be difficult for a farmer to buy chemicals to control pests and diseases in forage than for food crops. Unfortunately seed crops, including forages, need to be free from any diseases and pests.

Opportunities in forage seed value chains:-

- The study sites fall in Natural Region II which is suitable for agricultural activities including cropping. The main activities are crop production (maize, groundnut, cowpea and soya bean). Therefore, the area is suitable for quality forage seed production.
- Proximity to the main markets. The sites are located very close to Harare (60-80 km), where the main market for agricultural produce is located. Inputs can also be sourced from the suppliers in and around Harare that is from manufacturers, wholesalers and retailers. Farmers can easily take forage seed to the markets. Also seed companies which can buy the seed are located in Harare.
- Seed quality controls are in place and seed inspections can be conducted by the relevant authority, the Seed Services which falls under the Ministry of Agriculture, Mechanization and Irrigation Development.

However, for smallholder farmers to overcome the challenges and take advantage of the opportunities there is need for the following:-

- There is need to set up irrigation facilities and repair those that are non-functional. Crops for seed production require adequate water supply to ensure seed reaches maturity.

- Government should provide more resources to national research institutes so that they are able to evaluate new forage varieties that are adaptable to changing climatic conditions and adoptable by farmers.
- More trainings on forage seed production and general management practice should be offered to farmers. This will ensure that quality forage seed is produced by the farmers.
- Development of viable and sustainable forage seed markets where smallholder farmers can participate fully.
- Prices of forage seed should be affordable so that smallholder farmers can also access.
- Engagement of seed companies will help to ease farmers' production and marketing costs. There are costs also associated with seed crop inspections and certification. This will also ensure sustainability of the seed production venture as farmers are assured of market for seed.
- There is also need to strengthen relationships between farmers and all the stakeholders involved in seed production.

Household income maybe generated from direct forage seed sales, and indirectly income maybe received after the sale of livestock which will have been fed conserved forage (hay or silage). Few seeds may be produced from a forage crop and fetch a high price when marketed. Therefore, there is need to conduct a thorough market research and identify forage seed market requirements and other organisations that are involved directly and indirectly.

Private sector involvement (input suppliers, seed companies and traders) has proved to be beneficial in formalizing the informal seed systems that are prevalent in smallholder systems (GIZ, 2015). This can be achieved through innovation platforms that enable focused discussions among stakeholders and farmers included. These innovation platforms encourage farmers to participate and strengthen farmer groups and organisations in their activities for their benefit. These innovation platforms also give private sector players direct access to business opportunities at the smallholder farmer level. Studies have revealed that by joining a farmer organisation, adoption of technologies also increases as a result of knowledge acquired through discussion in such fora (Ramirez, 2013; Tolno, Kobayashi, Ichizen, Esham, and Balde, 2015).

Communication is an important aspect in that there is information exchange among value chain actors. Mode of communication kind of message to be transmitted has to be relevant to the recipient. From the study, it was revealed that farmers get information on agricultural practices from extension staff. This is through word of mouth or mobile phones.

Trainings and capacity building activities are also conducted to enhance knowledge base and common information on current and changes in practices. Communication channels are affected by technology, type of message to be transmitted, sender and receiver. Innovation Platforms also play an important role in communication as they create a platform for such dialogue among value chain players.

Contractual agreements affect the success of the contracted product. For this to have a positive effect on forage seed production, there is need for transparency. During discussions at FGDs, participants highlighted that they would appreciate Terms and Conditions that are drafted as a combined effort between the farmer and the contractor. Usually a contractor brings a copy of the contract that would have been prepared without the input of the farmer. They argue that combined drafting of the Terms and Conditions helps all parties to understand what is expected of them and reduce chances of defaulters. Therefore, IPs can also assist in creating this platform for dialogue. IPs will act as facilitation agents for such discussions.

However, Contractual agreements are also influenced by factors such as economic environment. For example, a contractor can pre-finance production, on agreement that costs would be recovered at the point of being paid when producer delivers product. Another factor is about policies governing contractual agreements, research and development, irrigation infrastructure, market structure and stakeholder engagement. To improve on forage seed business, it is important to know the costs involved up until marketing, that is, cost structure. Seed production systems enhance competitiveness if correct measures are taken. Aspects to consider include access to resources (land, labour, capital, information), clientele base being targeted. Input schemes should make efforts to include forage seed to cater for those who want to improve soils and venture into livestock production. Traditional practices need to be embraced, identify gaps and have relevant interventions.

5.3 Chapter summary

The chapter has identified the various challenges faced by smallholder farmers in forage seed production. There are many of these, some of which are beyond the farmers' control. The factors create a complex system where challenges are affected by some factors and they are also a result of other challenges within the system, resulting in cycles which continue to haunt the farmer. Therefore it is important to identify the causal factors so that remedial interventions can be developed that are relevant under smallholder farmer environment.

Of importance are challenges including unavailability of improved forage seed material on the market; limited involvement by private sector companies; low prices offered when marketing forage seed (if ever it is there); underfunding of national research institutions. Given also the dwindling arable land area, there is need to continue empowering communities on production of livestock feed, thus making use of forage seed. Other opportunities exist as a result of the increase in demand for livestock and livestock products; already existing knowledge among farmers; willingness by private companies to engage in forage seed production and intensification efforts being pursued in smallholder systems.

There is need to avail quality forage seed on the market, engage in forage seed production and do away with seed imports, engage private organisations like seed companies to contract farmers to produce seed. There is need to improve forage evaluation and screening efforts by researchers to improve forage seed yields and adaptability.

CHAPTER 6.RESEARCH FINDINGS ADDRESSING OBJECTIVE 3: BASED ON OWN ANALYSIS

6.1 Introduction

Forage seed production have been studied and documented, including the various players involved (Phaikew *et al*., 1997; Hare and Horne, 2004; Mapiye *et al*., 2006; Nangole *et al*., 2013; Singh *et al*., 2013) but little information is available on the whole forage seed value chain, especially in Zimbabwe. This is beside the fact that the informal seed sector in Zimbabwe offers easy access to smallholder farmers for all seeds.

This chapter identifies the various actors along the forage seed value chain, the various roles they play and how they relate to each other in service delivery. The chapter also analyses the relationships that exist between the value chain actors, who they interact with, the importance and which connections are missing along the value chain. Results from the study are based on data collected from sampled households, FGDs and KIIs that were conducted in the study area. The study employed the Social Network Analysis approach to describe the connectedness of the links between the actors. Some of the discussions in the chapter involve identifying how actors can contribute to effective functioning of the value chain. The chapter is organized in such a way that it first highlights results from the study, which is then followed by a discussion of the results and the chapter summary is presented.

6.2 Results and discussion

6.2.1 Value chain actors and their roles

Actors that were identified along the seed value chain included input suppliers comprising agro dealers and private sector, other community member households, development organisations and the government through agricultural schemes. Other actors along the value chain included producers (farmers, seed producers), marketers, services providers (NGOs, research and extension) and consumers (farmers, livestock keepers). These value chain actors are represented in the diagram below (Figure 6.1).

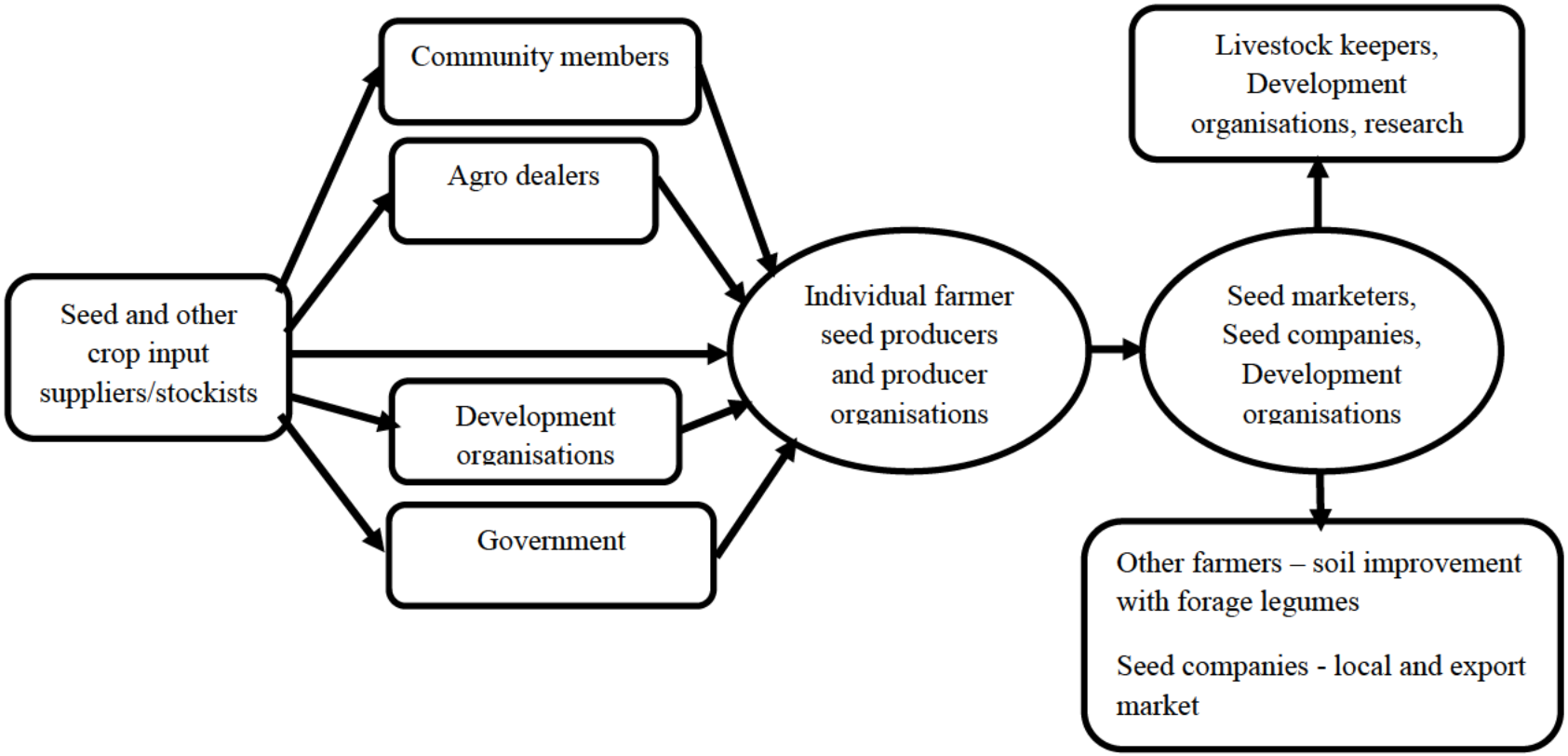


Figure 6.1: Forage seed value chain actors. Source: Developed by researcher from study results

6.2.1.1 Input suppliers

Input suppliers present in the study area include seed, fertiliser and crop chemical suppliers, general agro dealers, seed companies and stockists, hardware shops and stock feed sellers (Figures 1.1 and 6.1).

Seed companies consist of local and international companies and they are mainly in the business of breeding, multiplication and certification, and distribution of improved crop seed varieties. The seed companies distribute seed through a number of ways including direct sales from established warehouses, stockists or agro dealers and during seed fairs organised in communities. All these distribution pathways are essential for farmers to access seed of improved varieties (Wanyama, 2011; Lugusa *et al.*, 2016). About 43.0 % of farmers in Zimbabwe access their seed irrespective of seed variety through stockists and seed depots at agro dealer level (The African Seed Access Index, 2015). It is believed that seed suppliers, including agro dealers and seed stockists (those that sell seed on behalf of the seed producers or seed companies) play a crucial role along the seed value chain as they ensure that farmers get seed on time and close to their areas (Wanyama, 2011). However, from the study there is limited information on seed suppliers being able to supply any forage seed. Even though forage seed is important for livestock and without adequate supplies of forage seed, not much feed can be availed for livestock. NGOs and the Government have become handy in providing forage seed to farmers who are mainly into dairy production. However, such initiatives have been hindered by the unavailability of forage seed on the market. The seed sector is dominated by maize seed which is bred and supplied to meet food security. In Zimbabwe, ruminant livestock depends mainly on pasture (natural and improved) as the main source of feed. The seed companies are also members of the Zimbabwe Seed Traders Association (ZSTA). The primary purpose of the association is to coordinate activities and operations of the seed industry. It also represents its members at government and other business levels, also playing an advocacy role for both private and parastatal seed companies. The ZSTA is also a member of the African Seed Trade Association (AFSTA) which helps to create a conducive environment for quality seed trade by farmer producers in Africa.

Supply of other inputs such as fertiliser and crop chemicals is through manufacturers and agro dealers or stockists. Manufacturers such as fertiliser and crop chemical companies have now been venturing into direct sales to farmers because of the economic environment currently prevailing in the country. They are putting up depots and selling points at local shopping areas to reduce costs of paying commission to stockists. This is a benefit to the farmers as it reduces buying prices of inputs. Another benefit is that they get first-hand information on safe use of the inputs and any challenges

are handled and solved quickly. On the other hand, input suppliers improve on their products through direct contact with users, who are the farmers.

Agro dealers were the main input suppliers, with stocks of almost everything from inputs to groceries and tools and farming equipment such as ploughs, wheel barrows and knapsack sprayers. They were located within the locality of the communities, whilst the rest of the suppliers were located at district centres. Prices of commodities differed from one shop to the other, depending on brands and where goods were sourced from. For example, compound D basal fertilizer (7N: 14P: 7K) varied from US$25.00-US$30.00 50 kg^{-1} bag and hybrid maize seed (US$21.00-US$23.00 10 kg^{-1} bag). Respondents indicated that inputs are also available in smaller packs, which makes it convenient for farmers who cannot afford bigger packages and those with small pieces of land that do not require large amounts of inputs.

Input suppliers also concurred with farmers that forage seed is not available and if farmers have the knowledge to manage seed crops and produce forage seed, then demand for forage seed will increase and they can request the seed from seed companies for sale in their shops. Otherwise, currently demand is low although its importance is high in order to save livestock during times of feed shortages. Agro dealers are in close contact with farmers. The study revealed that farmers are in contact with agro dealers almost on a weekly basis, when they buy other household requirements and this makes it easy for communication and information exchange. It is important that agro dealers play an important role in the delivery of seed at farmer level and this helps to understand challenges being faced by farmers to access seed (Wanyama, 2011). The study also provides some insights into how this is organised, inherent constraints and how it can be improved for the benefit of farmers and stakeholders.

The Government and development organisations have also played an important role in the provision of inputs to smallholder farmers. Farmers indicated that they have also received crop inputs from input programs supported by the Government and development organisations. Unfortunately forages were not part of the inputs. Most input program support to smallholder farmers was a package containing 50 kg basal fertiliser, 50 kg top dressing fertilizer and 10 kg maize seed, adequate for 0.4 ha. Different approaches have been developed for farmers to access these inputs, including direct input distribution, where farmers would gather at an agreed venue and receive the inputs; paper or electronic voucher system, where farmers would redeem the vouchers to access pre-determined inputs or own choice at selected access points like agro dealers at local community level. The voucher system also involved seed companies and other input suppliers. Other voucher systems involved farmers contributing a certain amount of money towards the purchase of the inputs.

The private sector have also supported farmers, using different approaches to those who had own resources, including contract and input schemes. This also was a way of pre-testing their products for adaptability within smallholder systems. Other community members also play a role along the value chain through distribution of seed. Farmers by nature share seed and other inputs with neighbours. It is important that when training programs are being implemented, they include other members of the community who are not directly involved at that particular time. In the long run, other community members will adopt the technologies and source the same inputs, thus increasing input use within the community.

6.2.1.2 Producers

The primary producers of forage seed are the smallholder farmers. From the survey conducted, farmers revealed that they grow the forage crops for seed production, harvest the seed but then fail to get a good market for it. As producers of forage seed, farmers are involved in sourcing of farming inputs, manage crops in the field, harvest, clean the seed and deliver it to the market. One cannot easily sell to seed companies as their focus is on food crops. If one gets a market for the seed, the price is very low (US$1.00 kg^{-1} for mucuna and US$S3.00 kg^{-1} for lablab), considering the costs one would have incurred. Discussions revealed that costs can be as high as US$1.00 kg^{-1} for mucuna and US$2.00 kg^{-1} for lablab. Lablab costs are higher as the crop is easily attacked by pests and diseases and requires frequent control measures that include spraying. A farmer ends up selling at that low price as they will be in need of money for household necessities like paying for children's school fees, meeting medical expenses and food. Concerted efforts that ensure sustainable markets for farmers are required. This will also motivate farmers to focus on forage seed and produce quality seed. Across the seasons, only mucuna seed production is on the increase, compared to lablab and cowpea. Table 6.1 shows a summary of forage seed yields among smallholder farmers in Goromonzi and Murewa in the sub-humid region of Zimbabwe for three growing seasons. Discussions also indicated that the crop is easy to grow and does not require much attention.

Table 6.1: Forage seed yields from smallholder farmers during 2012-13 to 2014-15 growing seasons

Crop type	2012-13 season	2013-14 season	2014-15 season
Mucuna	2.0	4.5	15.5
Lablab	0.2	1.2	0.2
Cowpea	4.5	3.0	2.2

Source: Researcher compilation from field reports

Initial seed for mucuna and lablab were imported whilst cowpea was sourced from a local seed company and these were distributed to farmers. The main purpose of growing the forages was to conserve the forage and later feed ruminant livestock (cattle and goats) during the dry season when natural pasture is low in production and quality. The said forages were selected on the basis of best bet technologies and had been tested in prior on-farm trials and proven to be adaptable to the study environment. The seed (especially for mucuna) was included in feed rations, either as whole or crushed, then mixed with other feed ingredients such as maize grain, hay and mineral mix. At this time farmers were also on a learning curve on the different uses of the forages and seed. They started harvesting their own seed and exchanging and selling seed amongst themselves as they saw benefits being derived from growing the forages. Some farmers went to the extent of preparing what they called "coffee" (a hot beverage from ground roasted mucuna seed). Thus, there is need to match type of seed for production to the customer when the seed will be used. Also packaging (pack size) should be in line with where the market is. Farmers with small pieces of land or those who do not have adequate finance and would want it in small packages.

It should be noted that only grain types of cowpea were available for use. Much of cowpea breeding in Zimbabwe is for grain types which are used for human consumption. Over the seasons seed production for mucuna has increased whilst that of cowpea has been on a downward trend. The results show that mucuna has profuse seeding abilities. The trend for cowpea production reflects that farmers prioritised seed harvesting compared to forage as they wanted to meet household consumption. As farmers received trainings on forage production and conservation, there was a shift to consider hay making from cowpea crop especially with dairy farmers. Lablab seed production initially increased during the first two seasons then decreased in 2013-14 growing season, which could suggest that the season could have been shorter than its normal growing period (Chakoma *et al.*, 2016).

It is argued by Poudel, Sthapit and Shrestha (2015) that if farmers appreciate and understand how to grow certain crop cultivars, they will continue to produce them in their fields, harvest and conserve seed where possible and exchange seeds within their social networks. There is need to foster conservation and diversity of informal seed systems so that farmers are resilient to negative effects of climate change and other shocks. However, weaknesses have been sighted in such systems which limit access to new varieties, technology and interaction with formal systems (Pautasso *et al.*, 2012). This can be enhanced by innovative interventions that allows for improvement in access (through on-farm field demonstrations, seed fairs, field days, community seed banks) to new cultivars, capacity building and skills training on production and variety maintenance (Poudel *et al.*, 2015).

Farmer producers have formed groups through the Innovation Platforms (IPs) established by a project in the study area. The IPs creates a platform where farmers are able to meet with different stakeholders they interact with in their farming activities. In such fora, issues are discussed including availability of inputs, prices of goods and services, markets and market requirements. A committee of the IP also has the duty of inviting stakeholders with certain expertise to explain to farmers, and look for other stakeholders outside their communities who can provide them with goods and services. Through the IPs they are able to negotiate terms and services with one voice. So far there is an IP established in each ward and the committee members meet quarterly at district level and later give feedback to the rest of the members back in the respective wards. The FGDs also confirmed the existence of the IPs which were very beneficial for the farmers who are now able to identify their needs and how to improve on their income generating activities.

IPs have been used successfully in various sites to enhance stakeholder interaction and identifying priority areas of focus for development (Amede and Sanginga, 2014; Duncan, Teufel, Ravichandran, Hendrickx, and Ballantyne, 2015; Dusengemungu, Kibwika and Birungi Kyzze, 2016). Results have also shown that IPs play a pivotal role to unite different people and organisations working towards a common goal. Mahiya (2016) also asserts that IPs are characterised by diversities of the members and organisations they belong, such that their successes are dependent on management of these diversities. Besides selling forage seed, farmers also share with neighbours and use the seed as payment for labour.

Considerations need to be taken into account for the resuscitation of the Pasture Seed Producers Association, which once existed. Its services are vital in that it links forage seed producers and the rest of the stakeholders especially in the livestock industry. This will also reduce pressure on private seed companies who are serving on food crop seed production and marketing. The livestock industry should also play an important role in the sphere of forage seed supply than depend on the crop industry. This is because forage are viewed as less important than food crops as far as food security is concerned. Another aspect that makes forages less important is that in the livestock industry, more emphasis is put on animal health and breeding. The Pasture Seed Producers Association would also play an advocacy role, information source and market intelligence for the benefit of farmers and all stakeholders.

6.2.1.3 Traders, wholesalers and marketers

The forage seed market is not very prominent in Goromonzi and Murewa. It consists of other smallholder farmers from within and those outside the communities, NGOs and one seed company. Traders and wholesalers were not common as the product is unique and need a special market

segment, mainly those involved in livestock production. Farmers who have been involved in forage seed production are those who have been participating in a project implemented in the area since its inception in 2012. The different channels used by farmers to sell forage seed is shown in figure below (Figure 6.2). The channels included selling to farmers within the local community, that is, to fellow farmers. Other seed was sold to farmers outside the community but in-country, as far as in Hwange, Buhera, Chipinge and Mt Darwin districts in Zimbabwe and even exported to countries like Swaziland. Other channels were seed was sold were to private seed companies, development organisations that had similar or starting new projects on livestock, other private organisations and research institutions. In the first year of the implementation of the project, about 90.0 % of the seed was marketed through research institutions. This was because the research institutions facilitated the sales in order to motivate the farmers to venture into forage seed production, and the need to distribute more seed to other farmers in other villages and wards. Within all these different channels, there were no differences in seed prices. Mucuna and cowpea was sold at US$1.00 kg^{-1} whilst lablab was US$2.00-3.00 kg^{-1}.

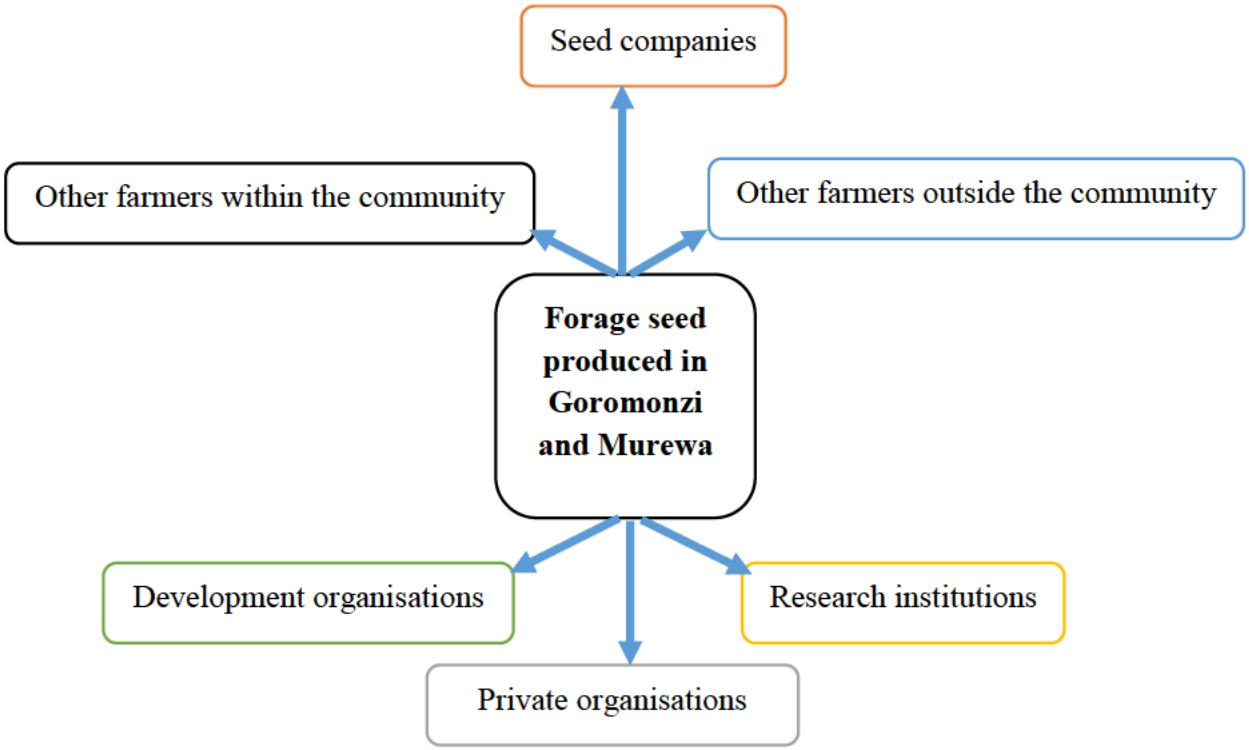


Figure 6.2: Forage seed marketing channels: Constructed by researcher

Farmers perceived the selling price for mucuna and lablab seed (US$1.00 kg^{-1} and US$3.00 kg^{-1} respectively) as low. This was despite the fact that the initial seed was imported from Australia at AU$9.00 kg^{-1} and AU$11.00 kg^{-1} respectively. On the other hand, private seed companies were buying the forages seed at US$1.00 kg^{-1} irrespective of forage type. They argued that that is the

prevailing price at the regional market. So it was up to the farmer to make a decision on whether to sell or not. Most farmers ended up not selling the seed companies that were interested in the seed. Seed marketing has been low since the project also had an aspect of forage production for livestock feeding during the dry season. Farmers were initially hesitant to grow and sell the seed as they viewed the practice with scepticism. Adoption of such technologies need time for farmers to accept. This is influenced by a number of factors, which can be categorised into technological, farmer and farm attributes, including size of land for farming, level of education, farming experience, membership to farming organisation and income (Berrett, 2013; Manyeki *et al.*, 2013; Beshir, 2014).

Agro dealers in the study area do not stock forage seed as they are not aware of it, do not know whether it will sell or not and do not have the knowledge to pass onto the farmers when they buy. To address this, innovation platforms are useful and they will make the agro dealers aware of the existence of forage seed. However, agro dealers will need training on seed handling aspects besides knowledge about how it is planted and its use so that they can convey the messages to their clients who are the farmers. It is important that stockists are equipped with information so they can be able to give correct advice to farmers. These should be encouraged to attend local area meetings and training sessions offered by seed experts and extension staff.

Innovation platforms (IPs) have been employed and found to be useful in engaging stakeholders including traders and wholesalers to participant in value chains in other studies (Duncan *et al.*, 2015; Mahiya, 2016). These have created platforms for discussion between farmers and output market so that there is common understanding of what is being experienced and required on either side along the value chain. Farm gate sales are very common within the smallholder system, thus ensuring farmers get proceeds immediately, although quality and price setting is not guaranteed to be up to standard. These IPs should be promoted within smallholder systems to enable farmers to have the skills and qualities to identify suitable markets and be able to have bargaining power for commodities.

Farmers, as marketers of seed, should be very proactive and innovative to do market research so that they are able to market forage seed. They should be able to recognise any market opportunities for forage seed, take advantage of that and grow their business.

As farmers in the study area already sell maize as grain, groundnut and cowpea whenever there is excess, they need to look for better markets even outside their usual market. McRobert (2009) illustrates that there can be market penetration where they sell forage seed as a new product in the current market and this applies also to forage seed. They can also diversify farming activities (Basu and Scholten, 2014) and venture into forage seed business, and then sell the seed as a new product in new markets. Forage seed market is a niche market, thus planning and management practices

should be of high quality. Diversifying into other farming activities like forage seed business gives farmers leverage on income generation and guarding against natural shocks like droughts and floods. If farmers have limited access to markets, they end up selling locally at low prices. Long distances to the market and low quantities and quality of products contribute to farmers generating low incomes from such activities. Figure 6.3 illustrates market opportunities open to forage seed business.

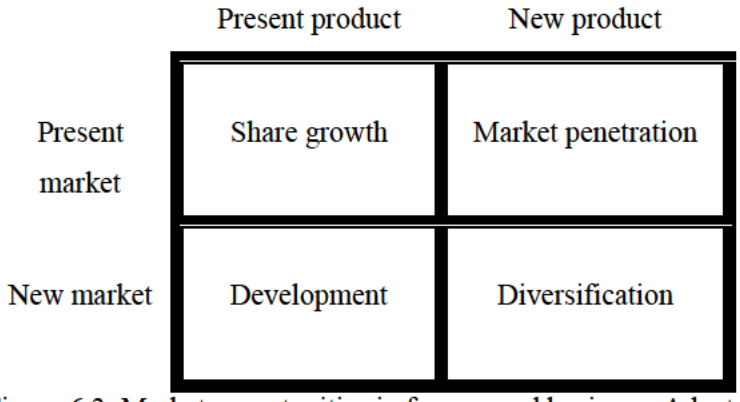


Figure 6.3: Market opportunities in forage seed business: Adapted from McRobert, (2009)

Traders and wholesalers take advantage of any opportunity that comes along the way. They look for business and farmers fall prey to some of these middlemen who offer seemingly attractive prices of commodities, yet it is the opposite. However, without quality seed, the market can fail. Good quality seed will ensure a good crop and through marketing and quality controls, farmers can build their businesses through marketing. This also comes with understanding customer needs and meeting those expectations.

6.2.1.4 Consumers

Within the forage seed value chain, consumers refer to seed companies, livestock keepers, development organisations, research institutions and other farmers who procure the seed for either multiplication and marketing, producing livestock feed from the forage crops or for soil improvement through crop rotations and nitrogen fixation of forage legumes. In Goromonzi and Murewa the demand for forage seed is on the increase. Through a project implemented in the area, lablab seed is now required in large quantities mainly for export market by private seed companies. Unfortunately the forage seed production system in the study sites are informal, resulting in very small quantities being produced. Manyeki *et al.*, 2013 suggest research-extension-farmer linkages to promote farmer participation and technology adoption. Other authors (Duncan *et al.*, 2015; Tolno

et al., 2015) encourage farmers to join farmer organisations and enjoy information exchange, bargaining powers and increase farm productivity.

Farmers usually save own seed for the following growing season and will only buy if funds permit and if the seed will produce a better crop and yield than own saved seed. This is like the agro dealers or stockists who will only stock seed if they are sure that clientele base will buy it.

6.2.1.5 Research and extension service providers

These comprise both international and national research organisations, AGRITEX and DLPD who give research and extension services on crops and livestock respectively. Respondents highlighted that research work which used to be conducted at research stations, now has focus on on-farm and the involvement of the farmer recipients although resources for full implementation is still limited. Also highlighted was that extension staff were based in the wards and provided technical support on agricultural activities, although their effectiveness was hampered by challenges including lack of transport and adequate equipment for measuring like tape measures, weighing scales, castrators and dehorning irons. Farmers who are located near where the extension staff resides, get better attention than farmers who are far from the extension staff.

The role of the extension staff is to give technical advice to farmers, monitor farm activities throughout the season, alert and inform farmers on disease and pest outbreaks, including control measures and assisting farmers with demonstrations. They also assist in the coordination of farming activities, farmer trainings and humanitarian efforts in times of disasters.

Some authors believe that traditional agricultural practices by the so-called peasant farmers are backward and unproductive and this may have contributed to the continued food insecurity among those peasant farmers (Mkandawire and Matlosa, 1993). This belief has given rise to the importation of technologies from the west by governments including those that change the customary practices and norms, and realigning them to large-scale commercial production. To boost agricultural production among smallholder farmers, support services including research and extension should look beyond just increasing productivity (Muzari, Wirimayi and Muvhunzi, 2012).

However, the effective execution of duties by extension staff is hampered by lack of resources, for example transport to move around the ward and they also short staffed. There is one LPD staff in a ward, instead of three. Extension staff are important in the system as they influence agricultural productivity, resulting in the improvement of production and linkages among stakeholders (Sezgin,

Kaya, Atsan and Kumbasaroğlu, 2010). Uzonna and Qiji, (2013) also suggest that extension staff should be readily available to serve the communities and respond to agricultural issues on time. Resource availability to extension staff also plays a crucial role in their delivery of services like transport, accommodation and equipment or tools to farmers. There is need to capacitate extension staff so that they deliver quality work and remain committed to it. ICT advancement tools need to be extended to extension services so that farmers have access to information real time (Davis, Babu and Blom, 2014).

Researchers have also been cited as providing technical support to farmers and other stakeholders on matters pertaining to forage seed business. The purpose of research is to gather evidence on adaptability and economics of technologies. However, for sustainability of technologies, it is advisable that research institutions should engage extension personnel and private companies to work with farmers. Farmers should be fully involved from the planning phase of the implementation stage of any interventions, such as seed production for them to understand and appreciate all stages up to the marketing stage. In this participatory on-farm research, farmers learn more through practice and doing the work.

6.2.1.6 Development partners and Not-for-profit organisations

Development partners that have been active in forage seed production in the study sites are Cluster Agricultural Development Services (CADS) and Community Technology Development Organisation (CTDO). These are local non-governmental organisations that work with communities with the aim of reducing poverty, building resilience, capacitating them and improving livelihoods. They implement various projects from agriculture, water and sanitation, gender and mainstreaming to capacity building. These partners have played an important role in the provision of training, extension services, facilitating setting up of demonstrations sites in such communities. These organisations are development oriented, thus ensuring adoption of technologies and enhancing incomes from the programmes being implemented (Tsado, Ojo and Ajayi, 2014). These development organisations, as part of service providers for knowledge, should ensure that information sharing, training and extension programs result in adoption of technologies and that there is participation of women and youths in such programs. They can take the lead in capacitating extension staff by conducting training of trainers' courses and the extension staff will then cascade the trainings to farmers.

However, trainings and implementation should be participative and not only depend on development partners as farmers tend to develop dependency syndrome for support (Hellin, Beuchelt, Camacho,

Badstue, Govaerts, Donnet and Riis-Jacobsen, 2014). Development partners have also promoted formation of farmer groups to that assist farmers improve on farm productivity and marketing (Ainembabazi, van Asten, Vanlauwe, Ouma, Blomme, Birachis, *et al.*, 2015). However, development partners should put in place exit strategies during the planning phase of projects. In many instances, projects have ended and there is no exit strategy. This causes dis-adoption of technologies which might have been successful if the project had continued.

6.2.2 Value chain actor relationships

On analysing how value chain actors are connected within and outside the study sites, Social Network Analysis (SNA) was employed using UCINET software package. The aim of analysing the relationships that exist among the value chain actors is to understand who communicates with whom and in which subject matter areas. The analysis scan also be used by the actors to develop own strategies along the value chain. Through the understanding of value chain relationships we can understand how the value chain functions and how operations of the actors affect other processes and actors within the value chain. This will also highlight what strategies actors will need to use to realise any value from the value chains. This can be achieved by analysing through social network analysis which brings together network elements and shows the extent of the relationships and whether there is one-way or two-way communication and at what level the actors relate to each other.

Groups and clusters in the social structures are examined by the network analysis, including how the network is composed of and how it functions. Understanding is also facilitated by examining network density and cohesion, that is, measuring centrality and reciprocation. Terms used in the SNA are presented in the Table 6.2.

Table 6.2: Description of elements used in Social Network Analysis

Element	Definition
Node	A single actor (any individual, organization, or other entity of interest) with in a network
Tie	Interconnections between actors
Directed tie	An ordered set of two nodes, i.e., with an initial/source and a terminal/destination node.

Ego	Actor of interest within a network
Dyad	Pair of nodes linked by a tie
Network	Graphical representation of relationships that displays points to represent nodes and lines to represent ties; also referred to as a graph
Centrality	Measure of the number of ties that a node has relative to the total number of ties existing in the network as a whole; centrality measures include degree, closeness, and betweenness.
Degree	Total number of ties a node has to other nodes. A node is central, when it has the higher number of ties with other nodes.
Closeness	Measure of reciprocal of the geodesic distance (the shortest path connecting two nodes) of node to all other nodes in the network. A node is "close" if it lies at short distance from many other nodes (as in being physically proximate).
Betweenness	Number of times a node occurs along a geodesic path. It is a node that can play the part of a liaison or broker or gatekeeper with a potential for control over others.
Core	Cohesive subgroup within a network in which the nodes are connected in some maximal sense
Periphery	Nodes that are only loosely connected to the core and have minimal or no ties among themselves
In-degree centrality	Number of ties received by the node. The in-degree of an actor is an index of prestige /indicate its importance/.
Out-degree centrality	Number of ties initiated by the node. The out-degree is usually a measure of how influential the actor may be.

Source: Scott (2000); Hanneman and Riddle (2005); Wasserman and Faust (2005) and Spielman *et al*. (2010).

6.2.2.1 Degree Centrality

Degree centrality shows the depth of the number of relationships a player is directly associated with or connected to. There are 6 organisations who are service providers and have a close relationship with the smallholder farmers. Livestock research, local authority, farmers' union, animal health, agro-dealers, extension services for crops and livestock are evidently highly centralized stakeholders in this study (Figure 6.4).

This entails that they are the key stakeholders within the forage value chain. The more the actor is in the central position in the network, the more that actor is accessible. Also the more chances of being well known by the farmers and offers more services to them. Cassidy and Barnes (2012) mention that a farming household can have more livelihood options when socially connected in a network as there will be communication and sharing of ideas, a high degree of social capital. Unfortunately, for forage seed value chains, effective partnerships between farmers and stakeholders have not materialised fully, resulting in poor adoption of forage technologies (Miles, 2001)

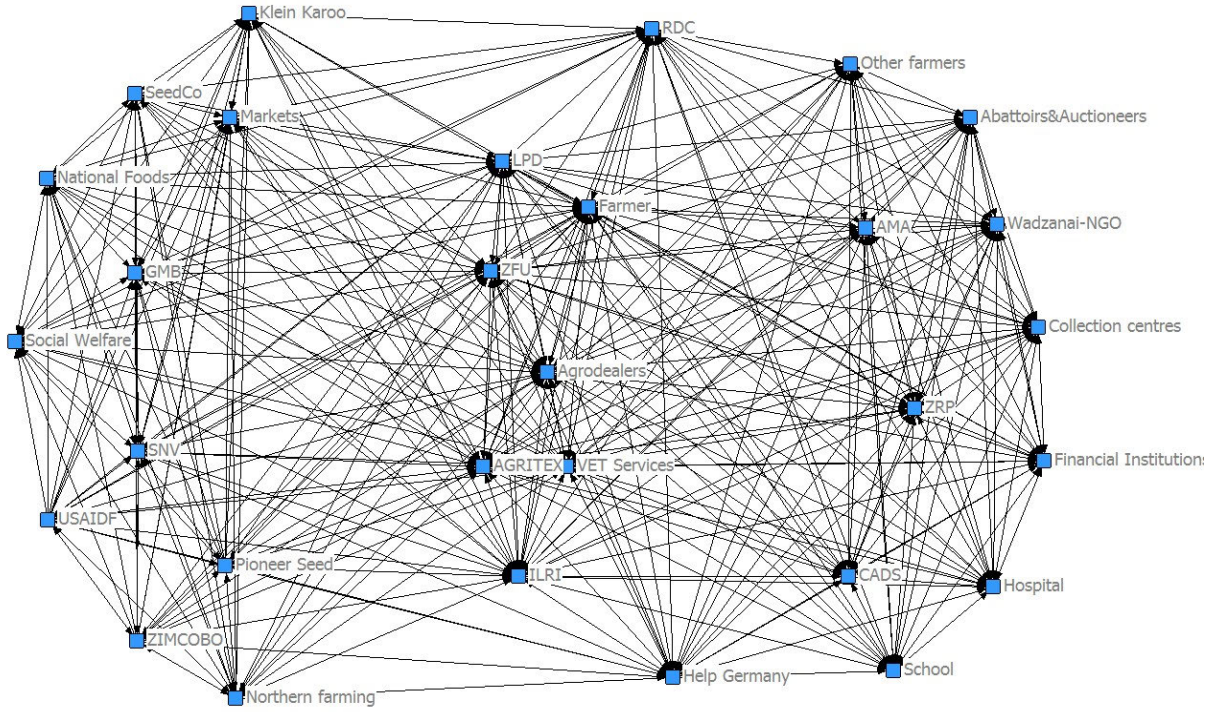


Figure 6.4: Network of actors and relationships identified in Goromonzi and Murewa districts. Source: developed by researcher from study results

It is in this respect that livestock research, local authority, farmers' union, animal health, agro-dealers, extension services for crops and livestock should work towards forming effective

partnerships with other value chain players through innovation platforms, stakeholder workshops and forage seed implementation partnerships. Even among those six institutions, there are two organisations that are very close to the farmers and these are livestock extension services and farmers' organisation. From FGDs, it was discussed that the livestock extension service is always in touch with the farmers, advising and offering technical support on matters pertaining to livestock production. Trainings on forage seed production and forage crop management were facilitated by livestock extension personnel. Farmers' organisations offer technical advice and market information to the farmers in the communities.

Other organisations that are present but do not interact so often with farmers are development organisations, schools, hospitals, markets and seed companies. Therefore, it implies that these organisations are necessary for other services but not directly related to farming activities or the farmer's every day operations. Development partners are implementing different projects in the study area, some of which are not agricultural related. Markets and Agricultural Marketing Authority (AMA) are present although at a distance in terms of relationship with farmers. This means that farmers are not participating in markets that frequent and relationships are not well-established. Even financial institution which are supposed to offer credit facilities are nowhere near the farmers in terms of relationship.

There were links that were identified by farmers to have some gaps. Relationships among NGOs partners are not very clear and this results in confusion and duplication of efforts when implementing any interventions in a community. This might be due to the fact that several NGOs are implementing different projects in the area, some of which are not related to the subject under study. Financial institutions are not linked to other stakeholders such as private organisations and the market, which presents challenges for farmers who would want to gain support to access credit facilities, even when a farmer has direct and strong relationship with other stakeholders. Stakeholders at the peripheral of the network indicate that their ability to link with the rest of the stakeholders is weak and this tends to affect any efforts that need their involvement.

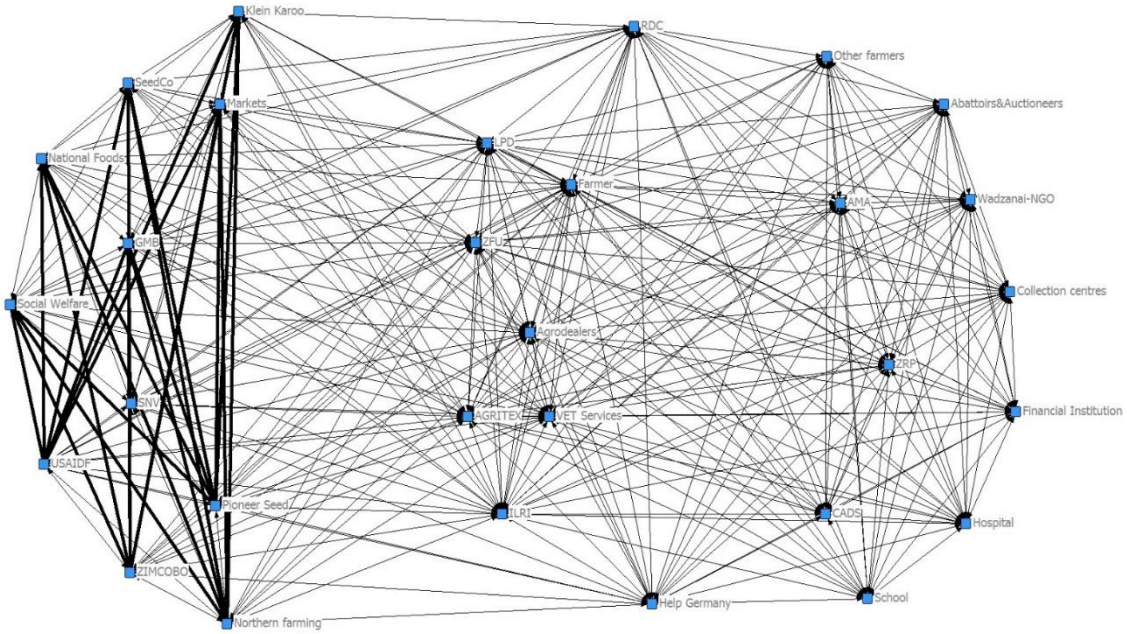
It should be noted that the closer the organisation is to farmers does not imply that services are of high quality. Livestock extension services is a division within the ministry and effectiveness of extension service delivery by its personnel is affected by lack of adequate resources that include vehicles to visit all parts of their operating areas and training materials.

Various authors have asserted that degree centrality can be used as a measure of stakeholder influence (Keskitalo, Baird, Ambjo¨rnsson and Plummer, 2014; Poudel *et al.*, 2015). Therefore, livestock research, local authority, farmers' union, animal health, agro-dealers, extension services

for crops and livestock play a critical role in ensuring the success of the forage seed value chain. From their case studies, Williams, Quesenberry, Prine and Olsen, (2005), asserted that the successful legume technology projects involved the formation of critical partnerships between significant stakeholders. This then entails that the success of the forage seed business depends on key stakeholders, who have the influence to mobilise other value chain actors as well as forming partnerships with other stakeholders to encourage a participatory approach.

6.2.2.2 Reciprocated (undirected) and unreciprocated (directed) ties

Reciprocated (undirected) ties measure the degree of cohesion, trust, and social capital that is present between certain sets of individuals within a network. Almost all stakeholders in this study had a dyad/reciprocal tie with various other organisations as evidenced by the dense network (Figure 6.5). This is an important sign as it denotes a strong communication pattern within the value chain players, though relationships could have been established on various other platforms that may not be concerned with forage seed systems. The cohesion, trust and social capital formed among stakeholders may be a gate way to unifying value chain players towards an effective partnership with regard to forage seed systems.



Key: ***Unreciprocated ties*** ***Reciprocated ties***

Figure 6.5: Reciprocated (undirected) and unreciprocated (directed) ties among stakeholders. Source: Developed from study results by researcher

It must be noted that the direct links that were identified in the study may not provide a full picture of how the relationships existing in the network have developed. Although from the FGDs it was highlighted that different organisations working in a community hold a meeting every month at the local authorities' offices. In this meeting, organisations are expected to report on their activities and this is a platform where they get to know each other and what they do. This does not mean that the different organisations have to work together as each has its own mission.

This means when farmers buy forage seed through social networks, it involves a continuous process where farmers consider their own experience, other farmers' experience in growing that type of forage and how they trust information given by other farmers. Therefore, the relationships can be strong or weak and thus influence behavioural change among the farmers.

Fundamentally, a group will generally function better when a key decision-maker is not only sought after for information but also seeks information from the group members. The red ties show relationships that are unreciprocated. The primary reason why stakeholders may have unreciprocated ties may be due to structural challenges, of which through policy advocacy may be corrected. For example, livestock research institute has unreciprocated ties with Extension services for crops. This can be attributed to the fact that the Extension services for crops' area of jurisdiction lies within the crop spectrum yet livestock research institute is mainly concerned with livestock. Also, the livestock research institute and extension service for livestock unreciprocated tie may be attributed to the proportion of Extension services-livestock officers to area coverage. One extension officer may have 3 wards as areas of jurisdiction, thus overstretching area of coverage. This alone compromises the quality of the relationship between Extension services-livestock and livestock research institute on aspects of alliances, building trust and cohesion.

The lack of cohesion between livestock research institute and Agro-dealers also shows a need for the value chain players, especially key stakeholders to use a participatory approach to enhance the adoption of a project. Such deficiencies among stakeholders may be corrected by multi-stakeholder meetings through innovation platforms, general livestock meetings and field demonstrations. In general, reciprocated ties tend to be stronger than non-reciprocated ties hence networking activities should be scheduled to improve cohesion between value chain players.

Farmers, research and extension officers, and agro-dealers are central to the network, such that they have relationships with almost all actors along the value chain. However seed companies and other service providers are identified at the peripheral of the network, which may result in weak relationships and lack of communication with the rest of the stakeholders. For forage seed production ventures to be successful, stakeholder linkages need to be strong and effective. There should exist

various stakeholders that are well informed and active in the processes involved. Communication and information exchange through meetings, field days, written and electronic media and use of mobile devices and would enhance effectiveness of forage seed value chains.

A better understanding of the information flow and knowledge sharing among actors along the value chain helps to improve technology adoption (Ramirez, 2013). It is common practise among farmers to consult other farmers and stakeholders on how best they can conduct better farming activities. Thus improvement in sharing of knowledge on forage seed production will inevitably increase livestock production and other benefits derived from forage seed production interventions.

Fellow farmers can be influential in creating linkages amongst other farmers and in this kind of network, it is best explained by the betweenness centrality principle. This network looks at the ability of a value chain actor to be an intermediary, that is, between two or more actors in the network. In the forage seed network, there are a number of actors who are acting as intermediaries in certain networks. For example, livestock research, local authority, farmers' union, animal health, agro-dealers, extension services for crops and livestock are central to the network and are connected to more than one network. This means they act as intermediaries to the outer nodes. The advantages of an actor becoming an intermediary. First that actor has information to give to the other two actors. For example, extension personnel can be intermediaries for different organisations for information dissemination since they are the ones in touch with the farmers more often. Secondly it might be because the centrally located actors in the network are more accessible in terms of geographical location or vicinity, have communication gadgets and it is easier for other actors to communicate with them. Another aspect is that as far as aspects concerning agricultural interventions are concerned, it is mostly through extension agents that information is passed so that it reaches to the farmers and this is no exception for forage seed production. In turn it requires the intermediary actors to be innovative, be alert and be able to effectively communicate with all other actors.

The closeness of connectedness has also an effect on how quickly actors can connect to each other. The far apart actors are connected, the slow information can be transmitted and the longer the actors do connect to each other. In other words it means the shorter the links, the quicker the nodes are connected within the network (Williams and Hummelbrunner, 2011). This may mean the actors have something in common and these actors also share resources such as training material, communication channels, and conduct almost similar interventions within the community.

6.2.2.3 Stakeholder K-cores

A k-core, a concept developed by Seidman (1983), is a maximal group of actors, all of whom are connected to some number (k) of other members of the group. A k-core makes use of identifying well and densely connected structures, making use of links with k number of connections within a network (Knoke and Song, 2008). The density of K-cores in this study is shown by the diagram above. The centrally located nodes have slightly higher connections compared to the rest of the noes. The K-core approach is more relaxed, allowing actors to join the group if they are connected to k members, regardless of how many other members they may not be connected to. Information content and flow should be highly monitored in instances of large K-cores as large flows may also give room to information distortion. K-cores can be and usually are more inclusive therefore promoting stakeholder participation.

6.2.2.4 Social network analysis on betweenness centrality

Betweenness centrality measures the possibility of a stakeholder resting between two others who are themselves disconnected. In this study, as evidenced in figure6.4, Division of Livestock Production and Development (DLPD) links farmers and Klein Karoo, also with Rural District Council (RDC). Prell (2009) asserted that stakeholders with high betweenness centrality are important for long term planning. This entails that the RDC and seed companies are important stakeholders for long term planning and bringing together disconnected networks thus bringing diversity of new schools of thought to the network.

6.3 Chapter summary

This study has identified the different stakeholders that farmers in the study area interact with at different levels and for different purposes in the forage seed systems. A key contribution from this study and data analysis is that opportunities to tap into knowledge pools are not equally accessible to all farmers. There are some sections of the network where some stakeholders are not in direct contact with others, for example, other farmers and feed manufacturers, local authority and some NGOs. This might be because the farmers are not into livestock keeping or production and the farmers find no reason to interact with such organisations. The findings also reveal the need for improved cooperation among stakeholders.

In this chapter, actors who have a link to forage seed production have been identified with their different roles that are interconnected. Findings are that actors along the value chain are important

for the functioning of the value chain. What is needed is to strengthen their linkages and facilitate information sharing and exchange. They (value chain actors) should appreciate the roles each player has and make use of each other's expertise in their own lines of operation. In the different wards under study, it has been observed that there is a web of social networks with different levels of relationships that have been developed between farmers and actors along the forage seed value chain. Those relationships between farmers, extension personnel and farmers' unions show that there is greater influence from these actors on adopting forage seed production.

There is need to explore further on the connectedness of the nodes, between them and closeness so that diffusion of forage seed resources can be improved among smallholder farmer. This also applies to communication channels between actors. Lead farmers can act as front runners in this as farmers easily adopt technologies when they see another farmer practising the technology. Therefore it becomes prudent to identify these lead farmers and other influential actors in the network and these need to be groomed to scale out any interventions to the rest of the community members. Although social network analysis is an important tool to analyse the relationships among actors along the value chain, it should be noted that these social networks are continuously changing over time, that is, they are not static. Therefore it becomes important when conducting such studies to make use of respondents who are very knowledgeable about the study site and subject matter. The study of the networks is a way to improve communication and relationships among the value chain actors. The analysis of forage seed value chains provides a platform to improve information and knowledge sharing within the network.

CHAPTER 7. ENHANCING FORAGE SEED PRODUCTION IN SMALLHOLDER SYSTEMS

7.1 Introduction

The chapter, in addressing objective 4 outlined in table 3.5, focuses on options for enhancing competitiveness of forage seed production and adaptable especially in smallholder systems. Farmers appreciate and are motivated when such activities are cognisant of their existence and are inclusive (FAO, 2013). To analyse factors that contribute to competitiveness of forage seed production as a business in smallholder systems, results of current production systems, challenges and opportunities, and value chain actors were used.

The chapter makes use of the economics of forage seed production as a business venture, thus employing Gross Margin and Sensitivity analyses approaches. These analyses contribute to decision making for farmers and other stakeholders along the forage seed value chain.

SEM was employed to develop a model for forage seed production, using data collected from 414 sampled households. The modelling approach was used to analyse factors that influence and significantly affect adoption of forage seed production by smallholder farmers. The SEM approach considers the household characteristics as measurable variables that lead to latent variables which have the impact on perceptions and decision making.

7.2 Enhancing competitiveness of forage seed business

A number of factors should be considered to make forage seed competitive in smallholder systems. These include input and output market, partnerships, sustainable intensification of production innovation platforms, policies, regulations and gender and social inclusion, which are shown in Figure 7.1.

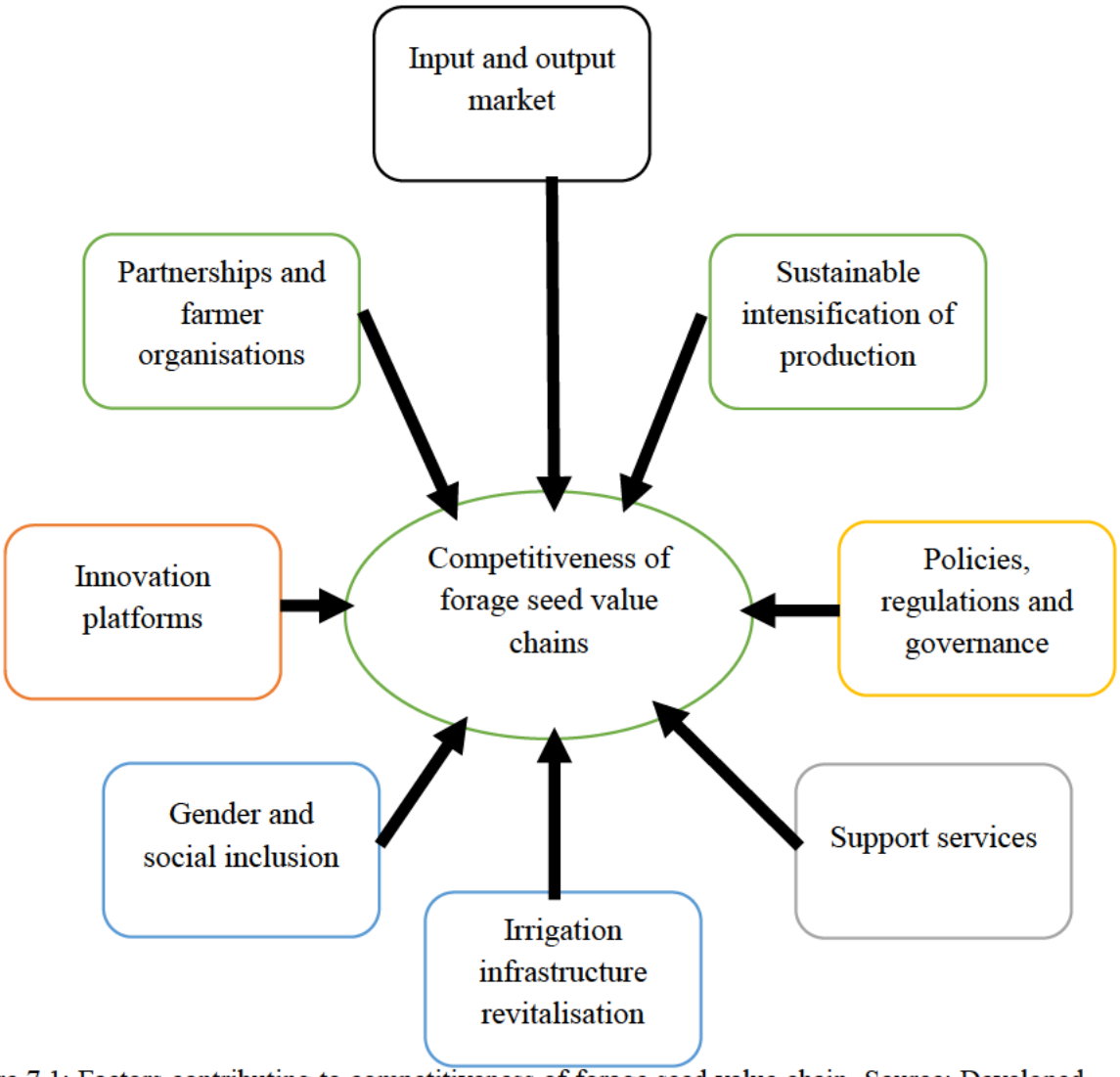


Figure 7.1: Factors contributing to competitiveness of forage seed value chain. Source: Developed by Researcher

7.2.1 Irrigation infrastructure revitalization

Results from the study indicate that farmers in the area depend on rainfall for crop production each growing season. There were no indications of the use of irrigation facilities. Even though the area receives rains that are adequate for crop production, the distribution of the rainfall is sometimes not even through the season. This makes it difficult to predict the rainfall pattern for the season and make concrete plans on crop production. Because of this, famers in the area prioritise food crop production than forages as they want to ensure food security within the household. Only when they have completed planting of food crops can they venture into forage seed production. This is worsened by the fact that they would be racing against the rains to establish crops in the field.

Therefore, in areas where there is potential for improved productivity, irrigation infrastructure development is an option. It is known that in Zimbabwe is one of the countries in sub Saharan Africa with water bodies which have the potential for irrigation use, although these are not being fully utilized (Murisa and Chikweche, 2015). It has also been recognized that availability of water for irrigation has a great positive effect on agricultural productivity. This is because irrigation has the potential to double the yields of rain fed (Mupaso, Manzungu, Mutambara and Hanyani-Mlambo, 2014; Murisa and Chikweche, 2015).

Before the Land Reform Program (1999-2000), the country is said to have had +/- 36.0 % of potential irrigable land of about 550,000 ha, which has since dropped to +/- 4.0 % (FAO, 2016). Rain fed agriculture is not viable, is very risky and unsustainable, especially in the wake of climate change and technological advancement. Therefore, investment is worth utilized in irrigation development and in this way forages can be included in agricultural activities. It has been noted that management of water in irrigation schemes for smallholders has been found to be poor (Gomo, Senzanie, Mudhara and Dhavu, 2014; Mutiro and Lautze, 2015).

Complex factors have been cited as contributing to this failure, especially in African countries where irrigation schemes have been set up for smallholders. Some of them include limited knowledge on operations of irrigation schemes on the part of the service providers, social dynamics that exist in these smallholder communities, limited technical capacity, poor set up of supporting institutions coupled with poor resource support, poor linkages to both inputs and output markets. In Zimbabwe, besides the above mentioned challenges, there is also inaccessibility of adequate and timely inputs, poorly developed and uncoordinated markets, limited back up services, weak governance structures, inefficient implementation of policies on set up of irrigation schemes especially for smallholder systems and little involvement of local community even if they are not direct beneficiaries of the irrigation scheme (Moyo, van Rooyen, Moyo, Chivenge and Bjornlund, 2016). Other factors include inefficient water allocation and scheduling. This then affects both production of crops and other farming activities that depend on the irrigation scheme, besides roles and responsibilities within the homestead. In this way, forage seed production, although it might have an opportunity in the irrigation scheme, may not benefit at all because of the challenges there.

Despite all this, water supply is critical for plant growth and maturation of seed which will give life to the next crop generation. Recommendations to improve on this are to manage farmer beneficiaries to fully participate in policies and best management practices so that they appreciate and embrace the concepts and what is expected of them in such interventions. Different irrigation types (conventional, sprinkler centre pivot, micro-jet and drip irrigation) can be explored for the different environments and management practices in smallholder systems. Then forage can be incorporated

in the cropping programs by farmers to efficiently utilise land and water, besides other benefits to be derived from use of these forages.

7.2.2 Intensification of production

Sustainable intensification (SI), as defined by Pretty, Toulmin and Williams, (2011), is a concept understood in a number of ways which are to increase yields per unit area, increase crop density or population or inputs per unit area and use of land to produce high value crops or commodities. Sustainable intensification has also been defined by Petersen and Snapp, (2015) as producing more food from a given piece of land area. However, the subject of sustainable intensification has been perceived as resulting in increased hunger and poverty among people, coupled with negative environmental effects. Other authors (Pretty and Bharucha, 2014 and Snyder and Cullen, 2014) note that sustainable intensification has challenges, especially in many countries in Africa. Thus, in summary, sustainable intensification for smallholder farmers involves the intensification of crop and livestock production, diversification of farming activities and integration of activities. On the other hand, sustainability encompasses the technical soundness of production, its effect on the environment, how it is perceived and accepted culturally and in society and whether it is adaptable and there is any economic sense in venturing into such activities (Figure 7.2).

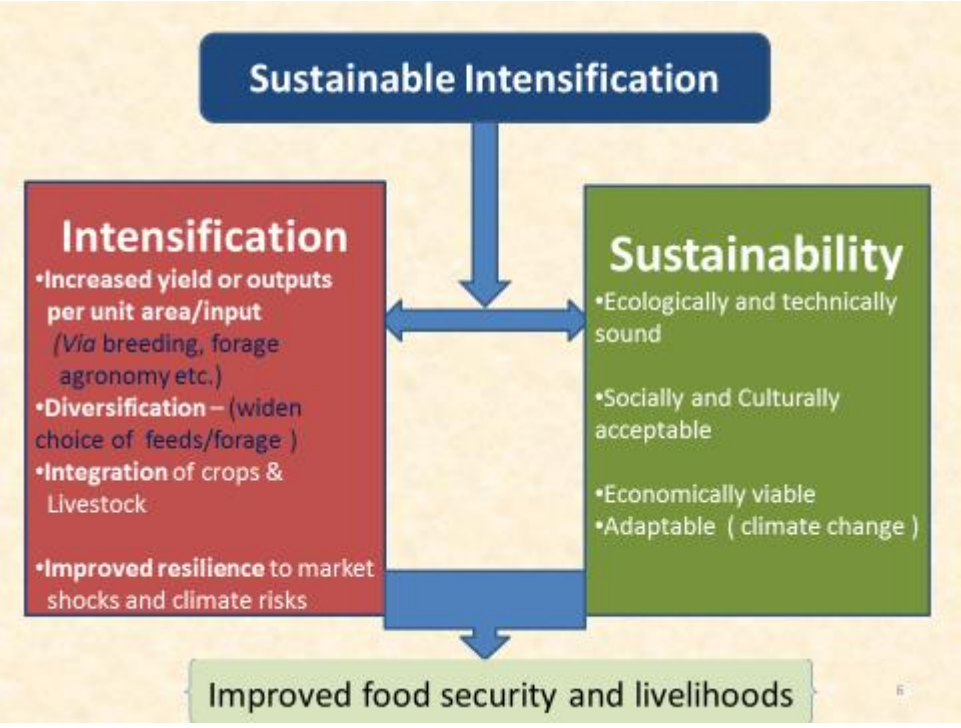


Figure 7.2: Sustainable intensification of production. Source. Adapted from Garnet *et al.*, 2013

Sustainable intensification explains the relationship between sustainability and intensification. In as much as intensification is important, it should be sustainable, thus it should be environmentally safe, socially and culturally acceptable and economically viable. Forage seed offer diversification in the farming system, thus spreading risk and generating income at the same time. Sustainable intensification should lead to improved food security and livelihoods and ensures farmers make efficient use of available resources within the household and do not waste any sourced inputs and protecting the environment.

This being the case, information is not very clear with some authors viewing sustainable intensification as a strategic platform or pillar to agricultural and economic growth in some African counties. The sustainable intensification system, they say, will be effective in areas and regions which are more densely populated and where households do not have adequate land to produce enough food (Vanlauwe, Coyne, Gockowski, Hauser, *et al*., 2014). Also when farmers are faced with lack of finance, technological advancement, good quality, high yielding seed varieties, and land, sustainable intensification will be the only option to ensure food security.

Sustainable intensification has also been viewed as protecting the environment and enhancing agricultural production. By this, competitiveness of agricultural activities and products will be improved. Thus farmers who encompass sustainable intensification practices maybe geared for success as they produce more from a small land area. They would concentrate efforts and inputs on a small piece of land, thus reducing input costs, losses and improving on production. As smallholder farmers are associated with small land sizes, leave land fallow for various reasons including limited inputs to fully utilise the land, can embark on sustainable intensification in order to increase production, save costs and concentrate efforts on the small land area.

Farmers in the study area have 1.4 ha arable on average, with about 45.0 % being allocated to maize (staple food) production. Land is therefore not adequate and there is need to produce more on the available land area. Sustainable intensification is one approach to address this. Farmers also do not use much fertilisers and chemicals, thus sustainable intensification become handy as the little inputs will be used efficiently. In this way, forage seed production can be accommodated on the land using the available resources such as fertiliser, labour and chemicals. Sustainable intensification needs to look at integrating crops and livestock within the context of whole farm system especially for smallholders. These smallholder farmers are characterised by activities that are both crop and livestock oriented and they complement each other. Crops depend on livestock for nutrients through manure application and draught power for land preparation and harvesting. Livestock also benefit from crops through quality feed as silage and hay. To achieve this, forage seed needs to be available.

For livestock production to improve, there should be improved breeds that perform better in terms of productivity, adaptability and ease of use.

Forage seed production fits well in the sustainable intensification approach, even where conservation agriculture system is employed. Forages are used as cover crops to conserve moisture, improve soil nutrient status and in intercropping systems. It is believed that smallholders have great potential to improve productivity (Pretty *et al.*, 2011). Results from the study show that there are on average 3 members in a household that can provide labour and this is not adequate for full utilisation of the arable land sizes and intensification will ensure efficient utilisation of household labour.

7.2.3 Innovation platform approach

From FGDs that were conducted in the study area, it was revealed that there were innovation platforms (IPs) developed at ward level and about 50.0 % of the farmers were members of the IPs. The innovation platforms have committees composed of chairperson, secretary, treasurer and two to three committee members. The purpose of the committee is to facilitate meetings of stakeholders, attend meetings and other fora at district and provincial levels, communicate any information to members and give feedback following any meetings. The innovation platform committee members have also managed to negotiate with service providers, including sourcing for prices at field days and sourcing markets for forages and seed. The innovation platforms have also collectively managed to discuss with a seed company for contracts during the 2016-17 growing season to produce lablab forage seed. Actors who have been active in these forage seed production discussions include NGOs, local extension personnel, seed companies, crop input suppliers and local agro dealers.

It is believed that most African economies are agriculture based and this is no exception for Zimbabwe, thus to ensure economic growth and sustained food security, there is need to promote conduct development focused research in order to commercialise agriculture in smallholders. However smallholder farmers find it difficult to fully participate in markets due to a number of reasons. These include limited knowledge and information on market requirements on quantity and quality, farmer perception that one cannot just participate in markets (inferiority complex), transaction costs that are beyond the reach of smallholder farmers. Interventions to overcome these complex challenges are not straight forward. Various strategies need to be formulated which are intertwined and at different levels (farmer level or institutional level) and may include aspects such as infrastructure (roads, communication network and markets), capacity development of the service providers, creating a conducive environment that meet farmers' needs. Innovation platforms aim to bring together actors along the value chain to communicate issues and have a sense of accountability and transparency and respect of other stakeholders along the value chain.

It should be noted that innovation platforms are not homogeneous in nature. Pumuk, Bulte and Adekunle, (2014) revealed in their study that there is variation on success rate of innovation platforms even at local level. This is also evident by the fact that innovation platforms cover a wide range of actors who have different views and aspirations and at different levels of engagement, that is, from policy level to farmer operational level. Thus success of innovation platforms depend on objectives for discussion, participants involved and prior knowledge the participants have on the subject matter, among others. In the life cycle of the innovation platform (Figure 7.3), that is, from formation to redesign of interventions, differences in rate of adoption and understanding of the importance of innovation platforms can result (Mango, 2012).

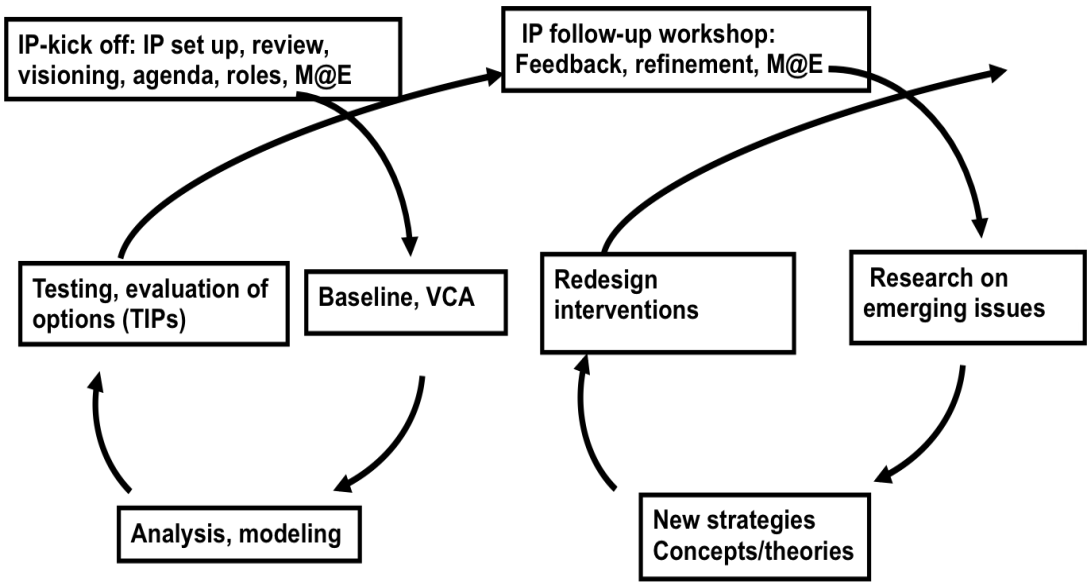


Figure 7.3. Innovation platform life cycle - structure of assessment, analysis, M and E, feedback and adjustment (adapted from Mango, 2012)

International agricultural institutions have been instrumental in the promotion and formation of IPs in the study sites, which were not known before then in the area. Most innovation platforms have been initiated by development organisations (van Rooyen and Homann, 2009) rather than the stakeholders themselves as this is a new approach to participative development and the process (Figure 7.4) needs a facilitation team to kick start the process and ensure its sustainability even after the life of a project. Extension personnel and development partners were initially trained on the IPs, what they aspire to achieve, who is involved, how they function. This was followed by consultative meetings in the study sites to introduce innovation platforms and let the farmers and stakeholders known what it involves.

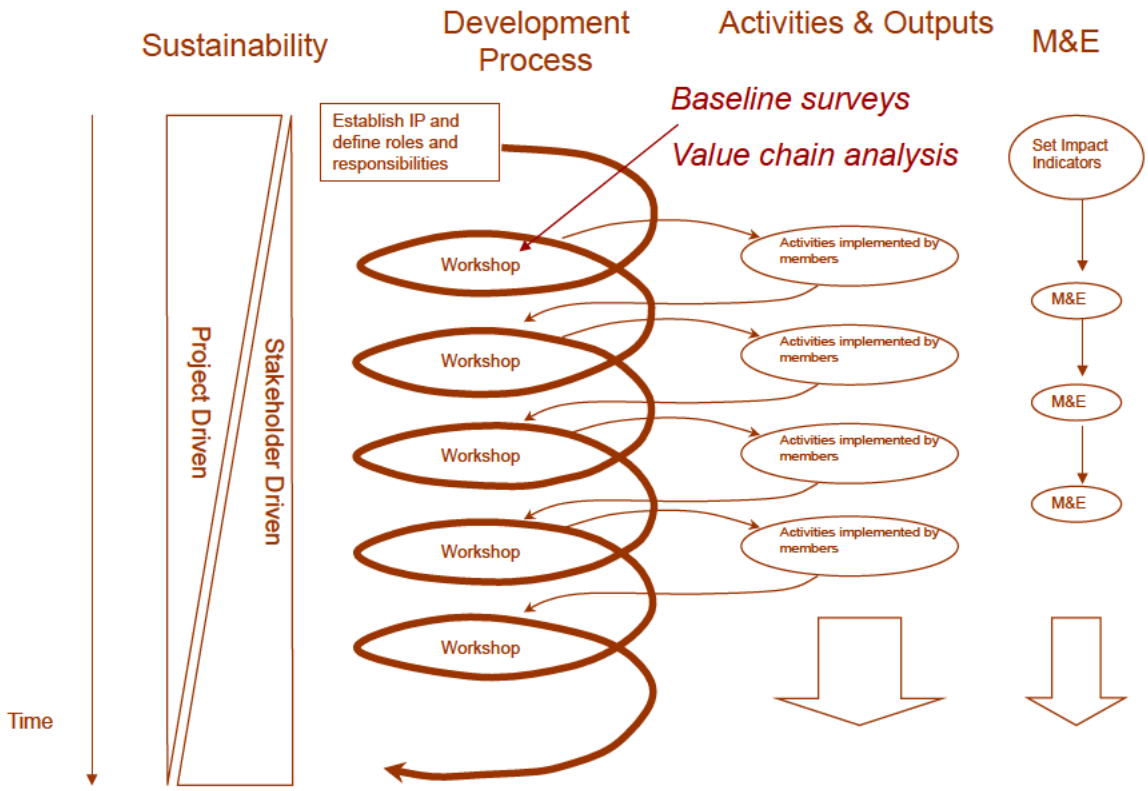


Figure 7.4: Innovation platforms as iterative processes. Source: van Rooyen and Homann, 2009

This made the formation of innovation platforms easy and enabling all interested parties to participate in discussions. It is also believed that farmer field schools, on-farm demonstrations and field tours have developed into innovation platforms over time. This is because, they have involved a number of stakeholders who were invited to the field schools and demonstrations to discuss on the subject matter. This has also resulted in increases in agricultural production, networking among stakeholders and improvement in communication (van Paassen *et al*., 2014). In the long-run, IPs develop into long-term relationships between stakeholders. They can initially be for other purposes but develop into those for crops, livestock or other commodities. Initially innovation platforms were developed for natural resource management, with the idea of sharing resources among stakeholders, besides collective management of the resources (Rölling *et al*., 2002). This is also the case from the study where results reveal that the different actors along the forage seed value chain communicate at different levels and for different purposes, for example, research institutions, seed companies, agro dealers and farmers.

It is the aim of innovation platforms to stimulate a culture of communication on technological innovations, new management practices, policies, markets and continuous involvement in innovative agricultural production and marketing. This is important in that stakeholders realise their existence in the value chain and that they need each other to facilitate the effective functioning of

the value chain. Also new and innovative ideas are developed in the innovation platforms that will benefit all stakeholders, besides sharing skills, information and resources (Schut, Rodenburg, Klerkx, van Ast and Bastiaans, 2014).

However, not all successes of value chains are a result of innovation platforms in smallholders (Markelova, Meinzen-Dick, Hellin, Dohrn, 2009). Some challenges have been observed in innovation platforms. Besides unlocking pathways for smallholder inclusion in value chains, innovation platforms have revealed group dynamics, some of which do not have coherent and positive relationships among the participants. Tensions, serious conflicts and lack of transparency have jeopardised the sustainability of these innovation platforms (Mahiya, 2016). To reduce failures in innovations platforms, training and capacity building is necessary as the initial phase in the process. This helps facilitators to fully understand the concepts involved and how to deal with a diverse of people and organisational cultures. The process also helps to build trust and create a conducive environment for information exchange. Innovation platforms should also not follow the top-down approach, like the design of most extension programs which follow a linear process and result in one size fits all recommendations. It should be participatory in nature and include all stakeholders in one meeting where everyone has an equal chance of participating and contributing to the discussions. Farmer organisations should be applauded for playing an important role in mentoring farmers to engage with stakeholders along value chains without the use of innovation platforms.

7.2.4 Input and output market

Lack of market for forage seed was one of the constraints highlighted by about 14.6 % of respondents. This implies that action needs to be taken to deal with market unavailability for forage seed. As agricultural productivity improves, farmers become more secure in terms of household consumption and the next step will be to venture into markets to sell excess produce. Sustained agricultural production also depends on opportunities that exist on the market, therefore, strategies need to be developed that incorporate competitiveness and profitability of agricultural enterprises for smallholder farmers. If farmers venture into forage seed business, they will need to look for the forage seed markets as they are not able to consume it in the home. However, present governments and development organisations are trying to find ways to enhance market opportunities and diversify avenues that enhance farmer participation.

Even though some of these strategies and initiatives to link farmers to markets have targeted export markets with the aim of economic growth, the majority have been using the top-down approach, thus lacking community participation and empowerment. Results that have come out of such

approaches have been varied in that most of the export markets are niche markets that call for specialities with high quality standards with requirements that smallholder farmers fail to meet. It is important to note that the forage seed market is one such market which is specialised. Such markets will only be utilised by a few farmers, who will then create a cartel of farmers, who will deal amongst themselves whilst smallholder farmers are not able to meet the requirements including costs and other related requirements to protect themselves from competition, resulting in the exclusion of smallholders. An example is that of the former Pasture Seed Growers Association which used to have commercial farmers as members and they were the ones responsible for the production and marketing of forage seed. Since its disbandment, no pasture seed has been produced and all is being imported. However, new opportunities exist on the local forage seed markets. There is a high demand for forage seed by various clients including livestock farmers, seed companies, crop farmers who want to improve soil status. Njuki, Kaaria, Sanginga, Kaganzi Magombo, *et al.*, (2007) mention that even though farmers are risk averse, agriculture activities are known to be risk business and one needs to understand especially, financial risk.

It has been noted before that forage seed is scarce. To enable farmers to access it, a number of initiatives can be explored.

- Government should initiate sourcing forage seed from local and outside sources. This could be importation of breeding material. This would be bred, tested and evaluated at national research institutes for conformity, adaptability to local environment and management practices, and seed multiplication for distribution to farmers. However, such initiatives require adequate funding and there is no recoupment of funds utilised for the initiatives. Government should also resource the research institutes by way of qualified researchers, equipment and funds. Currently research institutes are under resourced and not much can be achieved under such operating environments. This will also include on-farm research for development so that research results do not gather dust on shelves but are adaptable and adopted by farmers.
- Private companies can be engaged to breed or import forage seed, multiply and certify before selling it to the farmers at a profit. This is a sustainable approach although the final price of forage seed may be beyond the reach of many smallholder farmers who may be interested in the venture.
- Government or private companies can engage farmers to produce and multiply forage seed and the former would need to inspect production process before certification of the seed and selling to other farmers. This has to be supported by trainings for farmers and extension agents on production, harvesting and quality standards for forage seed.

Continuous importation of forage seed is not sustainable and drains a lot of other resources which might be channelled to other sectors.

7.2.5 Policies, regulations and governance

Promoting commodity exchanges play an important role in providing platform where farmers and traders interact and exchange commodities. In most countries, commodity exchange markets exist for food crops, other crops and livestock, both at local and export market. Commodity exchange market play a role in that prices can be stabilised and this allows farmer organisations to hedge against any price risks. These markets are used also by banks as collection mechanisms.

Compliance with market requirements and standards include assisting smallholder farmers meet market requirements, that is, they produce based on market demand. Loans can be advanced to farmers to invest in irrigation, infrastructure, farm equipment, vehicles and other investments. This will ensure success and reduce risk associated with weather, storage and handling. Forage seed also requires such interventions. Most smallholder farmers rely on rainfall for crop production. In order to produce good quality seed, there is need for irrigation infrastructure and other support services.

On governance issues, forage seed enterprises need proper management of finances and infrastructure and the accounting of all inputs as well as services provided (Vernooy *et al.*, 2015). Farmers should be very responsible, be able to record every activity, roles and responsibilities. This will give the market confidence in what the farmers are producing, making it easy for them to buy the product whose quality is assured. Farmers need to be supported especially through trainings and other technical services. It is important to note that farmers are not allowed to sell their farm-saved seed although policies to protect farmers' genetic resources are still lacking. However, development organisations have taken strides to create seed banks in an endeavour to address this shortfall. In most national seed policies and regulations, they address issues to do with seed production, multiplication, certification and distribution, also variety screening and registration and protection of plant breeder's rights. These also have to take cognisant of the smallholders so that they are able to meet the standards and operate at par with commercial entities.

It is estimated that the current share of global seed market in Africa is limited to less than 2 % of the international trade (Waithaka, Nzuma, Kyotalimye and Nyachae, 2012). This is despite the fact that most of seed trade is said to occur in southern African countries. Only a few crops are involved in this, namely maize, wheat, sunflower, soya bean and cotton.

Therefore, policies to be developed need to integrate all seed systems and create a conducive environment for all players. In this way, the informal seed system will be developed and aligned to

the formal system. There is need for policies to support accurate data capture on seed demand, seed breeding, registrations, certifications and variety release. This means the private sector should be involved for institutional support, quality assurance and market infrastructure development. There should be tax exemptions on imports of necessary equipment and other materials required for the seed system to function.

7.2.6 Partnerships and farmer organisations

Farmers should be encouraged to be in partnership with agro-businesses and traders. In such partnerships, the farmers are guaranteed of a market, also technical support and inputs as the partners commit to buy the farmer's produce. In the long-run, this will formalise participation of smallholder farmers in value chains, encourages transparency on all parties and build trust and strong relationships. Farmer associations can play a role in the establishment of these partnerships and foster good relationships and such relationships can exist in different forms. Partnerships can take the form of contracts where there is an agreement between the parties. The farmers agrees to produce a certain product and the prospective buyer either offers inputs in advance, technical support or no inputs but guarantees to buy the product under certain agreed terms and conditions. In other partnerships, it can take the form of a farmer being offered advance finance for the development of certain infrastructure, then there is production and the financier helps the farmer to get the market. Income generated will be used to repay the loan advanced.

Various forage seed production systems can work for smallholders due to the nature of the social set up and environmental conditions. Seed production systems mostly focus on commercial seed production and this will result in shortages of "inferior" or underutilised seed, including forages. Thus all stakeholders (government, NGOs, private sector) in seed production need to be involved.
Farmer organisations play an important role in enhancing the functioning of seed systems. If farmers become members of farmer organisations, they benefit by accessing information, getting subsidised inputs, transport and other things. Also prices can be negotiated on their behalf. Unfortunately in most cases, smallholder farmers do not join farmer organisations citing a number of reasons, the membership subscriptions are too high and beyond reach, the unions are concentrated in towns and rarely get in touch with farmers in the rural areas and not much benefit has been realised from being a member. On the other hand, farmer unions claim to serve the farming community well and would encourage all farmers to join.

However, farmer groups and organisation may fail to sustain themselves due to a number of reasons. Some of them include members that may not have joined voluntarily to share resources and responsibilities, conditions of joining the farmer organisation might be too restrictive such that

members are disgruntled and members may seek different benefits which the organisation might not be able to fulfil. Therefore, it is necessary that members join willingly and are aware of the objectives of the organisation.

For forage seed business, it is worthwhile for a farmer to be a member of an organisation since this is a unique product and costs are involved during production and marketing. Marketing requires expertise and identifying the right market with favourable prices. Farmer organisations also offer trainings on agricultural aspects, farming as a business and offering negotiating skills. However this may come with costs attached as the farmer organisation needs to operate and pay for some of the services. Of late, farmer organisations have partnered with virtual platform service providers to facilitate quick access to information by farmers. This has also tended to reduce associated costs incurred by farmers. Farmer organisations have been known to assist smallholders enjoy economies of scale for supplies and access to goods and services.

7.2.7 Farmer training and capacity building

Capacity building of small holder farmers has been seen as very important in recent years and many development organisations are valuing this aspect. This is through improving the level of education and skills, and empowering communities on health and nutrition. Capacity building contributes to alleviating poverty, besides infrastructure and technological development and in communities where they are poorly resourced, capacity building will be very important. Approaches that can be employed to enhance capacities among smallholder farmers include, participatory learning, activity-based learning, skills and knowledge sharing, field days, Farmer Field Schools (FFS), field demonstrations, field tours and exchange visits. All these help farmers to understand, practice and be able to replicate at their own time and area. Tsado *et al.*, (2014), reiterates that trainings need to be frequent and focussed so that farmers continually improve on practices. Through hands-on learning, farmers are able to practice and share their skills with fellow farmers. Therefore there is need to encourage farmers to be peer teachers and to share knowledge.

It is believed that farmers participate in trainings when it is convenient for them and have seen potential benefits from the training (Ndou, 2012). Farmers need all the support in their agricultural activities so that they can improve on production, are up to date with technology advancement and can access goods and services. Therefore, research needs to include farmers by conducting on farm based research. Farm based research seeks to bridge the knowledge gap between researchers and the farmers who are on the ground. This will help in alleviating global hunger, especially among the rural population in many developing countries. In so doing, this will take into account farmers' indigenous knowledge, skills and experiences, social dynamics and community cultural practices and beliefs. For example, in Zimbabwe there is a day (*Chisi*) in a week when community members

make it a custom not to go to work in the fields nor carry out operations like weeding and harvesting. Each community chooses its own day of 'Chisi'. On this day, farmers are free to carry on with other activities within the household or attend village meetings, including those that are agricultural related. It is the responsibility of the local leaders to enforce this and extension staff and development organisations need to be aware of such days within a community. Thus when researchers develop and design on farm work, they need to take note of rest days. Thus, it is necessary to include farmers in design of on-farm project interventions. In this way realistic implementation modalities can be formulated, including trainings and demonstrations to showcase interventions. Training approaches may include farm demonstrations, field days, field and exchange visits, farmer field schools and lead farmer approach. Methods of training also depend on farmers needs and expectations (Uzonna and Qijie, 2013) as these may also include videos, role plays, drama, film shows and group discussions. However, despite all these training approaches that have been introduced, smallholder farmers continually remain poor and are unable to improve farm productivity.

According to Uzonna and Qijie, (2013) and Ndou, (2012), effectiveness of farmer trainings depend on a number of factors including the approach used at trainings, effectiveness of the facilitator, relevance of training to the audience, timeliness of the training and participants' gender in relation to subject matter of the trainings. Farmers are known to research for information on their own, to verify what they will have been trained on and to look for further information. However, practically there are bound to be differences in the way farmers understand what they will have been trained on. This also results in variances on the effects these trainings might have on technology adoption and farmer behaviour.

Four principles are said to govern capacity building since this is a process and it is a long-term investment. These include:-

- The promotion of inclusion of smallholder farmers in market-based approaches. This increases farmer participation for improved livelihood.
- Creating an enabling environment for capacity building. Farmers will be free and able to participate.
- Building on existing knowledge, skills and strengths of individual and local organisations. These will in turn cascade their knowledge and skills to other farmers in the community. This can be through lead-farmer approach or host farmer demonstrations.
- Demand driven capacity building will be more relevant and sustainable. Only in instances where new technology is introduced that capacity building is initiated top-down.

Continuous improvement and innovation - There has been an increase in the use of participative approaches in agricultural activities especially those that make use of problem identification and needs assessment. This is because of insights into what farmers want and then focus on developing those interventions (Clark and Timms, 1999). The Continuous Improvement and Innovation (CI and I), initiated by Clark and Timms (1999), is a form of adult learning which looks at capacitating farmers and stakeholders so that they improve on identifying and prioritising needs, management practices, farm profitability , risk management and sustainability of farming enterprises (Figure 7.5). This is through decision making, innovativeness, inclusivity, processes and practices. The CI and I also allows for reflection and redesign of activities. For forage seed business, especially in smallholder systems, in study sites, CI and I is very relevant and appropriate as it caters for all situations, including handling and overcoming challenges with the involvement of farmers, who are the beneficiaries from the processes. The CI and I processes involved are situation analysis, impact analysis, action design, implementing action plans, then assessing performance and finally reflection, synthesizing and redesigning if need be.

Figure 7.5: Continuous Innovation and Improvement. Source: Adapted from Clark and Timms (1999)

7.2.8 Gender equity, social inclusion and training

The study has also considered gender roles and responsibilities. Data was collected using household surveys and focus group discussions. Results show that women are involved in a number of activities at household level (Tables 4.6 and 4.7). They do almost all of the cropping activities, except in a few instances where men are dominant, such as land preparation and spraying. In livestock activities, women are less involved in treating sick animals and marketing, but involved in the rest of the activities including herding, milking, feeding and sourcing of livestock related inputs. Results of participation of women in agricultural activities agrees with findings from Ogunlela and Mukhtar, (2009) and Mabundza, Dlamini and Nkambule, (2014) that in sub-Saharan Africa women are more involved in agricultural activities. This shows that women have an important role they play and there is need to develop interventions that take note of gender dynamics and its effect on farmer livelihood.

To enhance competitiveness of forage value chains, there is need to understand what roles are played by both gender. Research has also not dealt with gender issues adequately to acknowledge the need for capacity building and gender empowerment in order to address issues of hunger and poverty (Meinzen-Dick, Johnson, Quisumbing, Njuki, Behrman, Rubin, Peterman and Waitanji, 2011). This suggests that efforts should be made to develop interventions that promote growth in agriculture and take into account gender issues, especially those that undermine poverty objectives. This should involve:-

- Creating a conducive environment for the participation of women and under privileged members of the community. This involves having an array of options that a farmer can select from depending on available resources, ability to accomplish tasks involved ;
- Encouraging equal participation irrespective of gender, race or disability. Full participation encourages adoption of forage seed technologies as there is room for understanding and practising;
- Identifying income sources and levels for all including women and disadvantaged groups of the society. Through forage seed sales, farmers can sell some seed to other farmers and generate income;
- Promoting women to join producer groups and organisations. If women join producer and farmer groups, they increase chances of becoming leaders in the organisations. Also chances of their voices and concerns being heard will be more. In many of these organisations and groups, there is promotion of equal participation of men and women;
- Reducing any barriers that might hinder participation of women in forage seed value chains; and

- Developing technologies that save on labour and time. Women would adopt forage seed production if it yields increases in saving labour and time to do other activities within the household. Planting of forages that also act as green cover crops would help to reduce weed density, thus a saving in labour for weeding.

Women are known to be able to be careful and particular, especially on seed production and storage. These aspects include seed harvesting, cleaning and packaging, ensuring that only the best seed is selected. In so doing, forage seed production will be suited in their activities. This will require forage seed species whose management can easily be handled by the women. If machinery is to be used, this has to be easy to operate and handle for maximum benefit. Smallholder farmers do work hard and in particular women who also have to take care of children in the home. Agricultural interventions that lead to less time for women to look after children have led to malnutrition. Therefore, in order to have a positive impact in smallholder systems, interventions have to be gender-sensitive, that is, taking into account the role of men and women in agricultural activities, and the role of men and women within the household taking care and providing for the family. This includes time allocated for labour, allocation of resources and decision-making. Studies have shown that empowering the women also increases chances of increasing their incomes through improved nutrition and health of their children as compared to increases in men's income (Dioula *et al.,* 2013).

Even though the literacy level (97.0 %) is high in the study area, less women reached as far as secondary school than the male counterparts considering their respective categories. In the female category, 44.0 % reached secondary school, compared to 49.0 % that reached primary school level. On the other hand, 60.0 % got as far as secondary school level whilst 27.0 % went as far as primary school level. This implies that when designing trainings that include women, there is need to make use of approaches that participants easily understand, even using local languages and demonstrations for maximum effect. Even though extension agents and development organisations have conducted trainings to farmers, challenges have been encountered in getting information to female farmers. This has been because trainings are conducted at times that are not convenient to them, trainings are complicated and language is not understandable (Oyugi, Amudavi, Nandi and Ombati, 2014). Also the design of trainings is sometimes not appropriate to combine both male and female participants as their needs in agricultural activities are different. Female farmers have other responsibilities within the home other than farming activities. Thus they will prioritise home chores than attend to trainings.

Gender dynamics are an important aspect to analyse as it influences participation and benefits accrued by smallholders in forage seed production and marketing. This has to be seen as a priority and a goal in its own right. From the past few years there is a growing interest in gender inclusion

in development programs, particularly women who have been viewed as underrepresented. Adoption of technologies by women has been observed to be low (Ragas, 2012) as a result of limited access to services and resources. It is further suggested that most women fail to access resources and this presents major challenges as compared to efficient utilisation of the resources. Even though efforts have been made in addressing this, gaps still exist on the inclusion levels of women in market-oriented agriculture. Women play a big role in agriculture, even though perceptions are otherwise. Statistics show that 43.0 % of the labour force (50.0 % in Africa), especially in developing countries, in agriculture is composed of women (FAO, 2011). The World Bank (2013) advocates for women programs should be inclusive and participatory for interventions and innovations to be sustainable.

7.2.9 Support services

To improve effectiveness of value chain processes and actors, there is need for support services to develop business activities on input supply, research and extension, transport, market information and communication, and credit facilities. These services are important in that they create a platform for new innovations emerging from the market and create an environment for competitiveness and may result in sustained business activities. This is also the case with forage seed value chains.

Inputs supply – Inputs need to be accessed by actors along the value chain at the right time, in the right form and required quantities. These inputs may include crop seed, fertilisers, chemicals (herbicides, pesticides and fungicides), implements, packaging material, irrigation water, veterinary drugs, stock feed, syringes, spare parts and protective clothing.

Research services - Research services are essential for the development of new and improved varieties. Research will involve breeding of new and improved germplasm, variety screening and evaluation, environmental and management adaptability tests, adoption rates, seed multiplication and certification, technology development, production costs, crop and seed quality. In this way, research services becomes handy to improve on forage seed and ensure competitiveness. This is through low production costs, easy management, improved varieties, adaptable forages for various purposes including livestock feed, income generation from seed sales, soil improvement through nitrogen fixation by legumes and integration into cropping systems such as crop rotation and green manuring. In this way, research can foster farmers to move a step forward towards commercialised agriculture.

Extension and advisory services – For forage seed value chains to be successful business, there is need for effective and efficient extension service support. This can be through the local ward based government extension personnel from AGRITEX, Division of Livestock Production and

Development or NGOs. These offer technical information and extension advice on plant establishment and management practices on different agricultural aspects. This maybe for production, harvest, post-harvest handling and packaging, marketing and marketing information. In this category, development organisations are included, such as local and international NGOs.

Some private companies offer extension services but at a fee, although smallholder farmers may not be able to meet the costs which they consider unaffordable. Companies offer extension support for specialised activities and products. Thus, for forage seed, seed companies become handy in providing extension and advisory services. Extension services are known to enhance empowerment of farmers through trainings and capacity building of activities in agriculture and demanding for extension services within and outside their communities.

Extension service support should be innovative when working with both men and women as their extension service requirements maybe different. This may result in extension agencies not getting the required information from either party because of gender barriers, illiteracy. For example, female farmers may not be comfortable working with male extension agencies on certain agricultural activities such as mating in livestock. This will require that a female extension agent trains the women farmers instead.

Transport services – In many cases, transport issues are overlooked yet they are important in movement of goods. In forage seed, transport is involved in movement of input from market to farm, also of product from farm to market. Smallholder farmers usually buy inputs in small quantities which normally does not incur any transport costs. In cases where input quantities are huge such as fertilisers, and the taking produce to the market is involved, transport issues come into play. If a farmer buys a 50 kg bag of fertiliser, one has to pay a fee to transport the fertiliser bag from the shop to the homestead. For the study sites, transport ranges between US$2.00 and US$3.00 50 kg^{-1} bag. On sending seed to the market, transport costs also need to be met. It should be noted that the farmer also has transport costs to meet, that is, travelling to and from the market.

Mode of transport is another aspect that has to be considered in the transportation of forage seed. Seed is very delicate and important, any mishandling would lead to reduction in seed viability and huge losses. For example, some seed lose viability when stored or transported at temperatures above certain levels. Trampoline tent material is not encouraged for use when transporting seed material as heat is generated and will cause the seed to die and not germinate when planted. Seed material is easily affected by such environments include groundnut and soya bean. Seed needs to be packaged in appropriate packages that allow aeration during storage and transportation.

Distances are also important aspects to consider when transporting seed material. Farmers can have own transport and in this way, one is assured that seed will arrive in good condition and on time. Farmers can outsource transport for convenience and economic reasons. When outsourcing such services on seed material, care should be taken note of on the mode of transport, type of vehicle to be used, distances to be travelled, seed storage at drop-off points, prevailing weather conditions (rain, heat), transporter's experience in seed handling, road condition and costs involved. All these contribute to the competitiveness of forage seed value chains as they affect the product that will be sold on the market.

Market information and communication – Market information is essential in that farmers should know types of inputs, sources of these inputs, when they are available, when to send produce to the market, market requirements on quantity and quality, timing of buying or selling, packaging and costs involved. Knowledge of sellers and buyers is also important as it will assist in knowing how much is wanted, payment terms and if products will be delivered at the door step. This also applies to contracts, input schemes, joint ventures and similar production arrangements.

In forage seed, seed companies are involved, besides other famers. Seed companies buy from the farmers, clean and treating the seed and certify it before selling it to potential seed buyers. In this way, it reduces transaction costs for the producer farmers although there maybe instances where of farmers are being paid lower prices than the real value of the seed. Farmers also access market information from other farmers, farmer organisations or farmer unions, bulletins and magazines, and virtual platforms such as Ecofarmer and ESoko that provide information on agricultural activities and marketing to members who are subscribed. This enables farmers to make informed decisions on where to buy or sell.

Other information is available on the internet, but very few farmers have access to such platforms. Mode of communication include mobile phones, print media and word of mouth. The use of mobile phones has had a great impact on communication among farmers and other stakeholders. This has also resulted in reduction of transaction costs.

7.2.10 Seed companies engaging smallholder farmers in seed value chains

Seed companies in Zimbabwe focus mainly on food crops such as maize, sorghum, sugar bean, soya bean, groundnut and cowpea. Some used to include forage crops such as forage maize, sweet sorghum, lucerne, oats, rye grass and sun hemp. Unfortunately due to the unfavourable economic environment, forage seeds were no longer on their lists. Also the fact that most forage seed is self-pollinated and some is vegetative material discourages companies from producing seed as it is not

marketable. With such seed material, farmer tend to harvest own seed from better performing plants and store it for use in next season. This notion agrees with Guei *et al.*, (2011) that private seed companies involve themselves less on self-pollinated crop, even those with seed in the form of vegetative materials. It is believed these seeds have a low market value compared to hybrids.

Also with the recurrent droughts and floods, there has been a shift to focus on emergencies in terms of food security. Input programs were developed which included the procurement of crop seeds from seed companies. This new development made seed companies to refocus on what would make them grow their businesses and make significant profits.

From in-depth interviews conducted with seed companies, the companies indicated that they are willing to engage smallholder farmers in seed production. They also highlighted that if smallholders are to be engaged, a number of issues have to be addressed. These include thorough selection of participating farmers, training them on seed production aspects and working with those willing farmers than taking all including the speculators. Seed production is a specialised industry and thus requires expertise. To get seed from smallholder farmers need patience and mentoring so that quality standards are met. Farmers to be engaged need to show some level of commitment and be prepared to commit some of their resources rather than wait for government and donors for assistance. This agrees with what was highlighted by Tekalign, (2014), who conducted a study in Ethiopia. However, farmers will need mentoring and guidance so that they become experts in forage see production and marketing. More and frequent trainings need to be conducted on the different aspects of forage seed production, from agronomy, harvesting, cleaning, packaging, storage and marketing.

However, in as much as seed companies have an interest in engaging with smallholder farmers, there are many challenges that include:-

- The geographical location of rural farmers at times makes it difficult to implement seed production interventions especially field inspections of seed crops, unless farmers are concentrated in an area or community and fields are close by and maintaining isolation distances.
- In Goromonzi and Murewa, average arable land sizes is1.4 ha. Therefore, engaging many farmers in the community will not be feasible, more so when they are scattered geographically and when one wants to achieve quality see production, seed purity and meet other quality standards. Either farmers in such communities need to organise themselves in groups, get a common land area which they can use for such purposes or it will be farmers in close proximity for ease of management, trainings and information flow.

- Seed companies discussed with during in depth interviews said that smallholder farmers are known to be untrustworthy. Situations have arisen where a farmer is contracted, then after harvesting, diverts it produce to another market. The situation is worse when a farmer has been advanced inputs as the company would want to recover input costs from sale of produce.
- Smallholder farmers want to receive free inputs whenever an opportunity arises and these attitudes have given rise to a dependency syndrome. They suggest that companies would engage only when they see that a farmer has potential to repay or fully utilise the pre-financed inputs.
- Seed production requires good and conducive environment and water availability is crucial for plant growth. Climate change now requires seed production initiatives that provide water for crop and animal production. This is beside the fact that breeding should be towards drought resistant varieties.

However, to overcome these challenges, seed companies need to engage smallholder farmers more frequently, build relationships and grow the seed business for a win-win situation.

7.2.11 Financial inclusion

From the study, results on stakeholders indicate that there are no stakeholders from financial institutions (FIs) that the farmers interact with. Most of the stakeholders highlighted are extension staff, development partners, research, agro dealers and other farmers. Financial institutions that appear on the network are at a distance, implying that farmers do not have direct links with financial institutions.

If the forage seed business is to develop, there is need to have financial packages for smallholder farmers that are tailor-made to suit the needs and agricultural activities. Smallholder farmers do not qualify for financial services as they are said to high risk, yet suitable financial services can help to reduce the finance gap, thereby stimulating growth (IFC, 2014). Unfortunately the setup of most financial institutions in Zimbabwe is towards commercial agriculture, thus leaving the smallholders without access to financial services. Their lending criteria does not accommodate smallholder farmers.

Financial institutions (FIs) need to develop different packages that suit the different farmer categories at it does not have to be a one size fits all. This is because these FIs are said to generate employment, rejuvenate production among the farmers and within the sector and helps to reduce naturally occurring disasters of economic importance (Nwanyanwu, 2011). Farmers have different

financial requirements, which makes it more complex and have crop and livestock integrated activities at the farm (Oruenyo and Musa, 2012). Finance to activities such as forage seed production is still limited and the economic environment has also contributed to the failure by banks to fund such activities. Some financial packages have been developed for food crops. Examples include the Zimbabwe Agricultural Income and Employment Development Program (Zim-AIED) which operated in such a way that farmers, banks and private sector companies were involved. Banks would offer financial assistance which was ploughed back after selling. Private sector was responsible for giving technical advice to farmers depending on enterprise and to which market was produce was marketed. There is due diligence in the selection of beneficiary farmers by the banks and the private sector in collaboration with the extension staff in the respective communities. The project recorded successes and shown that smallholder farmers in Zimbabwe have the capacity to produce good quality produce if provided with the necessary resources that befit their interventions.

7.3 Economic analysis

After identifying the business models and factors that enhance competitiveness of forage seed production, the study also explored the Gross margins of various crops including forages. Results in Table 7.1 indicated that total benefits were highest on cowpea followed by mucuna and maize had the least. Benefits included income generated from sale of produce plus nitrogen fixation by the legumes.

Table 7.1: Comparison of Gross Margins for various crops including forages grown in Goromonzi and Murewa districts

	Maize	**Groundnuts**	**Cowpeas**	**Lablab**	**Mucuna**
BENEFITS					
Average Grain yield (kg/ha)	266.67	216.67	1,421.67	88.84	752.67
Price grain ($/kg)	0.30	0.70	0.60	3.00	1.00
Gross income	80.00	151.67	853.00	266.51	752.67
Other benefits (N_2 fixation)	40.00	36.58	82.70	101.94	125.38
Total Benefits	**120.00**	**188.25**	**935.70**	**368.45**	**878.05**
COSTS					
Crop management (planting, weeding, spraying)	40.00	40.00	40.00	40.00	40.00
Packaging and transport	3.20	2.60	17.06	1.07	9.03
Labour costs	120.00	80.00	60.00	60.00	60.00
Other Inputs costs					
Seed costs	70.00	80.00	40.00	69.00	32.00
Fertilizer costs	252.00	84.00	112.00	112.00	112.00
Herbicide costs	17.50	15.50	22.50	15.50	13.40
Total costs ($)	502.70	302.10	291.56	297.57	266.43
Gross margin (Gross benefits-Total costs)	**(382.70)**	**(113.85)**	**644.14**	**70.89**	**611.61**
Return to TVC	(0.76)	(0.38)	2.21	0.24	2.30

Source: Developed by researcher

Gross margins were positive for cowpea, mucuna and lablab, whilst maize and groundnuts had negative gross margins. The low gross margin for maize is attributed to costs of fertilisers and labour costs, which contribute 74.0 % of the total variable costs.

From the results, it shows that the average seed yields are low compared to the national averages of 2,000 kg ha^{-1} (maize), 1,500 kg ha^{-1} (cowpeas) and 2,000 kg ha^{-1} (groundnuts). Farmers in the study

sites indicated that whenever they cannot access seed of improved field crop varieties (maize, groundnuts and cowpeas), they resort to farm saved seed which they would have selected from the previous crop and perceived as good seed. This was also echoed by Hamukwala *et al.*, (2015) and Mwendia, Notenbaert and Paul, (2016) who said that farmers use farm saved seed. In this way they are assured of access to seed of crops they desire, irrespective of seed quality.

The unit (kg) price of seed is highest for lablab (US$3.00), compared to that of mucuna (US$1.00), groundnuts (US$0.70), cowpea (US$0.60) and maize (US$0.30). This is beside the fact that lablab is considered a garden crop and is low valued among other legumes crops especially when used as a food crop (Heuzé, Tran, Sauvant, Renaudeau, Bastianelli, and Lebas, 2016).

Since this is farm saved seed, the price for maize, groundnut and cowpea is equivalent to that of grain. Farmers use farm saved seed as a result of unavailability of seed of improved varieties at affordable prices. In Malawi, Siambi, Okori, Sichali, Madzonga and Audi (2015), seed producer companies failed to take up seed multiplication and the marketing of groundnut varieties, citing seed is uneconomic. This also is the case with forage seed of mucuna and lablab which are scarce.

The initial forage seed of mucuna and lablab used in the project were imported at a cost of US$8.00 and US$11.00 respectively. In the country there is no forage seed source and where it used to be produced, in national research stations, resources are limited to produce large quantities of seed for sale to farmers.

There are other benefits derived from forage production that is; from nitrogen fixation. The best value was calculated using the estimated amount of nitrogen fixed and related to nitrogen fixation benefit. Maize has no nitrogen fixation benefit as it is not a leguminous crop. Mucuna has the greatest nitrogen fixation benefit and this goes along with Waddington, (2003). The benefit that farmers will derive is through the reduced amount of nitrogen fertiliser that they will use in the field.

Costs are highest in the maize crop as a result of labour and fertilisers. Results indicate that for the maize crop, farmers use about 120 kg each for basal and top dressing fertilisers per season over 0.56 ha. This agrees with standard recommendations of 250-300 kg ha^{-1} for the area. Mucuna has the lowest variable cost (US$266.00) and this may be explained by the fact that the crop has low seed and fertilizer costs, although packaging costs are high (US$9.00) compared to the other crops.

The Gross Margin analysis indicates that mucuna has the highest return per dollar. This is in agreement with result trends for mucuna obtained by Waddington, (2003) using the Net Present Value (NPV) approach to analysis. This implies that forage seeds are a better business venture for smallholder farmers. Lablab is also an option for seed production. Legumes have been found to be

a better option for inclusion in cropping systems. However, adoption of forage legume seed is limited by the market structure, which is exacerbated by lack of knowledge on the forage seed. Results in Chapter 4 indicate that there is no reliable market for the forage legumes, a notion supported by Alemu, (2015) and Welu, (2015) who found similar results. It has been also put forward by Boelt *et al.*, (2015) that there is lack of information on legumes in an understandable way for the farmers to encourage adoption. Most information is technical publications in peer reviewed journals and there is rarely information on forage seed available in general local language for the smallholder farmers. This could be the reason for the low adoption. Most agro dealers questioned did not know of lablab nor mucuna. However, results from the study show that legumes present viable opportunities in smallholder farming systems (Zulu, 2011).

7.4 Sensitivity Analysis

Uncertainties on weather patterns and crop performance faced by farmers provides creates challenges of making decisions about which farming enterprises to venture into. A sensitivity analysis was conducted for maize, groundnut, cowpea, lablab and mucuna. This is because there are uncertainties in future and farmers have to face these and make decisions as they carry out their farming activities. It is assumed with improved management and practices, there is bound to be improved crop production. Yield levels of the various crops were projected at 1 and 1.5 t ha^{-1} (Table 7.2)

When maize yield is increased to 1 tonneha^{-1}, total benefits are more than double that of the current production level, which has a negative Return to Total Variable Costs (TVC). At yield levels of 1.5 tonne ha-1, total benefits and RVC also increase to US$122.00 and 0.33 respectively. Mucuna and lablab have the greatest Gross Margins at both yield levels of 1 tonne ha^{-1} and 1.5 tonne ha^{-1} and is the same for RVC. Of all the crops used in the study, lablab has the highest figures across the parameters analysed.

Table 7.2: Sensitivity Analysis for various crops in Goromonzi and Murewa

	CROP														
	Maize			**Groundnuts**			**Cowpeas**			**Lablab**			**Mucuna**		
Grain yield kgha^{-1}	267 (current)	1,000	1,500	217 (current)	1,000	1,500	1,422 (current)	1,500	2,000	89 (current)	1,000	1,500	753 (current)	1,000	1,500
Total Benefits	**120**	**340**	**490**	**188**	**737**	**1087**	**936**	**983**	**1283**	**369**	**3102**	**4602**	**878**	**1125**	**1625**
Gross Margin (US$)	**-383**	**7**	**122**	**-114**	**407**	**759**	**644**	**698**	**1000**	**71**	**2662**	**4332**	**612**	**715**	**1385**
Return to TVC	-0.76	0.02	0.33	-0.38	1.23	2.31	2.21	2.45	3.54	0.24	6.06	16.07	2.30	1.74	6

Positive returns are realised where maize production levels are 1 tonne ha^{-1} or more. Lablab seed production has positive return to total variable costs even at a low of 89 kg ha^{-1}. This is a result of the total benefits which include fertilizer N2 equivalence fixed in the soil. The returns for lablab are higher than that of maize at whatever production level. This might mean that lablab seed production is more beneficial than maize and farmers will generate more income from the legume crop. Therefore lablab is the most viable crop under the circumstances, followed by mucuna. This is assuming other factors of production remain constant, like fertilizer application rates, farmer management practices, area planted and climatic factors. Unfortunately that is not the reality, climatic conditions and farmer practices can change according to resource availability and market prices may affect yield.

Sensitivity analysis is used to test the impact of a good or bad season by comparing the impact of different yields on the overall gross margins received from growing the crop. The approach is used to investigate the effects of yield changes on Gross Margin and returns. It analyses the level of uncertainty and depending on circumstances, it measures the degree to which one can be certain on an event or changes in yield or crop performance. Market prices, both input and output are subject to change and it is beyond the control of farmers. Therefore farmers need to assess carefully so that they make informed decisions to set realistic targets. However, sensitivity analysis does not take into account the probability that there may be changes that can occur.

7.5 Forage seed business development

As revealed in chapter 4 from the current situation in the study area, there are a number of arrangements that the farmers have for their produce that is, from contract farming, to joint ventures, farmer-owned businesses, tenant farming and out grower schemes. Adjustment to develop a more robust model for production and marketing within smallholder settings is influenced by various factors including the driving forces for the change, the actors involved and how they view the need to adjust, perceived benefits for change and the enabling factors.

In an effort to improve these business arrangements in smallholder systems, there is need to upgrade processes and functions in line with changes that are taking place. This implies that there are changes from a perceived lower level to a higher level. These should be simple, flexible to accommodate and allow immediate adjustment, refocus and adapting to prevailing conditions and technological adjustments at the same time realigning to policies. Figure 7.6 shows an improved model for contract farming which was the most prominent and favoured by the farmers.

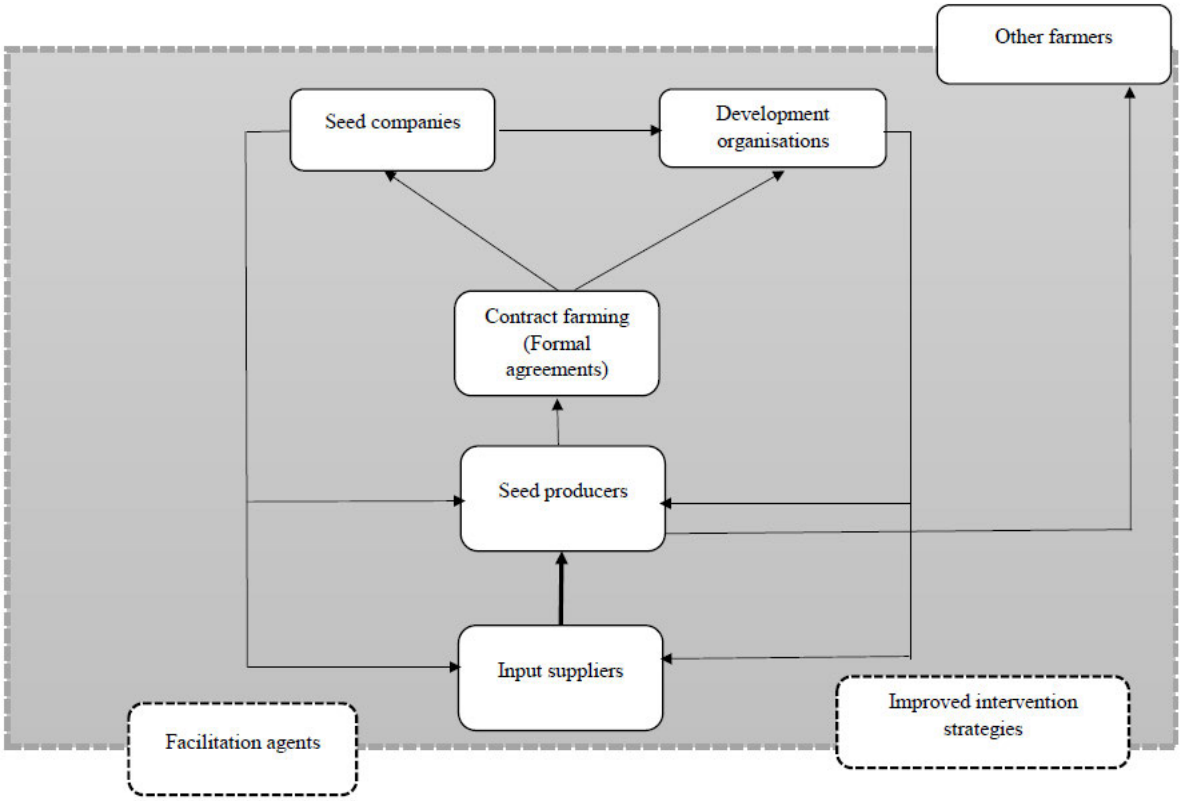


Figure 7.6: Improved business model for forage seed production. Source: Developed by researcher

The model involves the introduction of facilitation agents to facilitate engagement of all stakeholders along the value chain. Another intervention is the introduction of improved strategies including communication, technologies, knowledge and gender inclusion. The shaded area encompasses stakeholders and players to be involved and affected by the facilitation agents and the intervention strategies. Other farmers are partly involved as they are within the community and interact with the rest of the actors at different levels. These other farmers are those who are not involved in any contractual agreements but produce seed on their own and sell to the seed houses and development organisations.

Based on the arrangements revealed, there is need to adjust the current arrangements for farmers and the rest of the value chain actors to have added benefits. Figure 7.7 shows in shaded areas aspects that have been identified from the study that need to be looked at to improve the current scenarios and competitiveness of the agricultural activities.

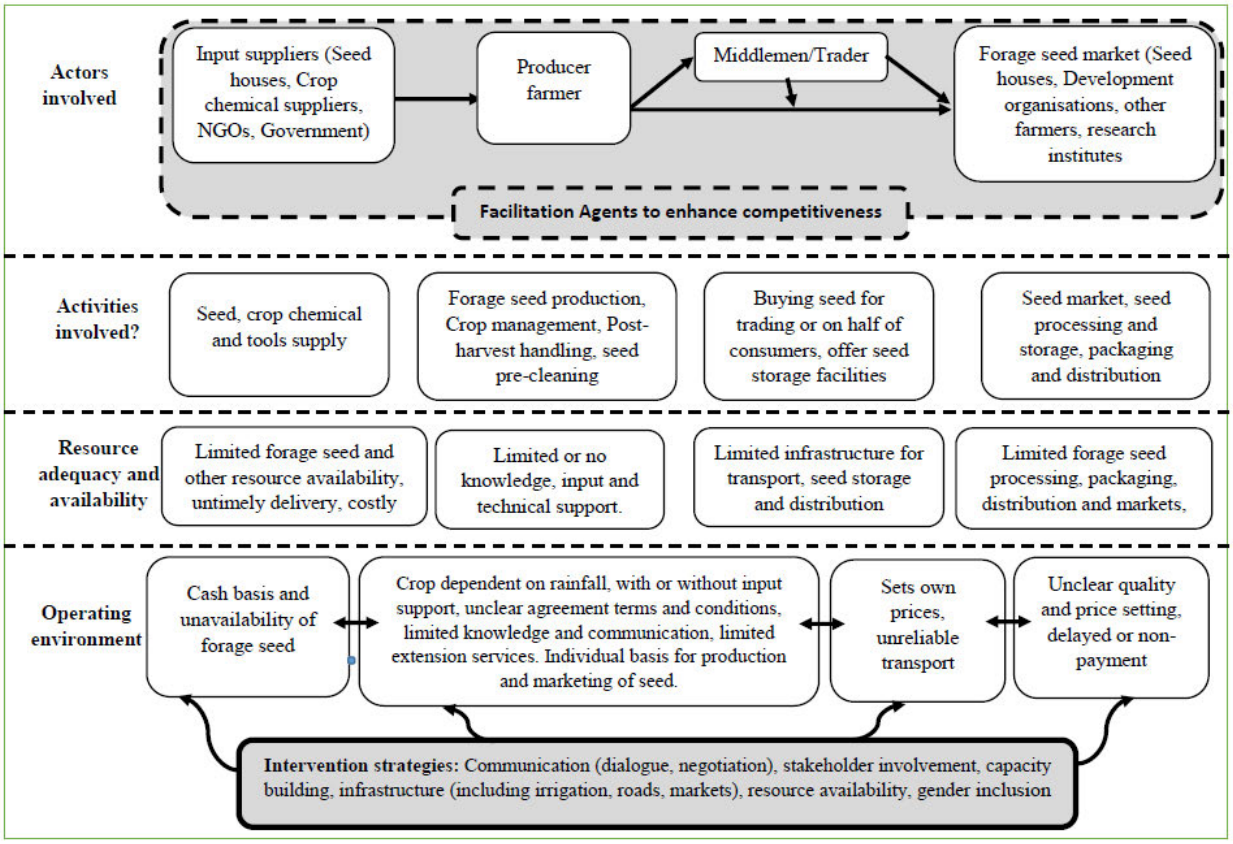


Figure 7.7: Business arrangements with suggested adjustments in shaded areas. Source: Developed by researcher

7.5.1 Potential business models for forage seed in smallholder systems

In the study sites, there have been a number of activities taking place in the marketing of forage seed, initially the forage being meant for livestock feeding and to sustain those initiatives, produce seed for use in the following season.

Farmers indicated that contract farming (Figure 7.1) is a viable option for forage seed production. They indicated that in contract farming:-

- The market is assured, so they do not have to look for forage seed markets. Since markets for forage seed are scarce, farmers need assistance and guidance on where the market is;
- Payment for forage seed sales are guaranteed, thus assuring them of income generation from the activity;
- Inputs can be offered by the seed buyer and this eases pressure on farmers on where to source the inputs for forage seed production;
- There is diversification of farming activities, thus guarding against food insecurity within the home. If food crop production fails, income generated from sale of forage seed will then be used to buy household necessities;

- There is building of relationships with different stakeholders, from input suppliers to the seed buyer; and
- There is capacity building and trainings offered in order to improve on forage seed production.

According to Lundy (2012), business models start as simple market linkages which may be initiated by actors along the value chain (Figure 7.8). They could be initiated by a change in consumer needs, growth in the agricultural sector, technological advancement, the need for specialised service providers and the need for increased food safety and delivery services. This is the case with farmers in the study sites. They have their product which is seed and there are some actors such as seed companies they are linked to, both formally and informally. It can be that these linkages may have been in existence for some time for other products or commodities.

Therefore, as a remedy to improve or develop new business models in the study sites, it may be appropriate to engage an independent entity (individual or organisation), sometimes called "Ethical agent" From the study, it was revealed that there is need for the agent who in this case facilitates the engagement of value chain players. The agent may be in the form of Innovation Platforms as an approach or development partners who are the facilitators in the engagement process. This may also comprise an organisation or individual who is not directly related to the producer and the buyer. As mentioned by Lundy, (2012), the purpose of the ethical agent is to create an environment for dialogue between the farmers and the buyer who is the seed company. The ethical agent could be a development organisation or innovation platform committee. Innovation platforms in nature allow dialogue between value chain actors so that they understand each other and build strong and viable relationships. The ethical agent encompasses every value chain actors, be it farmers who are the producers, service providers, buyers, processors, even transporters. Innovation platforms have been proven to be effective in coordinating and facilitating dialogue (Duncan *et al.*, 2015). Forage seed market is a niche market where market information is still scarce and no one knows how to go about it in enhancing competitiveness of that seed sector.

For this model to be effective and sustainable, the ethical agent needs to have very good facilitation skills. They play the role of mediator, identifying any constraints and develop strategies to overcome them. They create a fair field of play for the value chain actors. With time, these ethical agents need to wean off the actors so that they conduct business on their own.

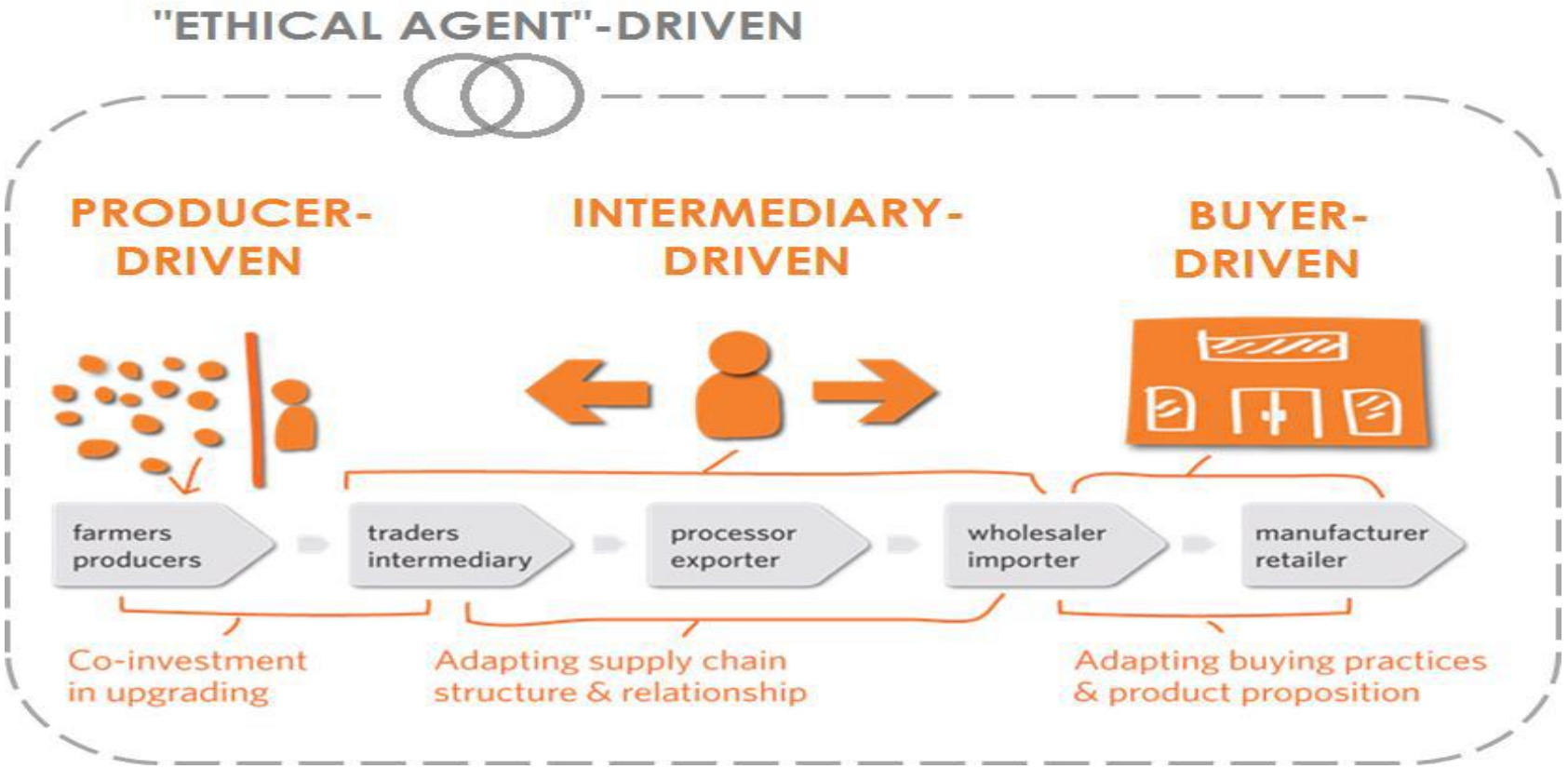


Figure 7.8: Different business models. Source: Adapted from Lundy *et al.*, 2012

Thus, an exit strategy needs to be developed by the agent. However for forage seed business, costs for ethical agent activities maybe limiting. Lundy, (2012) and FAO, (2015) also asserts that the role of the NGOs might be unclear as it is a non-profit making organisation. The NGO might also want to meddle in the affairs of both parties, which is an undesirable attitude. It also takes courage and time to convince especially the private sector to engage and deal with smallholders who may have different ideologies on forage seed production and marketing, and level of appreciation. The current economic environment also plays a role in decision making for both farmer producers and market players.

The ethical agent model needs to be supported by a number of factors for it to be effective. These include:-

- Thorough selection of participating farmers (FAO, 2012). This will ensure success and sustainability of interventions.
- Training of farmers on all aspects including farming as a business
- Financial inclusion – involvement of financial institutions to offer tailor made credit facilities will increase the chances for success
- Engagement of private sector who will offer technical advice besides assuring farmers of the markets available.

It should be noted that business models for smallholder farmers are not a one-size fits all. Thus there is need for due diligence on how to structure the models and mode of support for their sustainability taking into account the diversity of smallholder farmers and their environment. For the producer-driven model, success depends on farmer self-motivation to produce and market the product. Buyers of seed would be attracted by quality, quantities and storage. Farmers in this category have niche markets, where there are not many suppliers. Seed producers also have the advantage of bargaining for better prices.

In the buyer-driven model, seed companies would look at engaging farmers in their activities including forage seed production. Various arrangements can be made between the company and the seed producer that is, with or without inputs. Farmers in this model may not be very innovative to venture into other seed markets, they only rely on the seed buyer.

However, challenges may arise when the buyer is no longer interested in the product and the farmer gets stuck with the product without a market for it. Contractual agreements then come into effect to make buyers commit themselves to buy the product once it is produced. For the various approaches within the ethical agent model, the use of innovation platforms is important. The innovation platforms will pave the way for discussions for the different farmers at different levels along the seed value chain. There is need for support for the farmers and the ethical agent for the model to prosper. Government

intervention is required to maintain order and adherence to policies and regulations governing seed production and trade.

This can be termed buyer driven as it was the farmers who produced the seed and sold to other customers. Lately, a private seed company has initiated the engagement of farmers to produce forage seed for the company, transforming the model into buyer-driven as the company is now requesting more farmers to produce forage seed. More smallholder farmers are being motivated to venture into mucuna and lablab forage seed production. From FGDs, discussions were that the market is now assured and there is a private company that is willing to contract them to produce the seed. They say forage seed is different from the rest of the food crop seed which can be produced and sold in the retails shops. Forage seed is scarce and farmers are not used to producing forage seed for business. Farmers in Zaka, Zimbabwe managed to establish a successful seed business through collaboration and teamwork after realising that there is shortage of improved seed in their area (Case study 1).

For smallholders, business can be influenced by a number of factors which can be individual or producer groups, private or public buyers. Development organisations can also be potential buyers. It is interesting to note that it is not always the smallholder farmers who initiate business models, although farmers may become catalysts in the functioning of these models.

Initially agricultural inputs were distributed directly to beneficiaries. This was an emergency response initiative to combat food insecurity due to natural disasters like drought and floods in the country. Prospective beneficiary farmers would gather at a central point within their communities, have their names written down and they in turn receive agricultural inputs available at that time. These included seed of maize, sorghum, groundnuts and millet. Unfortunately, because they were to meet immediate food security they did not include forage seed.

As a way to move away from free agricultural inputs distributions, innovative market-based approaches were introduced. Some of the approaches introduced are paper and electronic based vouchers. Vouchers are a mode of payment that can be redeemable in exchange for the stated goods or services at designated points. The voucher scheme started as free inputs and farmers did not have to make any contributions. However, as they became more innovative, the voucher schemes included an element where a farmer contributed a proportion (range was between 5.0 % and 10.0 %) of the value of the inputs. The supply and access of inputs by farmers included the engagement of agro dealers, input suppliers, transporters and other stakeholders like financial institutions who would provide swipe machines to redeem electronic vouchers. Electronic vouchers had pin-swipe cards and farmers would use these at Point of Sale machines to redeem the vouchers.

Case Study 1: Zimbabwe Super Seeds (aka Zaka Super Seeds)

Zaka Super Seeds (now Zimbabwe Super Seeds), which started as a community seed cooperative under the Seeds and Markets Project (SAMP) in 2010, has now developed into a fully-fledged private seed company. The project, through sponsorship from The Swiss Agency for Development Cooperation (SDC) and received technical support from Food and Policy Analysis Regional Network (FARNPAN).Farmers would produce seed of certain crops and sell to the community seed cooperative who would then process, package and sell to other farmers in the local area and beyond. Consultative meetings with farmers in Zaka district revealed that farmers in the area use a lot of retained seed and about 80 % indicated that seed of improved varieties like *Zea mays*,L (maize), *Sorghum bicolor* (sorghum) and *Phaseolus vulgaris* (sugar bean) is not accessible on time and in required quantities.

Discussions in the consultative meetings revealed that improved seed varieties are not readily available and when available, they are beyond the reach of the farmers and farmers were willing to engage in seed production although efforts to link them to seed houses proved not sustainable for the seed houses who cited long distances and lack of agreement on seed prices.

This later led to the development of a seed growers association and its registration with Seed Services which is the certification authority which allowed farmers to produce, package, distribute and sell seed for profit. In that respect, Zaka Super Seeds was formed.

Through consultative meetings ad discussions with farmers and other stakeholders, a Zaka Seed Growers Association was formed, with a membership of 454, which later led to the development of Zaka Super Seeds. Development of the seed market started with that of the local market. This was important to ensure adequate supplies of seed to other farmers within Zaka and this was achieved through working with seed inspectors for quality checks and local agro dealers as distribution channels.

Area planted to seed production of the different food crops rose to over 624.0 % in three production seasons, between 2011-12 and 2013-14. Seed production also increased from an initial 26.5 metric tonnes to 151 metric tonnes over the same production period. Farmers realised a sales profit margin of about 25.0 % from seed sales. Incomes were over 100 % per farmer through selling of seed and not grain which was the normal practice.

Source: Munyaka *et al*. (2015)

These have been successful to revive the agricultural sector in Zimbabwe (FAO, 2011; Mazvimavi, Murendo, Minde and Kunzekweguta, 2013). However, suggestions on improvement are that there should be stronger coordination among the stakeholders so that farmers access inputs on time for the benefit and success of the initiatives.

7.6 Using Structured Equation Modelling for path analysis

The hypothesized research model that was developed in chapter 3 was then evaluated and the overall fit of the model was examined. The outcome variables used in the model under consideration were forage adoption and its competitiveness. SEM, which is a statistical modelling tool and a second

generation multivariate data analysis method is also referred to causal modelling, path analysis, linear structural relationship model, latent variable analysis, confirmatory factor analysis or covariance structure analysis, which is a statistical method for causal or latent variables, or measuring multivariate analysis (Hair, Black, Babin and Anderson, 2010; Hoyle, 2012; Little, 2013). SEM differs from other modelling techniques in that the later focusses on assessing constructs and relations between constructs whilst predicting whereas SEM evaluates the relationship existing between the observable and latent variables (Hair, Anderson, Tatham and Black, 1998; Alavifar, Karimimalayer and Anuar, 2012).

Of late, the modelling tool has gained attention and use in theory testing and modelling scenarios in the disciplines of behavioural science, socio-economic and psychological research. The modelling technique has also been applied in tourism research (Reisinger and Mavondo, 2007; Nunkoo, Ramkissoon, and Gursoy, 2013) as the techniques have been found to provide better flexibility than first generation techniques. Chin (1998) mentions that SEM provides greater flexibility for the interplay between theory and data than first generation techniques when dealing with regression, component and factor analysis.

A number of procedures are involved when conducting SEM and this study has followed the 7-stages model that was developed by Hair (2010), including developing a theoretically based model, constructing a path diagram of the casual relationship, converting the path diagram into a set of structural and measurement models, choosing the input matrix type and estimating the proposed model, evaluating good-of-fit-criteria, and interpreting and modifying the model. An example of the stages in structural equation modelling is demonstrated in Figure 7.9.

Stage 1 – where a theoretical based model is developed for the purpose of assessing the role of the modelling strategy and specifying causal relationships whilst avoiding specification errors.
Stage 2 – Causal relationship path diagram construction where elements of the path diagram are defined and any assumptions to the path diagrams explained.
Stage 3 – involves setting up the structural equations and specifying the measurement model, thus indicating the construct reliability and establishing any correlations among indicators
Stage 4 – Input matrix type is selected and proposed model estimated through inputting data and making assumptions and estimating the model. At this stage, any correlations and variances are identified for selecting the matrix which is best suited for the research problem. Use of theory is required at this stage as it assists in defining the model through hypothesized relationships especially among latent variables.
Stage 5 – assesses the structural model identification by way of checking order condition, identifying and problems and how to solve them.
Stage 6 – evaluating model estimates and goodness of fit by identifying misaligned estimates and establishing how well the model fits

Stage 7 – involves modifying the model, making use of standardized and unstandardized solutions. Empirical indicators would enable re-specification of the model

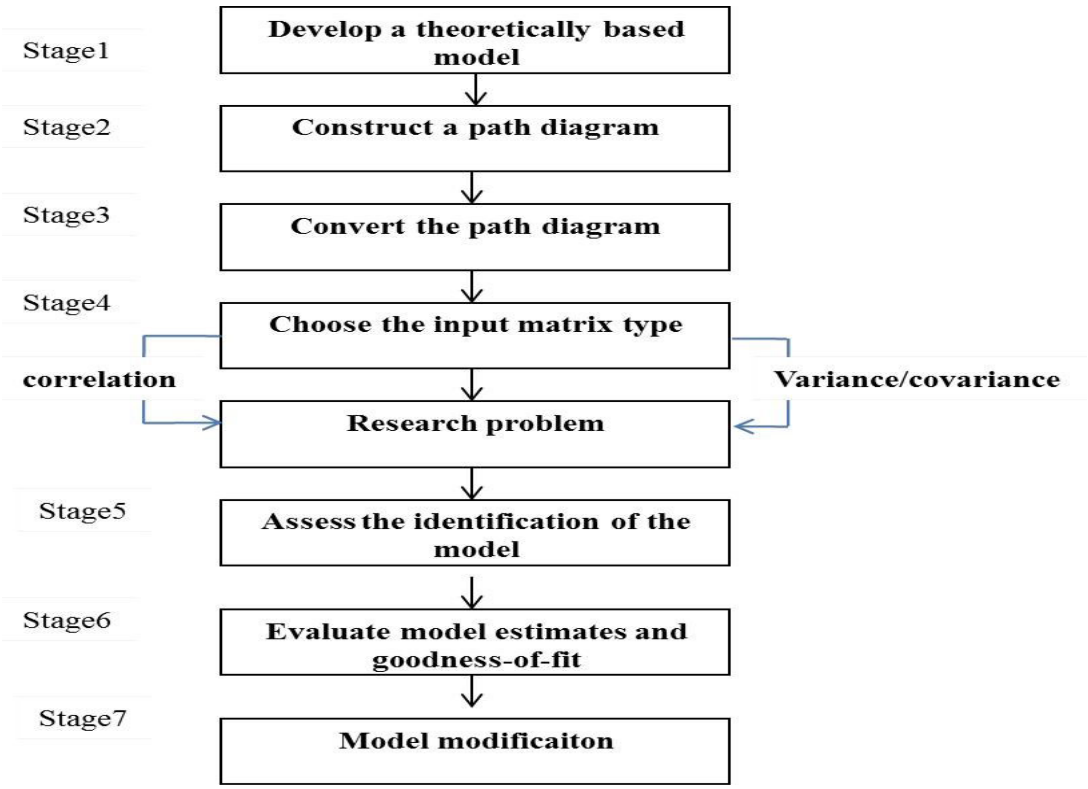


Figure 7.9: A procedure for structural equation modelling. Source: Adapted from Hair (2010)

Significance of the causal paths is not only the focus when evaluating structural equation models but also examined on how the criteria and the different stages and criteria were employed (Green, 2016). Different points of view should be considered when assessing structural equation models (Bagozzi and Yi, 1988) and should involve data input normality, criteria used to conducted preliminary evaluation, fitness measurement and internal structure model fitness assessment.

Input data normality assessment- When conducting a SEM, it is assumed that there is a normal distribution and this serves as the first point to consider before conducting any assessment of hypothesis of the research. Normality checks are often the first consideration before testing any hypothesis. Two indices have been suggested to help in examining normality in the model, that is skew and kurtosis (Kline, 2011; Asparouhov and Muthén, 2015). When kurtosis absolute value is < 20 and skew index has a value of < 3, then a normal distribution is assumed.

Pre-checks or preliminary evaluation - Check for anomalies such as very large standard errors, negative error variances, standardized coefficient > 1, (Bagozzi and Youjae, 1988; Hair, 2010; Kline. 2011). If that is the case consider, a different model specification.

Goodness of fit - A good model cannot be simply estimated by single test that best describes the strength of the model's prediction for example the chi-square value has a problem of being sensitive to the sample size, $\chi 2$ / d*f* should be < 3 (Kline, 2011). SEM needs assessment of different goodness-of-fit measures, such as Tucker Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error (RMSE). This means estimating using x2 (chi-square) to describe the strength of the model's prediction is not sufficient enough. A good model element exists when there is a fit between the sample covariance matrix and the estimated covariance matrix for the population under consideration.

Previous researches recommended the following respective cut off values, CFI and TFI >0.9 and small RMSE ≤ 0.05 (Hair *et al*., 2014; Byne, 2016). To improve on model fit, modification indices that STATA 13 provides can be of great assistance as there is addition of freely estimated parameters to model misspecification and it involves addition of a single parameter at a time.

7.6.1 Confirmatory factor analysis (CFA) model and the final structural model

The researcher confirmed each construct using Confirmatory Factor Analysis (CFA). CFA was used to ascertain existing pathway relationships against the hypothesized relationships including the overall structure for each construct by checking pathway significance and magnitude of coefficients (Tabachnick and Fidell, 2013; Brown, 2015; Neeta, 2016).

Both CFA and the final structural model were evaluated and improved by checking and adjusting to the best fit for each constructs (during CFA). Evaluations were done using the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) and Root Mean Square Error (RMSE). Literature recommends CFI and TFI >0.9 and small RMSE ≤ 0.05 (Hair *et al*., 2014; Byne, 2016).

7.6.2 Results for Structural Equation Modelling

In summary, the results are presented in figures and tables. Both figures and tables show the magnitude strength of association or the extent of the particular causal relationships in question. Figures give the pictorial view of the relationships and show the mentioned coefficients (β) as well as the direction of the influence. The β values can be negative or positive, the negative sign shows decreasing effect whilst the positive sign show the incremental effect. The tables relate to the figures but detailing the

significance levels of the β values. The individual equations and the overall equations are assessed for goodness of fit if we can trust the models projecting the relationships in question and these results are also presented in tables.

The proposed hypothesis was that there is a significant causal relationship between forage seed production and the following variables that include inputs availability, house hold head gender and education, land size owned and the seed storage type (Figure 7.10). As mentioned by Beshir (2014), gender has a positive effect on adoption as men might have access to more resources including inputs than women.

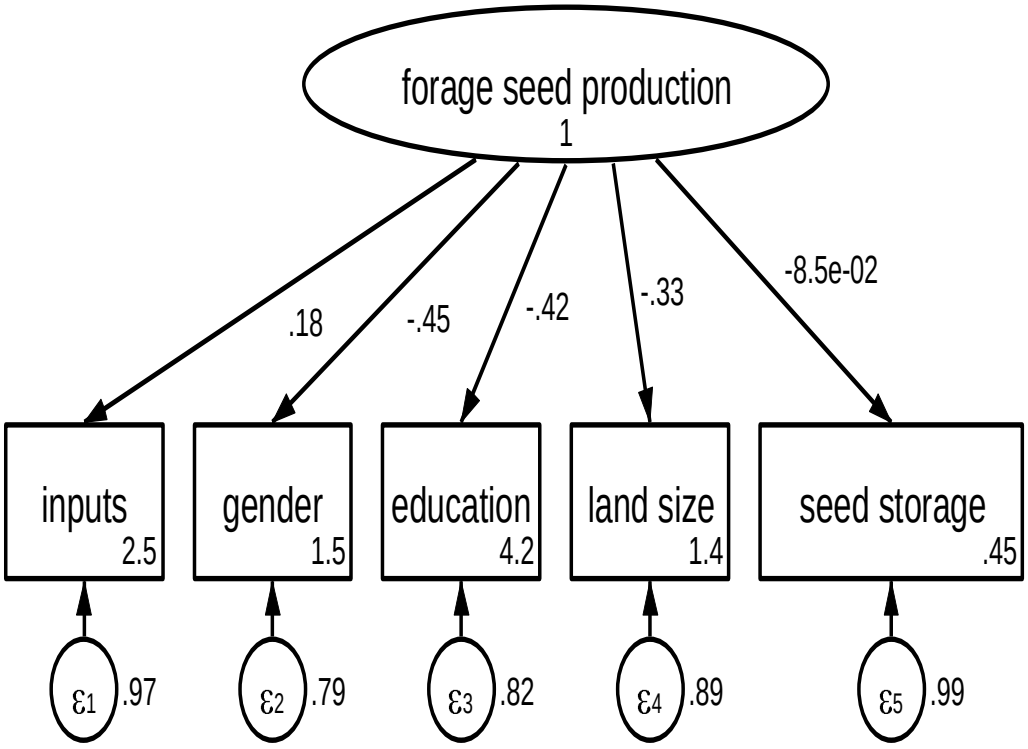


Figure 7.10: Proposed model for forage seed production with factors. Source: Developed by researcher

Table 7.3 shows more detail about the strength of association or causal relationships shown in Figure 7.10. Only one factor was positively associated with forage seed production, inputs availability, whilst house hold head, gender, education and land size owned negatively influence the extent of forage seed production (L1), ($p< 0.05$), with exception of the seed storage type ($p> 0.05$). In this study, the most influencing factor was the availability of inputs, coefficient (β) = 0.18, p= 0.026. Gender (β = - 0.45, p = 0.000), Household Head level of education (EduHH) (β = - 0.42, p = 0.000), land size (LandSZ) (β = - 0.33, p = 0.000).

Table 7.3: Forage seed production causal pathways' parameters (N=354)

Standardized	Coefficient	OIM Standard Error	z	P>|z|	[95 % Confidence Interval]	
Measurement						
Inputs availability <-						
L1	.181	.081	2.23	0.026	.218	.341
_cons	2.531	.093	27.36	0.000	2.350	2.712
GenderHH <-						
L1	-.454	.094	-4.84	0.000	-.638	-.270
_cons	1.545	.067	23.11	0.000	1.414	1.676
EduHH <-						
L1	-.419	.086	-4.85	0.000	-.589	-.250
_cons	4.150	.140	29.66	0.000	3.876	4.424
LandSZ <-						
L1	-.328	.089	-3.69	0.000	-.502	-.154
_cons	1.385	.063	21.92	0.000	1.261	1.509
Granary Type <-						
L1	-.085	.074	-1.15	0.248	-.229	.059
_cons	.448	.047	9.47	0.000	.356	.541
Variance						
e.Inputs availability	.967	.030			.911	1.027
e.GenderHH	.794	.085			.643	.979
e.EduHH	.824	.072			.694	.979
e.LandSZ	.893	.058			.786	1.014
e.GranaryType	.993	.012			.969	1.018
L1	1	.			.	.
Log likelihood	-4641.014					

LR test of model vs. saturated: chi2 (5) = 12.23, Prob > chi2 = 0.0318

Source: Developed by researcher

7.6.2.1 Goodness of fit

Model overall goodness of fit statistics or parameters shown in Table 7.4 are acceptable (Hair *et al*., 2014). The baseline comparison on Fit statistic shows that Comparative Fit Index (CFI) = 0.84 whilst Tucker Lewis Index (TLI) = 0.68. The Standardized root mean squared residual (SRMR) is 0.032. The parameters are close to the range as recommended in literature (Hair *et al*., 2014) of CFI and TFI ≥ 0.9 and small RMSE ≤ 0.05. The model coefficient of determination (CD = 0.388), meaning that the overall model explains about 38.8 % of the total variation. Basically it's a fair model fairly close to 50.0 % recommended by literature (Hair *et al*., 2014).

Table 7.4: Overall model goodness-of-fit

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms (5)	12.231	model vs. saturated
p > chi2	0.032	
chi2_bs (10)	55.048	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.054	Root mean squared error of approximation
90% CI, lower bound	0.015	
upper bound	0.094	
pclose	0.369	Probability RMSRA <= 0.05
Information criteria		
AIC	9312.028	Akaike's information criterion
BIC	9374.975	Bayesian information criterion
Baseline comparison		
CFI	0.839	Comparative fit index
TLI	0.679	Tucker-Lewis index
Size of residual		
SRMR	0.032	Standardized root mean squared residual
CD	0.388	Coefficient of determination

Source: Developed by researcher

7.6.2.2 Goodness of fit and individual equation level

Generally household gender explains a lot of effect on forage seed production, gender of the household head explains more variation about 20.8 % than any other factor in the model (Table 7.5).

Table 7.5: Equation level goodness of fit

		Variance				
depvars	**fitted**	**predicted**	**residual**	**R-squared**	**mc**	**mc2**
observed						
Inputs availability	.474	.016	.458	.033	.181	.033
GenderHH	.208	.043	.165	.206	.454	.206
EduHH	.417	.073	.344	.176	.419	.176
LandSZ	2.953	.317	2.636	.107	.328	.107
GranaryType	1002.543	7.236	995.307	.007	.085	.007
overall				.388		

Source: Developed by researcher

7.6.3 Reconstructed Structural model

7.6.3.1 Forage seed adoption structural model

A causal relationship between forage seed adoption and each of the following constructs: forage seed market and forage seed production (Figure 7.11). Forage seed market construct was perfectly measured by only 2 retained variables (Cronbach's alpha = 0.75; namely markets reliability of the source of information and prices reliability of the source of information). Access to technological information through membership to farmer organisations is also very important as farmers are persuaded to adopt based on the benefits and costs of each technology and can thus make informed decisions (Mariano, Villano and Fleming, 2012).

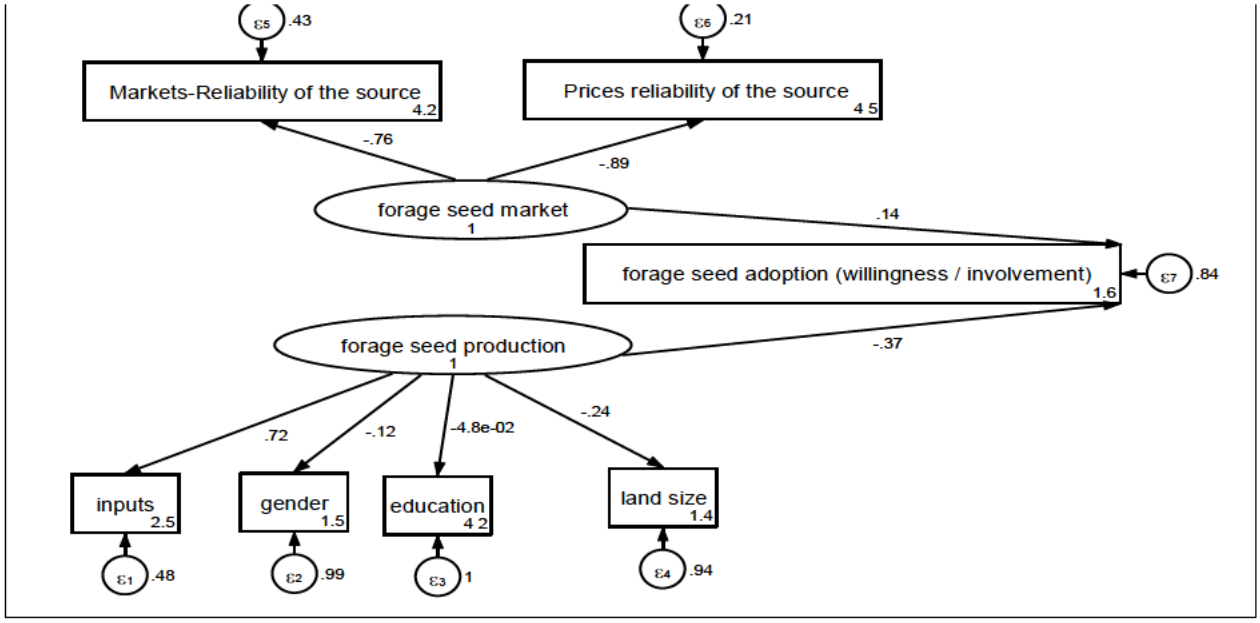


Figure 7.11: Final model for forage seed adoption with factors. Source: Developed by researcher

Forage seed production (L1) was measured by inputs availability, household head gender (GenderHH), household head education level (EduHH), and land size available for crop production (LandSZ). As inputs become more available, the better the adoption by farmers as this relates to access to resources. Adoption increases as more males become involved forage seed production.

More detail about the strength of association is shown in Table 7.6 shows. Inputs availability, influence the extent of forage seed production (L1) positively, ($p< 0.05$), whilst land size (LandSZ) owned was negatively associated with forage seed production, thus the bigger the land the less probability of growing forage seed may be due to a wide choice of alternatives. This implies that farmers who have smaller pieces of land are more likely to adopt forage seed production as a business compared to those with bigger land sizes. Forage seed production is a land saving technology and farmers can benefit more from smaller pieces of land. Land owned by smallholder farmers in Zimbabwe has reduced due to rapid population growth causing a decrease in production. Farmers are adopting intensive production practices as a means of promoting commercialization in order to maximize land productivity. Forage seed production business provides an opportunity for intensive production and increase smallholder farmer's participation in the market. As such those who are land constrained already are likely to quickly opt for this enterprise. The implication of this finding is that it is important for policy makers to promote forage as a business to land constrained smallholder farmers as uptake will more likely be higher.

On the contrary, gender of house hold head (GenderHH) and education (EduHH) was not associated with forage seed production ($p> 0.05$). Forage seed adoption (L2) was significantly influenced by the state of forage reliability of source information concerning markets and prices, $p = 0.000$.

Forage seed marketing impacted positively, coefficient (β) = 0.14, $p= 0.03$ whilst forage seed production impacted negatively ($\beta = - 0.37$, $p = 0.000$).

Table 7.6: Revised forage seed adoption causal pathways' parameters (N=354)

Standardized	Coefficient	OIM Standard. Error	z	P>|z|	[95% Confidence Interval]	
Measurement						
Inputs availability <-						
L1	.723	.170	4.24	0.00	.39	1.06
_cons	2.531	0.093	27.36	0.00	2.35	2.71
GenderHH <-						
L1	-.117	.074	-1.59	0.11	-.26	.03
_cons	1.545	.067	23.11	0.00	1.41	1.68
EduHH <-						
L1	-.048	.068	-.70	0.49	-.18	.09
_cons	4.150	.140	29.66	0.00	3.88	4.42
LandSZ <-						
L1	-.235	.075	-3.14	0.00	-.38	-.09
_cons	1.385	.063	21.92	0.00	1.26	1.51
Wish to be involved <-						
L1	-.370	.085	-4.35	0.00	-.54	-.20
L2	.144	.049	2.95	0.00	.05	.24
_cons	1.568	.068	23.16	0.00	1.44	1.70
Reliability of information on markets <-						
L2	-.758	.115	-6.57	0.00	-.98	-.53
_cons	4.208	.142	29.70	0.00	3.93	4.49
Reliability of information on prices <-						
L2	-.891	.134	-6.64	0.00	-1.15	-0.63
_cons	4.457	.149	29.87	0.00	4.16	4.75
Variance						
e.Inputs availability	.477	.246			.17	1.31
e.GenderHH	.986	.017			.95	1.02
e.EduHH	.998	.007			.99	1.01
e.LandSZ	.945	.035			.88	1.02
e.Wish to be involved	.843	.067			.72	.98
e.Reliability of information on markets	.426	.175			.19	.95
e.Reliability of information on prices	.206	.239			.02	2.00
L1	1	.			.	.
L2	1	.			.	.
Covariance						
L1						
L2	0	(constrained)				
Log likelihood	-3207.588					

Source: Developed by researcher

7.6.3.2 Goodness of fit

Model overall goodness of fit statistics or parameters shown in Table 7.7 are acceptable. Results show Comparative Fit Index (CFI) of 0.85, Tucker Lewis Index (TLI) of 0.76 and Root Mean Square Error (RMSE) of 0.076. Recommendations from literature indicate CFI and TFI ≥ 0.9 and RMSE ≤ 0.05 (Hair *et al.*, 2014) the parameters are approximately close to the range. The model coefficient of determination (CD = 0.93), meaning that the overall model explains about 93.0 % of the total variation. It is generally a good model and fairly close to 93.0 % recommended by literature. Participation in markets depends availability and access to information and in some studies in Bolivia (Jeffery et al., 2009) revealed a positive effect on potato channel choice due to access to market information.

Table 7.7: Equation level goodness of fit – adoption structural model

	Variance					
depvars	**fitted**	**Predicted**	**residual**	**R-squared**	**mc**	**mc2**
observed						
Inputs availability	.474	.248	.226	.523	.723	.523
GenderHH	.208	.003	.205	.014	.117	.014
EduHH	.417	.001	.416	.002	.048	.002
LandSZ	2.953	.163	2.790	.055	.235	.055
Wish to be involved	.293	.046	.247	.157	.397	.157
Reliability of information on markets	.276	.158	.117	.574	.758	.574
Reliability of information on prices	.238	.189	.049	.794	.891	.794
overall				.931		

mc = correlation between depvar and its prediction

mc2 = mcˆ2 is the Bentler-Raykov squared multiple correlation coefficient
Source: Developed by researcher

7.7 Chapter summary

The chapter has highlighted possible business arrangements to enhance forage seed production and on top priority was contract farming. Of the different business models identified during the study, contract farming was the most preferred and suitable for the smallholder farmers. Results also revealed that there is need to strengthen the knowledge that the farmers have on contract farming. This will create a good platform for sustainability and improvement on the adoption of forage seed activities among the smallholder farmers. Also inclusion of innovation platforms will enhance the success of the contracts through building of trust among stakeholders. These models need to take into account aspects like stakeholders, costs structures, market segments and revenue streams. In the chapter, a Gross Margin

and Sensitivity analysis was done and from these, lablab was more beneficial than maize, besides that maize is the staple food which is grown to meet food security within the household. It is important that farmers diversify activities to be able to cope with any disasters.

This study advocates for sustainable business-led development based on support from private companies, research and extension and full participation of all players along the value chain. However, difficulties arise as each value chain player has own motives of participating in value chains.

For competitiveness to prevail, there is need to look into those factors that favour it. As smallholder farmers they face a number of challenges and this calls for low cost activities. Innovation platforms, revitalisation of irrigation infrastructure, partnerships, extension service support, gender issues and social inclusion, input and output market, sustainable intensification and policies and regulations have been discussed and seen to be most suitable for the value chains. These aspects if given full support can bear testimony improving forage seed production value chain. These aspects are not exhaustive, therefore other studies may find a whole of other factors or other approaches. Various approaches need to be developed depending on circumstances and the most benefit to be accrued by the communities.

Proposed model developed through SEM suggested that inputs availability, land size and reliability of information on markets and prices can have an influence farmers' willingness to adopt forage seed technologies. Although in some studies gender has influence, in this study, the case was that more males need to be made aware of forage seed technologies so that they can participate.

CHAPTER 8. SUMMARY DISCUSSION, CONCLUSION AND RECOMMENDATION

8.1 Summary discussion

Here there are highlights of a summary of discussions from all the chapters, that is, on literature review, current forage production systems, challenges and opportunities, value chain actors and their relationships along the value chain, factors that enhance competitiveness of forage value chains and models that can be developed for forage seed business.

The study has been necessitated because of the following

- Even though a high percentage of livestock is owned by the rural population, productivity is low as a result of increases in human population and grazing lands are being turned into human settlements.
- Climate change, characterised by erratic rainfall and recurrent droughts have contributed to a decline in livestock productivity through deterioration in quality and quantity of grazing.
- Even though forages offer an alternative to livestock productivity, the main challenge lies in the scarcity of forage seed on the local market to enable farmers to produce fodder for livestock. Seed imports are expensive, beyond the reach of many potential farmers, besides them being unsustainable.

In reviewing literature on forage seed value chain, the study described the farming system in Zimbabwe that is, the agro-ecological zones and the associated agricultural activities. Also highlighted are the farming sectors before and after the Fast Track Land Reform Program. Livestock production systems are described, indicating livestock owned by each farming sector, and it is highlighted that about 70 % of the population owns livestock which depends on natural grazing as main source of feed. Livestock productivity is low in developing countries, especially in sub Saharan Africa. This is against a background of low production of natural pastures which form the major source of ruminant feed. Grazing quality and quantity declines during the dry season and farmers do not supplement their animals as they cite high cost of feed. Also grazing land is dwindling as a result of increase in human settlement which is taking up grazing space. This is beside the fact that there is a projected increase in demand for livestock and livestock associated products. Shortage of feed calls for alternatives such as forages which are planted and conserved as livestock feed.

Forages have contributed in agriculture activities through provision of livestock feed, soil nutrient improvement and structural improvement through biological nitrogen fixation and Green Manure Cover

Crops. Therefore there is need to avail forage seed in smallholder systems in a sustainable way. For this to happen, strategies need to be developed that include smallholders in forage seed production, thus enabling farmers to participate in markets and generating income. However, farmers have failed to adopt forage technologies citing high risks involved, limited knowledge on production, conservation, utilisation and marketing. Seed availability both at local and national levels is of major concern, even though the livestock industry is set to improve.

The seed industry for food crops is very vibrant. Focus is also on food crop seeds compared to forage seed. Unfortunately no particular attention is being given to forage seed. The Pasture Seed Growers Association which once existed, may need to be resuscitated. The National Research Stations that produce most of the forage seed through breeding and seed multiplication, are poorly resourced and cannot meet market demand. Therefore, forage seed is mostly being accessed on the informal market. Farmers who are producing share it with other farmers besides selling to communities outside the ward and development organisations. Thus, literature review has revealed that forage seed is required to alleviate livestock feed shortages, diversify agricultural activities to reduce risks and improve soil nutrient status. To this end, literature recommends that innovative initiatives need to consider inclusive value chains. These should also take into account gender roles as some roles are considered gender specific. For smallholder farmers to be engaged in forage seed production and marketing, various factors come into play and they include, capability of the farmers, resource endowment, including knowledge, land available and labour.

The research design employed for the study was both quantitative and qualitative approaches. This involved quantitative data collected using a pre-tested structured questionnaire for household survey. Qualitative data was also collected using FGD guides and in-depth interviews using KII guides. The study was carried out in Goromonzi and Murewa districts, which lie in Natural Region II, which is a high rainfall area suitable for both intensive crop and livestock production. Main crops are maize, groundnut and cowpeas, whilst livestock is cattle, goats, poultry and pigs. All cropping activities are dependent on rainfall and are on a subsistence level. Ruminant livestock depend on natural grazing as main source of feed. Main sources of income are crop sales and off farm activities. Markets for crops and livestock are within although some are located at a distance, but are accessible. Most of the agricultural activities, as indicated by results, are carried out by women. Only on most livestock activities is where males are involved. It might be because male counter parts are engaged in off farm activities that women who are present will be doing most of the work. Therefore, activities and technologies need to be gender sensitive, even use of implements. Forages are not a common crop grown in the area, besides mucuna and lablab that were introduced through a project for the purposes of improving livestock productivity through feed production, soil improvement and income generation through forage and seed sales.

The study also revealed that farmers adopt technologies and structural equation modelling was used to get an understanding of how farmers in the study site adopt forage technologies. Results indicate that asset ownership, availability of labour, land size, membership to an organisation and involvement in fodder production all have a positive influence on the adoption of technologies. Membership to an organisation and access to extension services increase access to information on production and marketing of forages.

Challenges identified from the study include lack of forage seed on the local market, climate change, which is threatening forage seed production initiatives. Therefore there is need to invest in irrigation infrastructure especially in drier areas. Unfavourable economic climate which results in farmers focussing on food security, thus thwarting market-led initiatives. Technological advancement which requires farmers to have access to services but equipment and other resources would be beyond their reach. Limited knowledge of forage seed production and the high risk associated with forage crops discourages farmers hesitant to venture into that sector.

However, opportunities make the enterprise lucrative. There is high demand for forage seed due to projected increase in demand for livestock and livestock associated products. Livestock enterprises are set to increase also because of government's move to improve livestock production and the need to rehabilitate pastures both natural and improved. Also there is extension back up and with high literacy levels, the initiatives are set to succeed.

Processes along the value chain need support at every stage. Input suppliers need to avail inputs in right quantities and quality at the right time. Producers, who are the farmers, need to produce good quality seed, which will be sold to other farmers locally and on the export market. Results also indicate that seed companies are not involved in forage seeds, but focus on food crop seed. Therefore, they need to engage with smallholder farmers to produce forage seed for the local market. Other constraints cited during the FGDs include lack of market for forage seed, low prices offered at the market and lack of market information. Financial resources are also limited and smallholder farmers' situation is worse as they are considered as risky to work with. They are viewed as not creditworthy.

Value chains have been seen as an important aspect in forage seed production and marketing. This is because farmers will be able to interact with different stakeholders, participate as producers and contribute to the smooth functioning of value chain processes. This will also facilitate adoption of forage technologies by smallholder farmers. The value chain involves processes where value chain actors such as input suppliers, producers, processors, traders and consumers meet and interact, making decisions

and looking for products. Relationships are at different levels such that models developed need to suit farmer's activities, resource endowment and capabilities.

Several value chain actors in the study area were identified through household survey and FGDs. These actors serve different purposes and relate to farmers at different levels. Input suppliers are there to provide agricultural inputs for both crops and livestock. These include crop seeds, fertilisers and chemicals, veterinary drugs, farming tools. In most cases they are located within the communities as agro dealers or stockists of larger firms. In some cases, they are located in Harare which is easily accessible and not far away from the sites. However, forage seed is not available from any of the input suppliers, even from seed companies that sell seed of food crops directly to farmers. Some inputs have been supplied through NGOs and development organisations. Even government has availed crop inputs through input schemes, using various approaches, from direct distribution to electronic vouchers and farmers contributing to these inputs.

During the study, it was revealed that the forage seed producers are the farmers. Through a project being implemented in the study area, some forage seed of mucuna and lablab were distributed for forage production and conservation, to be fed to livestock during the dry season. To enable availability of seed for the next season, there were initiatives to produce seed for the market. Unfortunately because the forages were not known to the farmers, there is no market infrastructure for that. There is need to resuscitate the Pasture Seed Growers Association, an organisation that used to link forage seed producers to markets.

Traders and wholesalers are not in existence for forage seed in study sites. Since the forage market is not well established in the study sites, seed dissemination is done by farmers who are sharing with other farmers within and outside the communities for livestock feed production, soil improvement and income generation through seed and fodder sales. Research, extension and development organisations are other value chain actors who are assisting farmers with technical and support services. There are aspects of farmer training, besides roles of facilitating meetings and sharing of information. Development organisations want to ensure that any intervention is sustainable and adaptable to farmer conditions. The links and relationships among value chain actors were observed using UCINET to establish reciprocated and unreciprocated ties. Farmers relate mostly with agricultural extension and research personnel, besides agro dealers and other fellow farmers. Other actors such as schools, hospitals, the police, are at the peripheral of the circle. More linkages have to be established and strengthened to increase information sharing among stakeholders. Links also show if there is a two-way communication among stakeholders.

Through FGDs, it was highlighted that farmers prefer contracts when engaging with private companies on forage seed production. This does not mean there are no other better options for farmers to choose from. Also that model is not a one size fits all as suitability of an option depends on farmer's operating environment, resource endowment and knowledge.

An economic analysis was conducted on the major crops grown in the area and two forage crops, mucuna and lablab. Gross benefit under current production levels was highest for cowpeas followed by mucuna and lablab, with the least being that of maize. Indications are that returns on maize are not economic. Sensitivity analysis on maize and lablab revealed that positive returns for maize are gained when projected yield is at 1,000 kg ha^{-1} whilst returns for lablab continue to be positive, even at current yield levels.

In the study, it was necessary to develop strategies that enhance the competitiveness of forage seed value chain in smallholders. This was to build upon an analysis of the current forage production systems, identification and characterising value chain actors and their roles, identification of challenges and opportunities in forage seed value chains and factors that enhance the competitiveness. Business Canvas Model was used to develop these strategies for forage seed. These would take into account target market, market structure, cost structure, communication channels, available resources for seed production, seed quality requirements, relationships that exist among with stakeholders and income sources. Potential interventions are those that involve an 'Agent' who can be development organisations or process of IPs to initiate the model development process. After some time, can the 'Agent' leave the processes to run on their own? In this way the interests of all stakeholders along the value chain would be catered for and protected. The Agent is impartial and facilitates dialogue and builds relations among value chain players.

To support the competitiveness of forage seed production and marketing, a number of factors need to be considered. There is need to invest in irrigation infrastructure, that is, rehabilitation and establishing new irrigation sites, coupled with efficient utilisation of the facilities. This would ensure good quality seed production, even in drought prone areas. Farmers with own resources would need to be supported to establish irrigation facilities. For irrigation schemes to be viable, there is need to have proper committees that run the affairs of the schemes as most irrigation schemes have failed mainly due to poor governance and lack of accountability by scheme members. Also there has been lack of sustainability and proper hand over take over from donors and development organisations when project ends. Intensification of production, which is increasing production per unit area or efficient utilisation of resources per unit area means that farmers should focus production and concentrate on an area they could manage and work on by putting adequate resources.

IPs are an avenue to promote and enhance competitiveness of forage seed value chains especially among smallholder farmers. As they involve all value chain stakeholders, they function as facilitating dialogues, identification of constraints and opportunities and how to make progress. It is believed IPs could handle even social dynamics and resolve some of the conflicts among members. As these IPs are not static, they would evolve over time as stakeholders get to know and understand each other together within their line of business. Innovation platforms are a new approach to encourage and motivate farmers to adopt new technologies. These IPs would need to be fully understood by all stakeholders, with a clear focus and full participation for maximum benefits.

Competitiveness improves with support of input and output markets. Availability of these markets ensures that farmers can access whatever they require for production and can also deliver to the market. Farmer organisations play a big role in bringing support to farmers, lobbying and advocating for a better environment for farmers. Farmers are encouraged to join farmers groups and farmer unions to get information and trainings. Farmer trainings and capacity building enhances understanding of concepts, reasons for such practices, making decisions and sharing with others. It is important that farmers are trained in different aspects of agricultural production. It also empowers them to negotiate terms on inputs and at markets for prices. Training could be through Farmer Field Schools, field days, demonstrations, workshops, exchange visits and tours.

Roles and responsibilities are important in smallholder systems. Therefore, it is important to include all (men and women) in interventions so that they share responsibilities. Women have been found to do most of the work and innovations need to be gender sensitive and responsive. Also support services need not be emphasised as they play a big role in keeping the farmers informed of new ways and technologies. Back up support is important and through extension services, farmers always have someone to turn to for advice. Information, communication and technology (ICT) has also the advantage of real time response although there is need to understand how to utilise it and get maximum benefit.
Lack of access to financial resources hamper the development of smallholder farmers as they are viewed as high risk. There is need to develop financial packages to suit the different farmer typologies within the smallholder systems.

Inputs availability, land size, willingness to be involved in forage seed production and reliability of information on markets and market prices are some of the factors to explain the probability of farmers adopting forage seed technologies. Land size was found to have a negative coefficient, thus farmers with smaller land would adopt forage seed business as it would be an opportunity for intensification of production. Therefore, access to information and type of information being access is very important as this influences other factors like willingness and decision making on crops to plant each season. Based on the results from the study, there is need to develop information packages that in turn improve access

to quality information and improve awareness of forage seed technologies and benefits to be accrued. This will in turn improve production of forages that will be used for livestock production and resultantly alleviate livestock feed shortages and improve livelihoods of farmers.

8.2 Conclusion

Forage seed production is indispensable in enhancing crop and livestock productivity through feed availability, and farmer incomes in the smallholder sector of Zimbabwe. The potential of forage seed business cannot be overemphasized. Despite their growing importance in livestock production and improving farmer incomes, adoption has been limited.

From the study, the value chain actors were found to have complementary roles. There is need to strengthen innovation platforms that focus on forage seed production for the purpose of collective bargaining for better grass seed prices. The study analysed forage seed business potential in smallholder systems of Zimbabwe. Results have so far indicated that this is a unique business venture that requires knowledge of the market and how to produce the seed. An increase in land size, more assets and higher level of education will positively influence adoption of fodder technology among farmers.

Farmers are willing to venture into forage seed business on contract farming under the following terms: short term contract (one season), payment at delivery, group selling and having a processor as a partner. To ensure supply of forage seed, there should be involvement of government and private sector. NARES should be well resourced to conduct preliminary evaluations and screening, whilst private sector will multiply in collaboration with farmers. This study was set out to identify how competitive forage seed business can be in smallholder systems in Zimbabwe. Key issues were addressed in a bid to enhance competitiveness of forage seed business in smallholder systems in Zimbabwe. These were understanding the current scenario on forage see production, challenges and opportunities that exist and how forage seed production could be a business.

Important factors associated with adoption of forages were seed availability, arable land area, access to information, asset ownership and membership to a farmer organisation. This study has confirmed prior studies which have shown that adoption of technologies, is influenced by factors including knowledge which is associated with some level of education, asset ownership and being a member of farmer organisation. Results have shown that a collaborative approach for improved technology adoption is therefore required. When farmer become knowledgeable through education and being members of farmer organisations, they will develop strategies to acquire assets which they will use on their farms. Gross Margin analysis has shown that forages have better margins than cereals. Even though it has its own shortfalls, Gross Margin indicates clearly what a farmer can expect for each enterprise and it assists

in decision making on whether to forego maize production compared to mucuna or lablab. Sensitivity analysis has also shown that lablab has a greater return compared to maize, which would attract farmers to produce forage seed, provided the market is available. Farmers are willing to venture into forage seed production and marketing as long as there is a market and are offered fare prices. Sensitivity analysis also aids in decision making.

Despite the limited scope of the study to Goromonzi and Murewa districts, the findings have generated immense information which can contribute to forage seed production strategies in smallholder systems. In order to improve the linkage among value chain actors such as research, extension and farmers, and thereby help them function synergistically with an aim to bring significant transformation in the lives and livelihoods of resource poor farmers, there is a need to promote group action in the production of fodder seed through contract model initially which involves active support of the farmers with agronomic information.

From the study, the value chain actors were found to have complementing roles. There is need to strengthen innovation platforms that focus on forage seed production for the purpose of collective bargaining for better seed prices. The study analysed forage seed business potential in smallholder systems of Zimbabwe. Results have so far indicated that this is a unique business venture that requires knowledge of the market and how to produce the seed. Acquiring more assets and higher level of education will positively influence adoption of fodder technology among farmers.

Farmers are willing to venture into forage seed business on contract farming under the following terms: short term contract (one season), payment at delivery, group selling and having a processor as a partner. To ensure supply of forage seed, there should be involvement of government and private sector. NARS should be well resourced to conduct preliminary evaluations and screening, whilst private sector will multiply in collaboration with farmers. This study was set out to identify how competitive forage seed business can be in smallholder systems in Zimbabwe. Key issues that were addressed in a bid to enhance competitiveness of forage seed business in smallholder systems in Zimbabwe. These were understanding the current scenario on forage see production, challenges and opportunities.

The three most important factors associated with adoption of forages were level of education, asset ownership and membership to a farmer organisation. This study has confirmed prior studies which have shown that adoption of technology is influenced by factors including knowledge which is associated with some level of education, asset ownership and being a member of farmer organisations. Results have shown that a collaborative approach for improved technology adoption is required. When farmers become knowledgeable through education and being members of farmer organisations, they will develop strategies to acquire assets which they will use on their farms.

Sensitivity analysis has also shown that lablab has a greater return compared to maize, which would attract farmers to produce forage seed, provided the market is available. Farmers are willing to venture into forage seed production and marketing as long as there is a market and are offered fare prices. Despite the limited scope of the study to Goromonzi and Murewa districts, the findings have generated immense information which contributes to forage seed production strategies in smallholder systems. Future research should focus on sustainability of the business models in different economic environments.

8.3 Recommendations

Recommendations are those that can contribute to the development of forage seed business especially among smallholder farmers. To improve forage seed multiplication and marketing, the following should be taken note of:-

- Sustainable intensification – this is through improving productivity per unit area and efficient utilisation of forage seed and associated inputs. This will facilitate production of food crops and that of forage seed from a small piece of land that is well managed. This can be achieved through crop rotation of cereals and legumes. Legumes will leave the soil rich in nutrients besides soil cover that will have reduced weed infestation, thus reducing number of weedings in a season and per crop.
- Investing in irrigation infrastructure – this aspect is required in the drier areas where rainfall is not adequate. A lot of water and nutrients is lost during runoff in flood irrigation systems. Planting of forages for seed production can act as an avenue for efficient utilisation of land area. Irrigation systems also reduce the risks associated with climate change and effects of droughts. This needs committed farmers who are willing to use their own resources than have the dependency syndrome where they expect handouts.
- Use of improved forage varieties – initial investment should involve importation of seed from reputable forage seed companies. This will serve as foundation material and farmers encouraged to venture into seed production.
- Establishment and strengthening of innovation platforms – these act as facilitators especially during meetings. IPs have a role to play for the success of smallholder farmers as they bring together stakeholders to discuss issues and prioritise what needs to be solved first.
- Training farmers on seed production and marketing. Empowering farmers with knowledge will produce positive outcomes in the future as farmers will be able to produce seed for the market rather than depending on seed imports. Extension personnel needs to be trained so that they can cascade knowledge to the farmers using approaches such as the lead farmer learning centres.

- Access to information. Farmers and other stakeholders need to have access to information so that they are abreast with what is happening. Information such as on markets, prices, production practices need to be availed on time and this will encourage the different gender to participate in forage seed production interventions.

8.4 Areas for further research

- The study has shown that forage seed production in smallholder systems has not been practised. The innovation therefore, requires intense capacity building of farmers and extension. Future research should consider assessing impact of such technologies, in areas where they have been adopted for some time.
- Forage seed production is a new technology which needs time for one to adopt and grasp. Further research needs to be conducted on the impact of producing forages in irrigation systems, on land use and farmer livelihoods. This would be required to explain how forages are impacting on the use of irrigation systems to produce fodder and seed for the market.
- Other areas for further research include the sustainability of the model suggested for forage seed, that of the Agent, where the Agent is IPs. IPs are a new approach and it will be interesting to understand how best it can be employed.
- Future research should focus on testing of the model in different economic environments, what factors will influence farmers to adopt forage seed technologies and incomes generated therein. This will also involve employing other model approaches to see whether the same influencing factors would be revealed.

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Appendix 1: Description of the Natural Regions of Zimbabwe

Natural Region	Area (000 ha)	% of total land area (%)	Annual rainfall (mm)	Farming Systems
I	613	1.56	> 1 000. Rain in all months of the year, relatively low temperatures	Suitable for dairy farming forestry, tea, coffee, fruit, beef and maize production
II	7 343	18.68	700-1 050. Rainfall confined to summer	Suitable for intensive farming, based on maize, tobacco, cotton and livestock
III	6 855	17.43	500-800. Relatively high temperatures and infrequent, heavy falls of rain, and subject to seasonal droughts and severe mid-season dry spells	Semi-intensive farming region. Suitable for livestock production, together with production of fodder crops and cash crops under good farm management
IV	13 010 036	33.03	450-650. Rainfall subject to frequent seasonal droughts and severe dry spells during the rainy season	Semi-extensive region. Suitable for farm systems based on livestock and resistant fodder crops. Forestry, wildlife/tourism
V	10 288	26.2	< 450. Very erratic rainfall. Northern low veldt may have more rain but the topography and soils are poor	Extensive farming region. Suitable for extensive cattle ranching. Zambezi Valley is infested with tsetse fly. Forestry, wildlife/tourism

Source: Adapted from Moyo, 2000; Vincent and Thomas, 1961.

Appendix 2: Livestock numbers by species by province in Zimbabwe

Province	Cattle		Sheep		Goats		Pigs	
	2014/15	**2013/14**	**2014/15**	**2013/14**	**2014/15**	**2013/14**	**2014/15**	**2013/14**
Mash West	684 328	773 569	108 479	130 021	116 565	111 003	89 541	85 278
Mash Central	506 892	509 289	32 255	38 977	274 414	268 877	69 079	65 790
Mash East	**618 072**	**566 893**	**27 806**	**30 006**	**199 899**	**196 661**	**39 477**	**37 597**
Manicaland	660 899	629 901	78 697	100 462	802 379	891 532	51 317	50 809
Midlands	727 767	712 693	93 510	93 796	524 755	499 703	28 249	26 904
Masvingo	1007165	1 039 666	16 589	17 904	398 115	368 722	25 435	25 623
Mat North	656 898	610 708	28 513	34 176	1 117 266	1 030 708	16 120	17 687
Mat South	615 359	525 387	70 778	76 265	616 135	574 068	26 031	32 539
Total	**5 477 338**	**5 368 105**	**456 627**	**521 607**	**4 049 528**	**3 941 274**	**345 249**	**342 227**

Source: Second Crop and Livestock Assessment Reports, MoAMID

Appendix 3: Household questionnaire

Forage Seed VCA Questionnaire – Household survey

A. Introduction

Start with greetings in the local language.

Please read out aloud the following for the respondents

I am a student at the University of KwaZulu-Natal, South Africa I have randomly selected households in two (**Goromonzi and Murewa)** districts of the country regarding farmers' perceptions and attitudes on aspects of forage seed production and marketing. The information generated in this study will be kept in a secure place and will be used only for the purposes of this research.

Thank you for taking time to respond to this questionnaire on forage seed in your area. The survey aims to identify challenges and opportunities for forage seed production by smallholder farmers. Please note your answers will be treated as confidential. You also have the right to terminate this interview or refuse to answer any questions you do not want to respond to.

Enumerators, note:

- ***The interview must be conducted either with the household head or the spouse***
- ***The questions may have more than one answer.***

B. General Identification of Household Information

1. **Identification information**

Questionnaire no.:……..

1.1 Date of interview:_____ **1.2** Name of Enumerator:_____

1.3 District_____ **1.4** Ward _____ **1.5**Village_____

2. **Household information**

2.1Name of respondent				
2.2 Age of respondent			**2.3** Respondent's gender *1=Male; 0=Female*	
2.4 Is respondent household head (HH)? *1=yes; 0=no*			**2.5** Relationship of respondent to HH head *1=Spouse; 2=child 3=Other*	
2.6Name of HH Head				
2.7 Age of Household Head			**2.8** HH head's gender *1=male; 0=female*	
2.9 HH head marital status *1=single; 2=married; 3=divorced; 4=widowed*			**2.10** HH head level of education *1=never been to school; 2=primary; 3=secondary; 4= tertiary*	
2.11 HH size			**2.12** HH labour size	
2.13 HH members	Male	Female	**2.14** Years HH has been farming	
2.13.1 Less than 15 years				
2.13.2 Between 16.1 and 30 years				
2.13.3 Between 31.1 and 60 years				
2.13.4 Above 60 years			**2.15** Main source of income 1=formal employment; 2=field crops; 3=horticulture; 4=cattle; 5=other livestock; 6=other (specify)	

3. **Asset ownership**

3.1 Asset	**3.2 Number owned**	**3.1 Asset**	**3.2 Number owned**	**3.1 Asset**	**3.2 Number owned**
1. Wheelbarrow		**5.** Knapsack sprayer		**9.** Motorbike	
2.Plough		**6.** Tractor		**10.** Car	
3.Ox-drawn harrow		**7.** Generator		**11.** Mobile phone	
4. Scotch cart		**8.** Bicycle		**99.** Other (specify)	

4. **Livestock ownership in past three years**

4.1 Year	**4.1.1 - 2013**						**4.1.2 - 2014**						**4.1.3 - 2015**						
4.2Type of animal	4.1.1.1 No. Owned	4.1.1.2 Value of each (US$)	4.1.1.3 Market (Code A)	4.1.1.4 Sales (reason) (Code B)	4.1.15 No of Deaths	4.1.1.6 Deaths (reason) (Code C)	4.1.2.1 No. Owned	4.1.1.2 Value of each (US$)	4.1.2.3 Market (Code A)	4.1.2.4 Sales (reason) (Code B)	4.1.2.5No of Deaths	4.1.2.6 Deaths (reason) (Code C)	4.1.3.1 No. Owned	4.1.3.2 Value of each (US$)	4.1.3.3 Market (Code A)	4.1.3.4 Sales (reason) (Code B)	4.1.3.5 No of Deaths	4.1.3.6 Deaths (reason) (Code C)	4.4Reason/s for keeping livestock (Code) Rank if many
Cattle																			
Bulls																			
Oxen																			
Steers																			
Cows																			
Heifer																			
Calves																			
Goats																			
Bucks																			
Does																			

Kids																			
Poultry																			
Indigenous Chicken																			
Broiler																			
Layers																			
Others																			
Other livestock																			
Pigs																			
Sheep																			
Others																			
Code A 1=Abattoir 5=Outside trader 2=Livestock auction 3=Local butchery 4=Local sale			**Code B** 1=Regular source of income 2=Special occasion 3=End of feeding period 99=Other			**Code C** 1=Sick 2=Old 3=Injured 4=Slaughtered for HH consumption													

4.5 How does the availability of feed vary over an average year? (On a scale of 0-10, where 10 = excess feed available, 5= adequate feed available and 0=no feed available)

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Feed availability (score 0-10)												

4.6 How much do the various feeds contribute to the diet of the animal throughout a year? Proportion of nutrition derived from different sources. The different sources **must add to 10**

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Crop residues (eg. maize stover)												
Legume crop residues (eg. Groundnut stover)												
Forage hay												
Grass hay												
Silage												
Green forage (eg.cut fodder crops)												
Grazing												
Beef concentrate												
Dairy concentrate												

Other – Specify												
Other – Specify												
Must add to 10	***10***	***10***	***10***	***10***	***10***	***10***	***10***	***10***	***10***	***10***	***10***	***10***

5. **Farmer organization**

5.1	Do you know any farmer/producer organization? *1=yes; 0=no*	
5.2	Which ones?	1---------- 2---------- 3----------
5.3	Are you a member of any farmer/producer organization? *1=yes; 0=no*	
5.4	If yes, which one?	1---------- 2---------- 3----------
5.5	If you are not a member, why? *1=cannot afford subscriptions; 2=Too far; 3=Do not understand its operations; 4=benefits not clear; 5= Is not represented locally*	
5.6	Would you join one if given a chance? 1=yes; 0=no	

C. Farm description and farming activities

6 Farm Description

6.1 Land Holding/Farm size (ha)	
	Ha
6.1.1 Homestead	
6.1.2 Field crops	
6.1.3 Grazing land/ paddocks	
6.1.4 Garden	
99. Other	
Total land holding	

D. Cropping activities
7.1 Field crop production

7.1.1 Crop type		1. Area planted (ha)	2. Major seed source (**Code A**)	3. Seed cost/kg (US$)	4. Technology (**Code B**)	5.Basal fertilizer (kg)	6. Cost/ 50 kg bag (US$)	7. Top dressing (kg)	8.Cost / 50 kg bag (US$)	9.Other (kg) (**Code C**)	10.Cost/ 50 kg bag (US$)	11.Chemical (**Code D**)	12.Cost/ unit (US$)	13.Inputs availability (**Code E**)
7.1.2		**2012-2013 Season**												
1. Maize														
2. Groundnuts														
3. Cowpea														
4. Other														
7.1.3		**2013-2014 season**												
1. Maize														
2. Groundnut														
3. Cowpea														
4. Other														
7.1.4		**2014-2015 season**												
1. Maize														

2. Groundnut														
3. Cowpea														
4. Other														
	Code A 1=Retained seed 1=Bought-in 3=NGO 4=Input program 5=Research 6=Neighbour				**Code B** 1=Conservation agriculture 2=Conventional		**Code C** 1=Manure 2=Lime 3=Gypsum 4=SSP		**Code D** 1=Herbicide 2=Pesticide 3=Fungicide 4=Grain protectant		**Code E** 1=Readily available 2=Available (medium) 3=Not readily available			

7.2. Forage Production

7.2.1 Have you been involved in forage production? 1=yes; 0=no _____

7.2.2 If no, do you wish to be involved if given a chance? 1=yes; 0=no _____

7.2.3 If yes, complete table below

7.2.3 Crop type	1. Area planted (ha)	2. Major seed source (**Code A**)	3. Seed cost/kg (US$)	4. Technology (**Code B**)	5. Cropping system (**Code C**)	6. Basal fertilizer (kg)	7. Cost/ 50 kg bag (US$)	8. Top dressing (kg)	9. Cost / 50 kg bag (US$)	10. Other (kg) (**Code D**)	11. Cost/ 50 kg bag (US$)	12. Chemical (**Code E**)	13. Cost/ unit (US$)	14. Inputs availability (**Code F**)	15. Intended purpose (**Code G**)
7.2.4		**2012-2013 season**													
1. Mucuna															
2. Lablab															
3. Cowpea															
4. Other(specify															
7.2.5		**2013-2014 Season**													
1. Mucuna															
2. Lablab															
3. Cowpea															

4. Other(specify															
7.2.6		**2014-2015 Season**													
1. Mucuna															
2. Lablab															
3. Cowpea															
4. Other(specify															

Code A	**Code B**	**Code C**	**Code D**	**Code E**			**Code F**	**Code G**
1=Retained seed program 4=Input 2=Bought-in 5=Research 3=NGO 6=Neighbour	1=CA-basins 2=CA-mechanised 3=CA-mulch 4=Conventional	1=Intercropping 2=Single crop 3=Ley cropping	1=Manure 2=Lime 3=Gypsum 4=SSP	1=Herbicide 2=Pesticide 3=Fungicide 4=Grain protectant			1=Readily available 2=Available (medium) 3=Not readily available	1=Silage 2=Hay 3=Seed/ grain

7.3 Rank the factors you think affect demand for forage seed

a)……

b)……

c)……

d)……

e)……

E. Marketing activities

8.1 Marketing of Crop Produce 2013/14 season

8.1.1 Crop type	8.1.2. Did you sell? (*1=yes 0=no*)	8.1.3 Who decided on sale? (**Code A**)	8.1.4. Amount sold (kg)	8.1.5 Where did you sell (**Code B**)	8.1.6 Major buyers (**Code C**)	8.1.7 Distance to closest main market (km) (**Code D**)	8.1.8 Means of transport to market (**Code E**)	8.1.9 Price per kg	8.1.10 Total income earned (USD)	8.1.11 How organized (**Code F**)	8.1.12 Cost of transportation (USD)
1. Maize											
2. Groundnuts											
3. Cowpea-Hay											
4. Cowpea-Seed											
5. Mucuna-Hay											
6. Mucuna-Seed											

7. Lablab-Hay											
8. Lablab-Seed											
9. Other (specify)											

Code A	**Code B**	**Code C**	**Code D**	**Code E**	**Code F**
1=HH head 2=Spouse 3=Male adult 4=Female adult 5=Male child 6=Female child 7=All 99=Other	1=Farm gate 2=Local market 3=Local town 4=Distant market 99=Other	1=Local community 2=Middlemen/Traders (Mention name) 3=NGO 4=Registered buyer 99=Other	1=Very close 2=Far 3=very far 99=Other	1=On foot 2=Bicycle 3=Ox cart 4=Vehicle 5=Public transport 99=Other	1=Individually 2=Collectively 99=Other

8.2 Market information

Row	8.2.1 Type of information	8.2.2 Do you get information (*1=yes, 0=no*)	8.2.3 Main source of information (**Code A**)	8.2.4 Main communication channel (**Code B**)	8.2.5 Reliability of main source (**Code C**)	8.2.6 Do you pay for this information? (*1=Yes, 0=No*)	8.2.7 How useful is this information? (**Code D**)	8.2.8 Do you share this information with other farmers? (*1=Yes, 0=No*)
1.	Input prices							
2.	Market prices							
3.	Quantities and quality demanded							
4.	Marketing opportunities							
5.	Supplies in different markets							
6.	Information on quality standards							
7.	Availability of transport services							
8.	Input support							
9.	Other specify							
	Code A	**Code B**		**Code C**		**Code D**		

	1=Private company 2=NGO 3=Government institution 4=Farmer group 5=Trade association 6=Other farmers 99=Other	1=Radio 2=TV 3=Mobile phone 4=Other farmers 5=Traders 6=Extension staff 7=Market bulletins 8=Newspapers 99=Other	1= Not reliable 2=Reliable 3= Very reliable	1= Not useful 2=Useful 3= very useful

8.3 Seed storage

Seed type	Storage type (Code A)	Reason for using such storage type Code B)	Any storage problems? (1=yes; 0=no)	If yes list 3 in order of importance (Code C)	How much seed is lost during storage? (%)	Suggested solutions –List 3 in order of importance (Code D)	Willingness to use alternative storage (1=yes; 0=no)
Food Crops							
Forage							
Code A 1= Granary 2=Bedroom 3=Silo 4=Bagged in kitchen 99=Other	**Code B** 1=Effective pest control 2=Maintains seed viability 3=Security of seed 4=Easy access 99=Other		**Code C** 1=Pest damage 2=No space available 3=Lack of durable material 4=High moisture 5=Theft 99=Other (Specify)			**Code D** 1=Physical control 2=Chemical control 3=Constructing new structures 99=Other (Specify)	

8.4 Organization of forage seed production and marketing in smallholder systems?

8.4.1 How can forage seed production and marketing be organized? List by priority (Code A)	**8.4.2 Support needed to implement the strategies (Code B)**	**8.4.3 Stakeholders to be engaged. List 3 most important in each row (Code C)**	**8.4.4 Challenges foreseen. List 3 most important in each row (Code D)**	**Suggested solutions. List 3 most important in each row (Code E)**
Code A 1= Contract farming 2=Joint ventures 3=Management contracts (tenant farming) 4=Farmer-owned business 5=Out grower schemes 6=Other (Specify)	**Code B** 1= Financial 2=Training 3=Research 4=Extension services 5=Infrastructure 6=Donor support 99=Other (Specify)	**Code C** 1= Research & extension 6=District staff 2=NGOs 7=Other farmers 3=Agro dealer 8=Private companies 4=Input manufacturer 9=Government institution 5=Output market 99=Other (Specify)	**Code D** 1= Lack of cooperation among stakeholders 2=Lack of financial support 3=Limited knowledge 4=Lack of trust & transparency 5=Lack of implementation plan 6=Lack of infrastructure 99=Other (Specify)	**Code E** 1= Training of stakeholders 2=Resource mobilization 3=Private sector involvement 4=Government involvement 5=Trust among stakeholders 99=Other (Specify)

F. Information and training needs

9.1Sources and reliability of forage production information

9.1.1 Type	9.1.2 Main sources (code)	9.1.3 Reliability of source (code) Code (1=not reliable. 2=reliable; 3=very reliable)
Production practices		
Input use		
Markets (physical)		
Prices		
Product standards (grades)		
Clearing procedures		
Timing of sales		
Source of information 0=None 1=Livestock Production department 2=Agritex 3=Farmer organization/association	4=NGOs 5=Radio or TV 6=Newspaper/magazine 7= Posters seen locally 8= Farmers	9= Livestock traders 10=Retailers 12= Market observations 13= Others (specify)

9.2 Information needs

9.2.1 Information needs	9.2.2 Rank (1=most important	9.2.3 Topics		9.2.1 Information needs	9.2.2 Rank (1=most important	9.2.3 Topics
Species identification				Seed production		
Planting and crop management				Business management and budgeting		
Silage making				Fodder and seed marketing		
Hay making						

9.3 Trainings on forage and seed production

9.3.1 Year	9.3.2 Type of training (**Code A**)	9.3.3 When (month) (**Code B**)	9.3.4 Where (**Code C**)	9.3.5 By whom (**Code D**)	9.3.6 Training approach (**Code E**)
2012					

2013					
2014					
2015					
	Code A 1=Silage making 2=hay making 3=Seed production 4=Marketing 5=Business management 99=Other	**Code B** 1=January 7=July 2=February 8=August 3=March 9=September 4=April 10=October 5=May 11=November 6=June 12=December	**Code C** 1=Ward Centre 2=Training centre 3=Hotel 99=Other	**Code D** 1=LPD staff 2=Agritex 3=Research Department 4=NGO 5=Private organization 99=Other	**Code E** 1=FFS 2=Classroom type 3=demonstration 4=Lead farmer approach 99=Other

9.4 Training needs on forage and seed production and marketing

9.4.1Training needs	**9.4.2** Rank (1=most important	**9.4.3 Topics**		**9.4.1 Training needs**	**9.4.2** Rank (1=most important	**9.4.3 Topics**

Species identification				Seed production		
Planting and crop management				Business management and budgeting		
Silage making				Fodder and seed marketing		
Hay making						

G. Labour, gender roles and decision making

10.1 Labour for crop and seed production (Write days taken to complete activity last season)

		Maize		Groundnut		Cowpea		Mucuna Hay		Mucuna seed		Lablab Hay		Lablab seed		Sweet potato		Tobacco		Soy bean		Other (Specify)	
	Age group	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Land preparation	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						
Planting	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						
Fertilizer application	Up to 16 years																						
	17-34 years																						

	35-64 years																						
	>64 years																						
Weeding	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						
Spraying	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						

Labour for crop and seed production (Cont'd)

		Maize	**Groundnut**	**Cowpea**	**Mucuna hay**	**Mucuna seed**	**Lablab hay**	**Lablab seed**	**Sweet potato**	**Tobacco**	**Soy bean**	**Other (Specify)**

	Age group	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F				
Harvesting	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						
Threshing	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						
Marketing	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						

Sourcing of inputs	Up to 16 years																						
	17-34 years																						
	35-64 years																						
	>64 years																						

10.2 What is the cost (US$) of labour per day?_____

10.3 Who makes decisions on crop management practices?

	Maize		Groundnut		Cowpea		Mucuna Hay		Mucuna seed		Lablab Hay		Lablab seed		Sweet potato		Tobacco		Soy bean		Other (Specify)	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Field selection																						
Land preparation																						
Planting																						
Fertilizer application																						
Weeding																						
Spraying																						
Harvesting																						
Threshing																						
Marketing																						
Sourcing of inputs																						

10.4 What do farmers use as basis for decision making on cropping programme? (Tick in boxes)

Crop type	Previous crop	Crop input availability	Labour availability	Soil type	Ease or production	Market availability	Market price	Weather conditions	Financial resources	Cropping system	Intended use
Maize											
Groundnuts											
Cowpea											
Mucuna											
Lablab											
Sweet potato											
Other (specify)											

H. Finance and Income

11.1 Income

	12.2.2 Income source	12.2.3 Income realized in past 3 seasons US$		
		2013	2014	2015
12.1	Sale of crops			
12.2	Sale of forage seed			
12.3	Sale of livestock			
12.4	Off farm activities			
12.5	Regular non-agricultural employment			
12.6	Remittances			
12.7	Other specify			

13 Finance

13.1.1Crop/livestock activities	13.1.2Sources of finance for yearly activities (Code A)		
	2013	2014	2015
Maize			
Groundnuts			
Cowpea			
Mucuna			
Lablab			
Sweet potato			
Cattle			
Goats			

Poultry			
Other (specify)			
Code A 1=Bank loan 4=Self-financed 6=ISAL 2=NGO 5=Farmer group 99=Other 3=Private company			

I. Stakeholder information

12 Stakeholder interaction

12.1 Who are the stakeholders you interact with?

12.1.1Stakeholder (Code A)	12.1.2 What services do they offer? (Code B)	12.1.3 How often do you interact (Code C)	12.1.4 Mode of communication (Code D)	12.1.5Stakeholder effectiveness in service delivery (Code E)	12.1.6Importance to your activities (Code F)	Rank in order of importance

Code A	**Code B**	**Code C**	**Code D**	**Code E**	**Code F**	
1= Government Extension staff 2=NGO 3=Agro dealer 4=Input manufacturer 5=Output market 6=District staff 7=Other farmers 8=Private companies 9=Government institution 99=Other	1=Extension 2=Inputs 3=Market 4=Finance 5=security 6=Daily needs 7=Training/Education 8=Communication 99=Other	1=Daily 2=Weekly 3=Monthly 4=Quarterly 5=Annually 99=Other	1=Phone 2=Word of mouth 3=Letters 4=Print media 5=Broadcasting 99=Other	1= Not effective 2= Slightly effective 3= Effective 4= Very effective	1= Not important 2=Important 3= Very important	

A. Challenges and solutions

14. What do you view as the THREE most important constraints on your ability to produce forage and seed and raise income from that?

14.1 Constraints-start with most important (Code A)	14.1.2 Suggestions to solve the problems-start with most important (Code B)	14.1.3 Stakeholders to engage-start with most important (Code C)
Forage seed supply		
1	1	
	2	
	3	
2	1	
	2	
	3	
3	1	
	2	
	3	
Forage seed marketing		
1	1	
	2	
	3	
2	1	
	2	
	3	
3	1	
	2	
	3	
Code A 1=Seed unavailability;	**Code B** 1=Import more forage seed	**Code C** 1=Research organizations

2=Labour constraints; 3=Land shortage; 4=Lack of market; 5=Lack of production knowledge; 6=Lack of marketing knowledge; 7=No stakeholders to engage; 8=Limited extension service; 9=Unfavourable prices; 99=Other (Specify)	2=Engage development organizations 3=Engage private sector 4=Mechanization of farm operations 5=Training 6=Favourable prices at market 7=Development of market infrastructure 8=Intensification of production 9=Improve on extension support 99=Other (Specify)	2=Seed companies 3=Input suppliers 4=Seed traders 5=Cattle and goat breeders and producers 6=Extension staff 7=Development organisations 8=Government 99=Other (Specify)

14.2 Any other suggestions that can make forage seed production and marketing in smallholder systems of Zimbabwe a success

……
……
……
……

Thank you for your invaluable time and responses!

Appendix 4: Focus Group Discussion Checklist

Focus Group Discussion Guide – Local area discussions

A. Introduction

Please read out aloud the following for the respondents

I am a student at the University of KwaZulu-Natal, South Africa I have randomly selected households in two **Goromonzi and Murewa** districts of the country regarding farmers' perceptions and attitudes on aspects of forage seed production and marketing. The information generated in this study will be kept in a secure place and will be used only for the purposes of this research.

Thank you for taking time to take part in this discussion on seed business. The survey aims to identify challenges and opportunities for forage seed production by farmers. Please note your responses will be treated as confidential. You also have the right to terminate this discussion or refuse to answer any questions you do not want to respond to.

B. Focus Group Discussion – General Information

District		
Ward Name		
Venue		
Number of participants	**Males:……..**	**Females:……..**

C. Discussion checklist

6. How is the rainfall pattern like in this area (mention also the seasons)?
7. Which are the major crop and livestock activities?
8. How the market is organized (e.g. distance, accessibility, prices offered, quality standards and transport). How are market prices for produce determined in this area?
9. Roles and responsibilities of farmers and other stakeholders.
10. Who is involved in what farm activities (males, females, age groups)?
11. Who decides on cropping and livestock programme and what factors determine crops and livestock to produce?
12. Who do you interact with on crop and livestock activities and how efficient are they?
13. What feeds are available for livestock and at what period of the year?
14. Is there any forage production activity in the area and how are the seeds sourced?
15. Is there a need for forage and seed production?
16. What would you consider in shifting from your usual cropping programme to that which includes forage production?
17. What form of support (financial, infrastructure, training etc.) would you require to venture into forage seed business?
18. Who should be engaged in support of your seed business and what will be their roles and responsibilities?
19. What challenges are there and foresee in forage seed production and marketing?
20. How can these challenges be overcome?

Our discussion has come to an end. Thank you very much for taking your time to come and share your opinions and experiences with us.

Attendance Register

Focus Group Discussion Register **District:…….Ward:……** **Date of discussion:……Venue:……**				
Name	**Gender**	**Ward/ Organization**	**Position in ward/ organization**	**Signature**

Appendix 5: Key Informant Interview Checklist

Key Informant Interview Guide – Organization checklist

A. Introduction

Please read out aloud the following for the respondents

I am a student at the University of KwaZulu-Natal, South Africa I have randomly selected households in two **Goromonzi and Murewa** districts of the country regarding farmers' perceptions and attitudes on aspects of forage seed production and marketing. The information generated in this study will be kept in a secure place and will be used only for the purposes of this research.

Thank you for taking time to take part in this discussion on seed business within your organization. The survey aims to identify challenges and opportunities for forage seed production by organizations. Please note your answers will be treated as confidential. You also have the right to terminate this interview or refuse to answer any questions you do not want to respond to.

B. Key Informant Discussion - Checklist

Name of company/organization			
Address of organization			
Contact number of organization			
Name of respondent			
Position of respondent in organization			
Age of respondent		Respondent's gender*1=Male; 0=Female*	
When did organization start operations		How many people are employed by the organization	

Branch network		Any subsidiary companies	
Annual turnover			

1. What is the nature of your business?
2. Who are your main customers (consumers of your goods and services)?
3. What is your experience in working/engaging with smallholder farmers?
   - Main objective of engaging with the farmers
   - In what ways/forms were you working with them?
   - What was their response?
   - Highlight challenges encountered and how you dealt with them
4. What has been the impact of engaging farmers with your organization?
5. What is your opinion on smallholder farmers being engaged in forage seed production?
6. What is your experience with smallholder farmers producing forage seed?
7. Which category of farmers do you think is best suited to produce forage seed for the market?
8. Who are the other stakeholders who work with smallholder farmers?
9. What opportunities exist for smallholder farmers engaging in forage seed production as a business?
10. What challenges do you think are being encountered or foresee in the seed business?
11. What strategies should be developed for the forage seed business to be competitive?
12. What form of support (financial, infrastructure, training, extension, etc.) is needed to make this a success?
13. How can the forage seed business be improved?
14. Who should be engaged to work with the farmers for the success of the forage seed business?

Appendix 6: Consent form

UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL

For research with human participants

GWARO REZIVISO KUBVUMIDZO

Ziviso kumudzidzi: Zvichisanganisira kuti pane mitemo inofanirwa kutevedzerwa pakupinda mutsvagurudzo ino, zvakakosha kuti chiziviso chekumbiro ino chinofanira kuva chakanyorwa uye chine tsananguro yakajeka inonzwisisika kune vachaiverenga nekuishandisa. Nekudaro, gwaro rino richaiswa mundimi dzinoita kuti vese vacharishandisa vakwanise kuriverenga nekurinzwisisa.

Pane dzimwe nhambo dzekuti gwaro rakafakazirwa zvataurwa rinobvumidzwa, saka nhambo idzi dzinopihwa mvumo ne HSSREC.

Mashoko Zanhi ne Bvumidzo kuve Mutsvagurudzo

Zuva:

Vadiwa Chiremba/Va/Mai/Muzvare/Zvimwe: ……

Zita rangu ndinonzi Irenie Chakoma ndichishanda neve International Livestock Research Institute (ILRI), Harare. Parizvino ndiri mudzidzi pa University ye KwaZulu-Natal, Graduate School of Business and Leadership. Mbozha nhare:+263 77 338 9265 Tsamba:ireniechakoma@yahoo.com

Munokokwa kufunga nezvekuva mutsvagurudzo ichaitwa maererano nebhizimusi rekurima mbeu yechikafu chezvipfuyo nemafuro kuvarimi vemumaruwa muZimbabwe. Chinangwa chetsvagurudzo iyi ndechekuda kuongorora kuti bhizimusi rembeu yakanangana nechikafu chezvipfuyo rinokwanisika here. Izvi zvichaitwa kubudikidza nekuongorora kurimwa nekutengeswa kwembeu yechikafu chezvipfuyo nemafuro, matambudziko anosanganikwa nawo, nezvingaitwa kugadzirisa, makambani anoita zvembeu uye mafambisirwo angaitwe bhizimusi rembeu iri.

Tsvagurudzo iyi inotarisira kushanda nevarimi mazana mana nemasere munharaunda dze Goromonzi ne Murehwa, makambani anoita zvembeu gumi nemashanu, makambani maviri anoita zvemari nekukweretesa varimi, vanamuzvina bhizimusi vemunharaunda vashanu, vanoita zvebudiriro munharaunda vaviri, mapoka maviri evarimi, uye mapoka ehurumende anoongorora kurimwa nekutengeswa kwembeu nevanopa dzidziso kuvarimi. Tsvagurudzo iyi inotarisira kuita hurukuro nemurimi umwe nemumwe anenge arimutsvagurudzo iyi achipindura mibvunzo yakanyorwa pasi. Kana mafunga kuva mumwe wevari mutsvagurudzo iyi, hurukuro iyi inotarisirwa kutora awa rimwechete nechikamu chepakati. Kuchaitwazve hurukuro nevakamirira mapato anoshanda nevarimi munharaunda. Kumakambani akazvimiririra, mushandi mumwechete anomiririra kambani ndiye achakurukurwa naye.

Kana matendera kuva mutsvagurudzo iyi, zvinotarisirwa kuti munogona kubvunzwa mibvunzo inoburitsa zvinhu zvisiri nyore kutaurira mutorwa, sezita renyu rese uye makore ekuberekwa. Zvinotarisirwa zvekare kuti hapana mubairo kana muripo uchapihwa maringe nekuva mutsvagurudzo iyi. Zvakadaro, tinovimba vachapinda mutsvagurudzo iyi vachabatsirikana neruzivo rwebhizimisi rekurima mbeu yechikafu chezvipfuyo uye kwekutengesera kwacho. Zvimwe zvamuchawana pazviri ipundutso yamunowana zvikuru kuvandudzika kwevhu nekukodzwa kuchaitwa zvipfuyo kana zvadya hufuro hunobva mumbeu idzi.

Zvichida munogona kuona musina kusununguka kune mutsvagiridzi wamunenge mapiwa kuti mutaure naye, makasununguka kuzivisa mudzidzi Irenie Chakoma kuti mugowanirwa umwe mutsvagiridzi.

Hatitarisiri kuti kupinda mutsvagiridzo ino kunokusanganisai nenjodzi.

Tsvagurudzo iyi yakaongororwa nekubvumirwa neUKZN Humanities neSocial Sciences Research Ethics Committee (Nhamba dzehubvumirwa_____).

Kana pakaitika matambudziko kana mibvunzo, batai mutsvagiridzi pa 4 Ilkley Close, Ashdown Park, Harare, Zimbabwe. Mbozha nhare:+2637 7338 9265 kana tsamba:ireniechakoma@yahoo.com kana UKZN Humanities ne Social Sciences Research Ethics Committee panotevera:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Tinotenda kuti kuve kwenyu muchiitiko chetsvagurudzo ichi, maita nekuda kwenyu zvisina kumbunyikidzwa kana kumanikidzwa. Mune kodzero yekurega kana kuramba kupindura mimwe mibvunzo yamusingakwanise kupindura, uye makasununguka kubuda mutsvagiridzo ino chero nguva ipi zvayo. Hapana icho mucharasikirwa nacho uye hapana zvichakuwanai kana marega kuve mutsvagurudzo iyi. Kana muchinge musingachakwanisa kuva mutsvagurudzo ino, makasununguka kutizivisa kana kusatizivisa chikonzero chekurega. Mutsvagiridzi akasunungukawo kukuregeresai kuve mutsvagiridzo iyi kana zvaonekwa kuti maitiro enyu haana kuenderanana nezvinotarisirwa, uye kana akaona mhinduro kana hurukuro yenyu isingabatsire pazvinodiwa netsvagurudzo ino.

Hapana mubhadharo uchavepo pakuve mutsvagurudzo iyi.

Munotendera kuti mashoko achabva muhukuro kana kunyorwa mumafomu achachengetedzwa mupfimbi yezvinyorwa kumahofisi eILRI uye veUniversity yeKwaZulu-Natal, vanemvumo yekuongororawo zvinyorwa izvi.

Bvumidzo

Ini …….. ndaziviswa nezve tsvagurudzo irikuitwa maererano rekurima mbeu yemafuro sebhizimusi kuvarimi vekumaruwa muZimbabwe

Ndanzwisisa chinangwa nenzira dzichashandisa pakuita tsvagurudzo iyi.

Ndapihwa mukana wekupindura mibvunzo patsvagurudzo iyi uye ndapindura mibvunzo zvandigutsa.

Ndinoti kuve kwangu mutsvagurudzoiyi kuda kwangu handina kumanikidzwa uye ndinokwanisa kuregera chero nguvai pasina kurasikirwa nezvipundutso izvo zvakaringana neni.

Ndaziviswa nezve muripo nekurapwa kungavepo kana ndakuvara kubudikidza nemafambisirwo anenge aitwa tsvagurudzo.

Kana ndine mibvunzo kana kushushikana maererano netsvagurudzo iyi, ndinokwanisa kubata mutsvagiridzi pa 4 Ilkley Close, Ashdown Park, Harare, Zimbabwe. Mbozha nhare:+2637 7338 9265. Tsamba:ireniechakoma@yahoo.com

Kana ndine mibvunzo kana kushushikana nezvekodzero dzangu pakuve mutsvagiridzo iyi, uye kana ndine kushushikana pane chimwe chezvetsvagurudzo ndinokwanisa kubata:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Rimwe bvumidzo, kupi zvichiendererana

Ndinopa bvumidzo ku:

Hurukuro yangu inotorwa mumasaisai / Hurukuro nevamwe pamwe	Hongu / Kwete
Hurukuro yangu inotorwa vhidiyo / Hurukuro nevamwe pamwe	Hongu / Kwete
Kushandiswa kwemifananidzo yangu panyaya yetsvagurudzo iyi	Hongu / Kwete

_____ _____

Runyoro rwemupinduri musi

_____ _____

Runyoro rwemufakazi musi

(Panoendererana)

_____ _____

Runyoro rwemuturikiri musi

(Panoendererana)

Appendix 7: Ethical Clearance Letter from Ministry of Agriculture, Mechanisation and Irrigation Development

MINISTRY OF AGRICULTURE, MECHANISATION AND IRRIGATION DEVELOPMENT

All Communications to be addressed to
"THE PRINCIPAL DIRECTOR"

Telephone: 263-04-706960/706650
E-mail address: pd.hq@drss.gov.zw
Fax: 263-04-700339

DEPARTMENT OF RESEARCH AND SPECIALI
SERVICES (DR&SS)

Fifth Street Extension
P O Box CY 594, Causeway
Harare, Zimbabwe

Ref: 1520/F2

25 August 2015

I.C. Chakoma (Mrs)
International Livestock Research Institute (ILRI)
c/o CIMMYT Southern Africa Regional Office
12.5 km Peg, Mazowe Road
Harare
Zimbabwe

Dear Madam,

RE: REQUEST FOR AUTHORITY TO CONDUCT SURVEY ON FORAGE SEED VALUE CHAINS IN THE SMALLHOLDER SECTOR OF ZIMBABWE

Your letter dated 12 August 2015 with the above subject refers.

The Ministry advises that you can proceed conducting the survey in the said districts. As this is a vital component towards improving the agricultural sector in Zimbabwe, the Ministry would appreciate being appraised of any outcomes from the survey. This would assist rural farmers improve their livelihoods from forage seeds and feed for livestock.

[redacted]

D. Kutywayo (PhD)
Acting Principal Director, Department of Research and Specialist Services

Appendix 8: Ethical Clearance Approval Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

20 January 2016

Mrs Irenie Chakome 215081016
Graduate School of Business & Leadership
Westville Campus

Dear Mrs Chakome

Protocol reference number: HSS/1621/015D
Project title: Forage seed production as a business in smallholder systems of Zimbabwe

Full Approval – Expedited Application

In response to your application received 30 November 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

You [redacted]

.....

Dr Shenuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

Cc Supervisor: Dr Bibi Z Chummun
Cc Academic Leader Research: Dr M Hoque
Cc School Administrator: Ms Zarina Bullyraj

Humanities & Social Sciences Research Ethics Committee
Dr Shenuka Singh (Chair)
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Website: www.ukzn.ac.za