

Report of the Feasibility Study on the Dairy and Beef Value Chain for Western Province

**By Chisoni Mumba, PhD: Livestock/Animal
Health Economics**

2020

TABLE OF CONTENTS

LIST OF TABLES.....	iv
LIST OF ABBREVIATIONS.....	v
EXECUTIVE SUMMARY	vi
ACKNOWLEDGEMENTS.....	xiv
DISCLAIMER.....	xv
1.0 INTRODUCTION	16
1.2 Problem statement	17
1.3 Objectives	18
2.0 METHODOLOGY	19
2.1 Study design, technique and study sites for quantitative data	19
2.2 Sample size estimation for quantitative data	19
2.3 Data collection instruments for objective (i) and (ii).....	20
2.4 Sampling technique for quantitative data	20
2.5 Sample size estimation for qualitative data.....	21
2.6 Sampling technique for qualitative data- Key informant Interviews.....	21
2.7 Sampling technique for qualitative data- Focus Group Meetings	22
2.8 Data management and analysis.....	23
4.0 RESULTS AND DISCUSSION	24
4.1 Factors affecting smallholder livestock farmers' participation in livestock markets..	24
4.1.1 Absence of commercial farmers in Western Province	24
4.1.2 Lack of improved dairy breeds	24
4.1.3 Inadequate extension services	26
4.1.4 Lack of a business mindset and skills	27
4.1.5 Poor road infrastructure	28

4.1.6	Lack of supportive production and market infrastructure	29
4.1.7	Seasonality of milk production in Transhumance cattle herding systems	30
4.1.8	Livestock ownership	31
4.1.9	Consumption habits and beliefs.....	32
4.1.10	Sparsely located livestock population and markets	32
4.1.11	Lack of knowledge and sensitisation	33
4.1.12	Lack of transport.....	34
4.1.13	Poor governance of dairy cooperatives	34
4.1.14	Traditional governance system.....	35
4.1.15	Lack of a holistic approach to value chain development.....	36
4.1.16	Lack of grading system in beef markets	36
4.1.17	Uncompetitive pricing.....	37
4.1.18	Lack of dairy markets (dairy processor).....	38
4.1.19	Continuous reduction in cattle population over the past five years	38
4.2	Relationship between household herd size and participation in cattle markets.....	40
4.3	Key players in the dairy and beef markets for Western province	42
4.4	Status and adequacy of the existing supportive infrastructures.....	43
4.5	Existing risks as well as opportunities for embedding other agricultural services	44
4.5.1	Existing risks for embedding other agricultural services	44
4.5.1.1	Marketing risk	44
4.5.1.2	Animal disease risk.....	44
4.5.1.3	Risk of loss.....	45
4.5.1.4	Risk of losing land	46
4.5.2	Opportunities for embedding other agricultural services that are currently lacking	

4.5.2.1	Bailing natural grass	47
4.5.2.2	Value addition	47
4.5.2.3	Transportation of milk as a youth empowerment programme	47
4.5.2.4	Diversification to goat farming	48
4.5.2.4	Feedlotting.....	48
4.5.2.4	Information dissemination.....	48
4.6	Key constraints faced by the key players in putting in place information systems.....	49
4.6.1	Lack of information providers in the livestock markets.....	49
4.6.2	Lack of resources for insemination dissemination.....	49
4.6.3	Information asymmetry among livestock value chain actors.....	50
4.7	Prospects for research and development in technology innovations	51
4.7.1	Research on dairy and beef breeds that can adapt to Western Province.....	51
4.7.2	Nutrition Research	51
4.7.3	Research on information communication technology	51
4.7.4	Research on holistic and sustainable livestock market models	51
5.0	CONCLUSION AND RECOMMENDATIONS	53
5.1	Conclusion	53
5.2	Recommendations.....	53
5.3	Rank of the critical factors affecting the beef and dairy interventions.....	55
6.0	REFERENCES	57

LIST OF TABLES

Table 1: list of veterinary camps that formed the sampling frame	21
Table 2: List of Key informants.....	22
Table 3: Population of cattle in Western Province and estimated milk production levels	25
Table 4: Mean and Median parameters for cattle producers in Western Province	40
Table 5: the relationship between the number of cattle owned and participation in beef sales	41
Table 6: stakeholder matrix of key players in the dairy and beef value chains	42
Table 7: milk collection centres and abattoirs in Western Province.....	43

LIST OF ABBREVIATIONS

ACF	Agricultural Consultative Forum
AGM	Annual General Meeting
AI	Artificial Insemination
BRE	Barotse Royal Establishment
CBPP	Contagious Bovine Pleuropneumonia
CSO	Central Statistical Office
DFLC	District Fisheries and Livestock Coordinator
DVO	District Veterinary Officer
FGD	Focus Group Discussion
FMD	Foot and Mouth Disease
ICT	Information Communication Technology
Km	Kilometres
L	Litres
LDAHP	Livestock Development and Animal Health Project
LT	Livestock Technician
MCC	Milk Collection Centre
MCCs	Milk Collection Centres
MUSIKA	Musika Development Initiatives Limited
PFLC	Provincial Fisheries and Livestock Coordinator
PDLFs	Practical Dairy Learning Farms
PPCR	Pilot Program for Climate Resilience
PPP	Private-Public Partnership
PVO	Provincial Veterinary Officer
ROI	Returns on Investment
SMEs	Small and Medium Enterprises
SVO	Senior Veterinary Officer

EXECUTIVE SUMMARY

The cattle industry is a critical component in the Zambian livestock sector, contributing to poverty reduction and economic growth. However, the sector is fraught with low productivity levels, low participation rates in both the dairy and beef markets by small-scale farmers and limited access to formal off-take markets. This is despite the potential market that the livestock subsector presents in Zambia.

This feasibility study aimed to assess factors affecting private sector investment and provide a factual basis for making informed decisions about interventions in the small-scale dairy and beef sub-sectors related to improving productivity levels, participation rates in both dairy and beef markets, and access to formal off-take markets in Western Province of Zambia. The objectives of the study were guided by the terms of reference (ToR), which included:

- i. To identify and analyse the factors affecting small-scale livestock farmers' participation in livestock markets, i.e. dairy and beef markets.
- ii. To determine if there is any relationship between household herd size and participation in cattle markets, i.e. dairy and beef markets.
- iii. To establish the key players in the dairy and beef markets for the Western Province, i.e. traders, processors, information providers, veterinary health providers etc.
- iv. To establish the status and adequacy of the existing supportive infrastructures, i.e. processing, storage facilities etc. against the demand for services by small-scale farmers.
- v. To establish the existing risks as well as opportunities for embedding other agricultural services that are currently lacking.
- vi. To establish the key constraints faced by the key players in putting in place information systems.
- vii. To explore prospects for Research and Development in technology innovations.

A cross-sectional study design employing both quantitative and qualitative data collection technique was used. An integrated sampling approach (interviews survey, in-depth interviews and participatory focus group meetings) involving key actors along the dairy and beef value chains were used to conduct this study.

The study revealed that the factors affecting smallholder livestock farmers' participation in livestock markets, i.e. dairy and beef markets include:

1. Absence of commercial farmers in Western Province: Commercial livestock farmers serve as role models where small-scale farmers can learn some skills. So farmers find it difficult to comprehend.
2. Lack of improved dairy breeds: The farmers in the Western Province are using the local Barotse breed for milk production, which currently only produces a maximum of 2 litres of milk per day for a lactation period of six months.
3. Lack of a business mindset and skills: Livestock farmers in Western Province lack a business mindset and skills to participate in livestock markets actively.
4. Poor and lack of road infrastructure: Other than the main Lusaka-Mongu road, which is also in a poor state between Nkeyema and Luampa districts, more than 90% of the road network is poor with predominantly sandy terrain and limited access feeder roads to rural parts where cattle farming activities take place in Western Province.
5. Inadequate supportive infrastructure: There is currently little private sector engagement supporting herd health. Those previously supported by MUSIKA closed, citing low returns on investment due to lack of willingness to pay (low purchasing power) for these herd health services. The farmers cited lack of resources to pay for herd health services.

6. Livestock ownership: The owners of livestock in Western Province are mostly in Lusaka and other cities making the implementation of interventions difficult as decision-making is not in the hands of the custodian of animals (cattle keepers).
7. Consumption habits and beliefs: In some parts of Western Province sour milk serves as a relish, a primary protein source. So it becomes difficult for farmers to sell the little milk they have, which is their primary source of animal protein in place of meat, which they cannot afford. Apart from the affordability of meat, culturally, in Western province and many other parts of Zambia, traditional cattle farmers do not slaughter cattle for consumption.
8. Sparsely located livestock population and markets: A Milk Collection Centre (MCC) must be in the radius of at least 10km to where animal production is taking place. This is not the case in the Western Province where all Milk Collection Centres (MCCs) are as far as 70km away from where the animals graze in the Zambezi floodplains.
9. Lack of knowledge and sensitisation: There is a lack of knowledge on producing and handling milk among traditional dairy farmers in Western Province who are culturally used to handling sour milk.
10. Lack of transport: Long distance and bad terrain to sparsely located milk collection centres require reliable transportation.
11. Poor governance of dairy cooperatives: Poor governance systems of dairy cooperatives in Western Province discourage members from joining or supplying milk. In all the dairy cooperatives, membership reduced from over 80 members to less than 20 members who are attempting to resuscitate operations of MCCs. All dairy cooperatives in Western Province are currently not able to meet overhead costs such as electricity because they are not producing.

12. Lack of grading system in beef markets: The lack of a grading system for beef does not motivate the farmer to sell the best animals.
13. Uncompetitive pricing: The prices for livestock in Western Province have been very uncompetitive until recently when a new player came on the beef market. The entire province had seven abattoirs, with one controlling the most significant market share (more than 50%). The new entrant on the beef market seems to have brought competition to the beef industry in Western Province, although they cite tough competition as one of the challenges they face.
14. Lack of dairy markets: currently, the closure of the milk processing plant in Mongu has discouraged participation in dairy markets. The presence of the market stimulated production with farmers planning to acquire dairy breeds to produce more volumes. The closure of the milk plant has somehow shuttered these gains.

The key players in the dairy and beef markets in Western Province include cattle producers, cattle processors, cattle transporters, cattle traders, milk traders, traditional leadership (Barotse Royal Establishment), public and private extension service providers, cattle association, information providers, input suppliers, politicians, non-governmental organisations.

The existing supportive infrastructure is not adequate, with the entire Western Province only having six milk collection centres (Mwandi, Senanga, Sioma, Nalolo, Nanjucha, and Limulunga) and eight abattoirs in Senanga, Sesheke, Mongu, Limulunga) and others under construction in Shang'ombo, Lukulu, Sesheke, Kaoma and Limulunga). All six MCCs are currently inactive. All the abattoirs are active because the beef industry is more developed than dairy. Formal livestock markets are placed along the tarred road away from communal grazing under the transhumance cattle herding system. Since all formal MCCs are now inactive, milk

sales, predominantly sour milk are informal with traders buying milk from the floodplains and sell it in town centres using bicycles as the main mode of transport.

Despite the highlighted challenges of livestock production in Western Province, there are opportunities for private sector investment, i.e. embedding other agricultural services currently lacking. The opportunities include:

1. Bailing natural grass: There is an opportunity for bailing natural grass through dairy cooperatives and private investors linked to dairy cooperatives. Cattle remaining paddocked in the upland for milk production will need to be supplemented with the fodder and concentrates. Bailing natural grass and exotic grass by private investors, dairy cooperatives, and individual farmers is an excellent opportunity for livestock development in Western Province. The BRE offered their support for such an initiative.
2. Value addition: Opportunities exist in value addition at milk collection centres, especially those with an urban setup, e.g. Mongu dairy cooperatives. Value addition, such as the manufacture of yoghurt and packaging of sour milk can improve market access and incomes for livestock farmers in Western Province.
3. Transportation of milk as a youth empowerment programme: There is an opportunity for embedding transportation services at milk collection centres. This is where youths can be contracted to collect milk from the floodplain using motorbikes and tricycles and be paid at the end of the month. This, however, increases the cost of milk production hence the need for a cost-benefit analysis.
4. Diversification to goat farming: there is an opportunity for dairy cooperatives to diversify to goat production, which is taking centre stage in Western Province due to forests with abundant browse for goats.

5. Feedlotting: there is an opportunity to feedlot and fatten beef cattle in the Western Province. There is an absence of choice beef in the province due to lack of feedlots. The opportunity for bailing grass can also be connected to feedlotters because the animals in feedlots will need both grass and concentrate feeds. Feedlots can also run as demonstration centres to showcase good animal husbandry to traditional cattle farmers and cattle keepers in Western province.
6. Information dissemination: there is currently an opportunity for private investment into information dissemination. Private information disseminators in the livestock value chain can be linked to farmers through the cattle association, and processors, with subscriptions so that market information can be constant through all media platforms, i.e. radio, street shows, televisions, social media. These should also be supported by MUSIKA and other stakeholders in livestock value chain development.

There are risks involved in the above-highlighted opportunities for private sector investments. A risk is a condition in which there is a possibility of an adverse deviation from the desired outcome that is expected or hoped for. Private investment risk is a risk that has three possible outcomes, i.e. possibility of loss, the possibility of no loss and possibility of a gain. These risks include:

1. Marketing risk: If a private sector investor invests without a proper market plan for processing milk, there is a risk that the collected milk might overwhelm Western Province and transporting processed milk to Lusaka may be expensive than the milk produced by Kalundu dairy in Chisamba. This can affect projected returns on investment.
2. Animal disease risk: private sector investment in livestock value chains is under risk of endemic livestock diseases. Anthrax and Contagious Bovine Pleural Pneumonia are

endemic in Western Province with sporadic outbreaks of Foot and Mouth Disease. For instance, the December 2020 FMD outbreak led to the closure of all abattoirs in Western Province due to a livestock movement ban. This affects prospects for private sector engagement. One of the control measures for CBPP on Western Province is Test and Slaughter; thus, if one animal tests positive, all may be slaughtered. This has the potential of discouraging participation in livestock markets.

Concerning prospects for research and development in technology innovations, there are still gaps in research in Western province. Some of the gaps identified include:

1. Research on dairy and beef breeds that can adapt to Western Province: With regards to productivity and production, there is a need to research which dairy and beef breeds are suitable for prevailing terrain and climatic conditions?
2. Nutrition research: there is a need to research the types of grass and their nutritional contents to supplement the nutrients that are lacking in the grass. Is there a need to improve natural grasses currently in the Zambezi floodplains?
3. Research on Information Communication Technology (ICT): there is a need to research on the technology to track the production, milk supply and collection, which should result in payment and ensure that people are paid according to the volumes. There is also a need to research the use of technology to monitor the cows properly so that small-scale farmers can efficiently track the animals to ensure that there are reasonable conception rates following Artificial Insemination (AI). However, this should come with an improved veterinary extension service provision to build capacity in farmers to be able to make use of ICTs.

4. Regarding processing, there is a need for research on technologies that can help maintain the quality of milk in the value chain by keeping it fresh or processed to some level.

ACKNOWLEDGEMENTS

I express my gratitude and appreciation for the assistance and advice from key informants in the livestock value chain in Western Province, University of Zambia, Ministry of Fisheries and Livestock staff, the Barotse Royal Establishment and all those who contributed in one way or another in the production of this document.

DISCLAIMER

This feasibility study was commissioned by Musika Development Initiatives. The views, expressions and recommendations presented in this report are those of the author and do not in any way, represent the views of Musika Development Initiatives.

1.0 INTRODUCTION

Within the context of Agricultural Development, the livestock sub-sector is considered one of the most critical areas for economic growth in Zambia (Anonymous 2014). Others are tourism, manufacturing, mining and energy. Of the total land, 47.5% is agricultural land, and 85% of this agriculture land is under pasture, signifying the availability of more land for grazing than arable (World Bank 2011). The remaining 52.5% is forest, national parks, and game management areas (Sinkala et al. 2014).

The livestock production system in Zambia is categorised into traditional and commercial sectors. The traditional subsector accounts for approximately 84% of the livestock population, while the commercial subsector is approximated at 16% (Sinkala et al. 2014). The cattle population's spatial distribution shows that Southern, Central, Western and Eastern Provinces of Zambia account for 90% of the national livestock (Sinkala et al. 2014). The Zambian livestock sector's productivity is generally low, especially among the traditional subsector (Sinkala et al. 2014). For instance, cattle's productivity in the traditional subsector is characterised by slow growth rates, with most cattle reaching market weight after 4–5 years instead of the standard 2-3 years (Mumba et al. 2017). High mortality rates (calf mortality rate of 20-30% and adult mortality rate of 9%) and, low reproductive performance, characterise the traditional sector (World Bank 2011). Three types of herding and grazing patterns exist in the traditional cattle system; village resident herds (always in the villages), transhumant herds (move between the village and the floodplains), and interface herds (permanently stay on the floodplains) (Mwacalimba et al. 2012). Western Province predominantly practices transhumant cattle herding system.

In comparison, the commercial sector's production ratios have low calf mortality of 1-2%, high reproductive rates estimated at 65-70%, and an off-take between 17-18% per annum (World Bank 2011). Commercial farms are situated along the rail line, on titled land, while traditional farms are scattered in rural areas, often practising communal grazing (with low quality of fodder) on land held in trust by traditional leaders (Muma et al. 2011; Muuka et al. 2012). Traditional farmers are not market demand-oriented and do not practise acceptable animal husbandry practices to run livestock farming as a business, which has resulted in reduced

conception rates, high mortality rates, and high disease incidence, which results in low national herd growth which stands at 2% per annum (Muuka et al. 2012; Muma et al. 2014; Sinkala et al. 2014).

What obtains nationally is not different from what obtains in Western Province of Zambia. Cattle farming is the most important agricultural activity in Western Province because crop farming is seasonal and limited by flooding soils in the Zambezi floodplain, which favours rice farming to a larger extent. Cattle farming in Western Province is characterised by low productivity levels, low participation rates in both the dairy and beef markets by traditional farmers and limited access to formal off-take markets. This is despite the potential market that the livestock subsector presents in the province and the entire country. For instance, Lubungu et al. (2015) estimated that the demand for meat products is projected to grow by 400% between 2012 and 2027 due to the rise in national income levels and urbanisation. However, the current national production and marketing conditions might create a supply gap of roughly 320,000 metric tons of beef. In terms of the dairy subsector, only 15% of the dairy potential is currently tapped, making the country a net importer of milk and milk products by 2.5-3 million kilograms annually (World Bank, 2011). Furthermore, the national milk consumption levels are low at 36 litres per capita against a recommended global average of 200 litres per capita (ACF, 2012; Mumba et al., 2011). Therefore, identifying strategies to enable small-scale cattle owners to fill these gaps will play a critical role in improving the poverty reduction linkages.

1.2 Problem statement

The Western Province of Zambia had the second-highest cattle population in 2015 with an estimate of 711,070 herds, but in 2018 it had the fourth-highest number of cattle with an estimate of 450,949 herds (CSO, 2018). Despite the reduction in herd numbers, it still contributes significantly to the national herd. Despite the high herd numbers, only a third of households produce milk (MAL, 2013 and RAL, 2019). Mumba et al., (2018) attribute this to the low cattle productivity, poor herd health and traditional practices. This not only presents a real threat to the viability of the livestock subsector in the province but also to the livelihoods of traditional farmers who depend on it. These inefficiencies were the basis for Musika to have previously supported dairy interventions in both Southern and Western Province. However, what has since been observed over the years is that dairy interventions in Southern Province have performed significantly well in contrast to the Western Province dairy interventions. It is

against this background that Musika commissioned a feasibility study to understand the cattle value chains, specifically in Western Province. The study mainly focused on critical issues surrounding the dairy and beef value chain development in Western Province. It was envisioned that this study's findings would provide an opportunity for Musika to design interventions, which are cognizant of different factors, which might have potential in affecting the performance of the interventions.

1.3 Objectives

This study aimed to assess factors affecting private sector investment and provide a factual basis for making informed decisions about interventions in the traditional/small-scale dairy and beef sub-sectors related to improving productivity levels, participation rates in both dairy and beef markets, and access to formal off-take markets in Western Province of Zambia. The following specific objectives helped to achieve this aim:

- i. To identify and analyse the factors affecting small-scale livestock farmers' participation in livestock markets, i.e. dairy and beef markets.
- ii. To determine if there is any relationship between household herd size and participation in cattle markets, i.e. dairy and beef markets.
- iii. To establish the key players in the dairy and beef markets for the Western province, i.e. traders, processors, information providers, veterinary health providers etc.
- iv. To establish the status and adequacy of the existing supportive infrastructures, i.e. processing, storage facilities etc. against the demand for services by smallholder farmers.
- v. To establish the existing risks as well as opportunities for embedding other agricultural services that are currently lacking.
- vi. To establish the key constraints faced by the key players in putting in place information systems.
- vii. To explore prospects for Research and Development in technology innovations.

2.0 METHODOLOGY

This study was undertaken in Western Province amongst key value chain actors in the dairy and beef value chains. Overall, a cross-sectional study design employing quantitative and qualitative (mixed methods) data collection techniques were used. An integrated sampling approach (interviews survey, in-depth interviews and participatory focus group meetings), involving key actors along the dairy and beef value chains were used to conduct this study.

2.1 Study design, technique and study sites for quantitative data

Spatial stratified sampling technique using both purposive and random sampling was employed. Six districts of Western Province namely Limulunga, Mongu, Nalolo, Senanga, Sioma and Sesheke were chosen purposively based on their already existing smallholder dairy activities and beef production and marketing (abattoirs). The sample was spread across the six administrative districts to capture as many local variations as possible.

2.2 Sample size estimation for quantitative data

The sample size was obtained from estimating the number of observations potentially needed to distinguish between the 16 districts of Western Province by a difference of 30% in some of the important farm/household variables highlighted in the objectives. Assuming the desired confidence interval of 95%, and using a coefficient of variation of 68%, which was the observed coefficient of variation of households in dairy herds from previous studies (Kaguongo et al., 1997); a minimum sample size of 40 in each district was calculated. The calculation of sample size in each stratification class (district), to estimate a difference, was based on equation 1 by Poate and Daplyn (1993).

$$n=2[z c/d]^2 \dots\dots\dots \text{Equation 1.}$$

Where: n = minimum sample size,
z = 1.96 for 95% confidence interval,
c = Coefficient of Variation (0.68),
d = Level of difference (0.3).

The chosen sample required was 240 respondents (40 x 6 districts). These 240 respondents provided preliminary information on the factors affecting smallholder livestock farmers' participation in livestock markets, and the relationship between household herd size and

participation in cattle markets (as required in objective number (i) and (ii) in the ToR). After data collection, out of these 240 respondents, 42 or 17.4% were female. The disaggregation of a dairy and beef farmer was difficult because all dairy farmers are beef farmers since all milk in the Western Province is produced from beef cattle. The disaggregation point was at a level of focus group discussion, which classified all beef farmers belonging to dairy cooperatives as dairy farmers. The focus group discussion for Limulunga dairy had three dairy farmers owing pure Friesian and Jersey breeds. Otherwise, all the 240 were treated as beef farmers, but the questionnaire had a mixture of questions on both dairy and beef.

2.3 Data collection instruments for objective (i) and (ii)

Interview-based semi-structured questionnaires were administered to the 240 smallholder dairy and beef farmers to provide preliminary information about interventions in the traditional/small-scale dairy and beef sub-sectors related to improving productivity levels, participation rates in both dairy and beef markets, and access to formal off-take markets in Western Province of Zambia. The questionnaire was prepared in English but translated to Lozi during interviews.

2.4 Sampling technique for quantitative data

In each district, the District Veterinary Office (DVO) was approached to provide a list of Veterinary camps, which are accessible by road and have a large number of cattle. Veterinary camps are the smallest administrative offices in the district and are manned by veterinary assistants who all report to the District Veterinary Officer. These veterinary camps formed a sampling unit for the study. Out of the 34 veterinary camps in study districts, 14 or 41% were sampled as indicated in table 1. In each veterinary camp, traditional or small-scale dairy and beef cattle farmers were randomly selected from the different veterinary camps and semi-structured questionnaires administered in face-to-face interviews. Farmers were interviewed at abattoirs/slaughter slabs, cattle markets, district veterinary offices, livestock service centres, milk collection centres and the floodplains where they graze their cattle. This was done, because households are far from each other, making it practically impossible to visit the farmers at their homes.

Table 1: list of veterinary camps that formed the sampling frame

District	No. Veterinary camps	Veterinary Camps sampled
Senanga	6	Namilundu, Lukanda, Naande, Wanyau (4)
Limulunga	4	Limulunga (1)
Mongu	12	Mongu Central, Kaande, Malengwa (3)
Sioma	7	Sioma, Nangweshi, Kaanja (3)
Sesheke	5	Sesheke Central, Kalobelwa, Maondo (3)
Total	34	14 (41%)

The data collected using this methodology provided information on:

- i. Factors affecting smallholder livestock farmers' participation in livestock markets, i.e. dairy and beef markets.
- ii. Relationship between household herd size and participation in cattle markets, i.e. dairy and beef markets.

2.5 Sample size estimation for qualitative data

The sample size for key informant interviews was 23 and five for focus groups. The sample size (N) was arrived at after reaching a data saturation point for both key informant interviews and focus group discussions. Strauss and Corbin, (1990), state that researchers should collect data until "no new or relevant data" seem to emerge regarding a category. Interviews were conducted with different categories of informants in the dairy and beef value chains following a line of "theoretical sampling" to construct and refine the hypothesis in terms of reference continuously. The method of determining saturation in data collection was an iterative process for each interview, which involved recruiting key informants or focus groups, interviewing them and analysing the data.

2.6 Sampling technique for qualitative data- Key informant Interviews

A total of 23 Key informant interviews were conducted from all the study districts. The interviewed key informants in the small-scale dairy and beef value chain are indicated in Table 2. Key informants were interviewed from their offices. Efforts were made to interview all those at the provincial office on the same day in different offices to avoid discussion before the interviews. Appointments were made via the phone and physically to schedule an interview with each key informant. All interviews were recorded verbatim. Verbal consent to record the interview was sought. Data was also validated through a professional WhatsApp Vet group

made up of public field veterinarians, private veterinarians and academicians to validate responses from the field.

Table 2: List of Key informants

Key informant	Number
Provincial Veterinary Officer	1
Provincial Fisheries and Livestock Coordinator	1
District Fisheries and Livestock Coordinator	2
District Veterinary Officer	2
Senior Veterinary Officer	1
Senior livestock production officer	1
Livestock technicians	2
Veterinary assistants	1
Beef processors	1
Dairy processor	1
Dairy Farmers (Pure breeds)	2
Cattle producer association	1
Transporter	1
Trader	1
Politicians (mayor and member of parliament)	2
Service providers (extension services)	2
Academician	1
Total	23

2.7 Sampling technique for qualitative data- Focus Group Meetings

A total of five focus group meetings were conducted. The focus group meetings with farmers in the smallholder dairy and beef value chain included: Nalolo Dairy Cooperative, Limulunga Dairy Cooperative, Mongu Dairy cooperative, Senanga Dairy cooperative and the Barotse Royal Establishment. Apart from the one conducted with the Barotse Royal Establishment (BRE), all focus group meetings had a mixture of men and women involved in dairy and beef value chains. The minimum number of participants in each group was 6, with a maximum of 13. The focus group meeting with the BRE had 17 participants because it was a full Kuta

meeting, chaired by the Ngambela (Prime Minister). However, the researcher was still a facilitator of the guided questions as per terms of reference. Participants of the focus group meetings were not involved in the survey to avoid them coming with preconceived ideas into the meeting.

2.8 Data management and analysis.

For **quantitative data**, the questionnaires were coded and entered directly into Statistical Package for Social Sciences (SPSS version 20, IBM Analytics, Armonk, NY). After clean-up and preliminary analysis using frequencies and descriptive statistics. Preliminary analysis revealed some errors and missing data in some cells. This necessitated a further clean-up until the dataset was clean and fit for further analyses.

For **qualitative data**, audio files for key informants and focus group meetings were translated into English after which they were transcribed into computer files. After reading and re-reading the narratives, the data were coded manually. Initially, broad coding was done using significant themes derived from the topic guides in terms of reference. This was followed by further coding from the major themes into sub-themes (dairy and beef value chains). Framework matrices were then formulated by identifying key quotes under each sub-theme and summarising the narratives under each major theme. Framework matrices were used to crosscheck narratives from key informants with focus group participants to identify divergently or supporting views.

4.0 RESULTS AND DISCUSSION

4.1 Factors affecting smallholder livestock farmers' participation in livestock markets

Stakeholders in the traditional or small-scale dairy and beef value chains identified several factors that affect participation in livestock markets. These include:

4.1.1 Absence of commercial farmers in Western Province

There are no commercial livestock farmers in Western Province as is the case in Southern and Central Provinces of Zambia. This is attributed to, among other factors, the traditional land tenure system. The commercial farmers want title deeds to the land for them to access credit facilities for investment. Commercial livestock farmers serve as role models where small-scale farmers can learn some skills. There are no commercial farmers in Western Province where the small-scale farmers can get ideas on running the dairy and beef farming. Even after interventions to improve animal health, farmers sometimes opt not to do certain things, because they have not seen; thus they cannot differentiate, between a farmer who has done well in terms of management and a farmer who has not done anything. So traditional cattle keepers and farmers cannot comprehend. A key informant who is quoted below stated that:

“I would say is that the farmers in Western Province do not have role models. So no such farmer where the farmers can go and be getting ideas from how to run the dairy farming. However, other interventions to improve animal health, you realise that a farmer can opt not to do certain things because they have not seen, they cannot differentiate, between a farmer who has done well in terms of management and a farmer who has not done anything. Unlike in Southern Province where people have been able to learn from commercial farmers, that this is how we are keeping our animals and when you take them to the market they are fetching so high and here it is the opposite. So farmers cannot comprehend. I think we need to; when we come up with intervention, we should be able to differentiate between a laggard farmer who is not doing anything and a farmer who is doing something on their livestock. I do not know if, maybe from a market point of view, whereby the returns on someone who is keeping their animals very well should be seen. That is going to influence others, and they can adapt very fast”.

4.1.2 Lack of improved dairy breeds

The farmers in the Western province use the local Barotse breed for milk production, which can only produce a maximum of about 2 litres (L) per day due to poor nutrition and low milk production genetic potential. Otherwise, the Barotse breed produces 0.5-1.0L per day for a short lactation period (6 months). So for a farmer to make 20 litres per day, they should have at least 45 cows. However, this study revealed that the average number of cattle is 39 per household, including bulls, calves, tollies, oxen, steers, heifers and cows. According to Lubungu et al. (2015), only 36% of the herd in Zambia are cows. This means that all being equal, the average amount of milk a household can produce if all the cows were producing milk per day is 7.02 litres ($0.36 \times 39 = 14.04 \times 0.5L = 7.02L$ per day). So it becomes unprofitable for the processor who wants more volumes when the supply from the farmers is not sustainable. The current cattle population is estimated at 480,500 out of which 181,980 (36%) are mature cows, which indicate the potential for dairy development, as shown in table 3. If each household produces 7.02L per day, a total of 12,959 cattle keeping households can produce 90,972L per day the entire Western Province.

Table 3: Population of cattle in Western Province and estimated milk production levels

District	No. of cattle	No. of mature cows	No. of cattle keeping households	Estimated milk production levels (L)
Mongu	50,000	18,000	1,285	9,020.7
Senanga	46,000	16,560	1,179	8,276.6
Sesheke	27,000	9,720	692	4,857.8
Shang'ombo	55,000	19,800	1,410	9,898.2
Kaoma	18,000	6,480	461	3,236.2
Kalabo	52,000	18,720	1,333	9,357.7
Lukulu	30,000	10,800	769	5,398.4
Limulunga	25,000	9,000	641	4,499.8
Nalolo	49,000	17,640	1,256	8,817.1
Mulobezi	20,000	7,200	512	3,594.2
Mwandi	25,000	9,000	641	4,499.8
Sioma	40,000	14,400	1,025	7,195.5
Luampa	10,000	3,600	256	1,797.1
Nkeyema	8,500	3,060	217	1,523.3
Sikongo	25,000	9,000	641	4,499.8
Mitete	25,000	9,000	641	4,499.8
Total	480,500	181,980	12,959	90,972.2

Source: adapted from **DVS report, 2020**

Efforts to improve the Barotse breed through artificial insemination with Friesian and Jersey semen have failed due to low conception rates (as low as 20%), which also have caused the

farmers to lose confidence in artificial Insemination. Some of the factors that led to low conception rate were reported to be poor nutrition for animals, poor handling of the semen (cold chain), animal disease and transhumance cattle herding system. There was also a high level of poor extension by the service providers with regard to the preparation and management of animals to be served. The extension was inadequate and inconsistent as the service providers (Ultravetis and Agriserve) tried to serve as many farmers as possible, thus spreading themselves thinly. The current efforts are to procure dairy bulls and cows, but this is done by individual farmers who have sold beef animals to procure dairy animals. So the prevailing reasonable beef prices are a catalyst for dairy development in Western Province. Focus group discussants reported that they could sell beef animals and buy dairy bulls or cows. However, procuring dairy cows is not a good idea because previously, MCCs received pure Jersey and Friesian breeds from the previous projects such as Livestock Development and Animal Health Project (LDAHP), but most of them died due to poor nutrition and disease. Thus, exotic dairy breeds should be introduced gradually until the farmers develop the capacity to manage them with improved extension services put in place. Beef breeds have been improved through procurement of Boran bulls by individual farmers and previous projects. A key informant had this to say about improving breeds:

“Then the artificial Insemination that is being promoted by Musika and its partners, I think in these animals is a bit chaotic. Okay, the system needs to be done properly. You know you need to isolate the female nicely to avoid disturbance by bulls, and you need a good plan of nutrition because the animals are seasonal breeders. They only give calves at a certain time of the year when the grass is okay, so you cannot inseminate anytime without some supplementary feeding, the results have been very poor. The results have been very poor we need to work on that, several programs have come, we had money from EU to promote artificial Insemination, even then it did not work out, because okay you need a paddock, you need to isolate animals you need to feed them then they pick very nicely. So the idea was that we just buy semen from the improved breed and inseminate them. I think these are things that we need for artificial Insemination to be improved. Or if it is bringing bulls, we need to work on something like that; otherwise, the program is very much needed”.

4.1.3 Inadequate extension services

Generally, there is inadequate support from the Government when it comes to extension services. Extension services in Western Province are dominated by the Government, which is facing many of its challenges. For instance, in most veterinary camps, the officers do not have motorbikes and fuel. So there is an inadequate extension in Western Province making the implementation of intervention difficult because predominantly there are no private institutions that can provide or offer clinical service. Extension services are an essential aspect of participation in livestock markets, and the participation of private sectors is key. A key informant (former extension service provider supported by Musika) who is quoted below stated that:

“The terrain in Western Province and the rigidity of cattle farmers discourages private sector interventions. So investors that are looking at huge turnovers over a short to medium timeframe may fail in the market and prematurely leave the interventions”.

Rigidity is due to several factors: not running cattle farming as a business, lack of sensitisation, and getting used to traditional (cultural) ways of animal production where animals grow without any animal health management practices up to market age in some instances. Farmers are also rigid to adopt and pay for extension services because they are used to free services. They assume all private investors are projects, which come with grants to offer a service for free.

Therefore, there is a need to support capacity building for the government extension staff or system more sustainably through Private-Public Partnership (PPP) for any livestock intervention.

4.1.4 Lack of a business mindset and skills

Livestock farmers (100%) in the Western Province lack a business mindset to participate in livestock markets actively. Interventions have not done enough sensitisation regarding farming as a business; thus, the livestock farmers are not investing in their cattle. Additionally, the livestock markets in Western Province have been terrible because of the livestock movement bans. The ban that has been imposed for a long time due to livestock diseases such as Contagious Bovine Pleural (CBPP) has prevented farmers from accessing high-value markets.

This also has impeded livestock farmers from making correct investments into livestock business.

Traditionally, livestock farmers keep cattle for prestige and only sell animals when there is a household's pressing financial need. For instance, when schools open, that is the only time many farmers sell their livestock. Because of this, cattle sales reduced during the time schools closed in March 2020 due to a COVID-19 pandemic because the farmers did not have to worry about school fees. Therefore, the livestock farmers sell their animals because of financial pressure (optional liquidity) and not because it is a business. Livestock farmers do not see the need for investing in their livestock. Livestock off-takes are also motivated by disease (forced liquidity); thus, when an animal is sick and does not respond to treatment, the farmers will be forced to sell it. The beef from traditional cattle farmers is mainly from culls (old and sick animals).

The lack of business mindset and skill has also made it difficult for farmers to participate in dairy markets. It will take a lot of sensitisation and training for farmers to participate even after introducing market interventions. A key informant stated that:

“People also need to be taught to understand that livestock is a business; you cannot come from nowhere just embark on livestock farming and achieve what you have been dreaming about. But then people here have inherited animals they have become farmers through inheritance with no capital injection. So you find that if I have inherited 40 animals from an uncle, I will be told two animals have died, so what? It still does not count to you because you have not spent anything. So we need to teach these people that you could have inherited these animals fine, but we need a mindset shift and technology transfer. I know they will say it is hampered by the land tenure system here, which is true, and the communal grazing system, but these are some of the policies that encourage laziness, because your job now is just to move animals from one place to the other. You hear there is a bit of water this side you move you take them there when the water finishes again you move”.

4.1.5 Poor road infrastructure

Other than Mongu-Kalabo and the main Lusaka-Mongu road, which is also in a poor state between Nkeyema and Luampa districts, more than 90% of the feeder road network is poor with a predominantly sandy terrain and limited access to rural parts where cattle farming

activities take place in Western Province. The Kaoma-Lukulu-Mitete, Sioma-Shangombo, Sesheke-Kazungula roads are all in a bad state, affecting participation in livestock markets and private sector investment. This makes delivering of milk to the aggregation point difficult. The sandy terrain makes it challenging to ride bicycles to the milk collection centres, which are along the main tarred road. The Kaoma-Kasempa road, which is used for trading livestock with the mining town of Solwezi and Kasumbalesa, is also in a poor state. Poor road infrastructure hinders private sector investment in livestock markets in the province, which eventually affects livestock farmers' participation. Markets have a pull and push effect on livestock production.

4.1.6 Lack of supportive production and market infrastructure

Most of the traditional cattle farmers are in rural areas that are not supported by good feeder road infrastructure, making access to better markets and inputs challenging. Both farmers and their livestock have inadequate access to clean water supply and sanitation, meaning that providing clean water and feeding to dairy animals that remain in the upland will be a challenge. There is currently little private sector engagement supporting herd health in Western province. The private investors who were previously supported by MUSIKA on improving the genetics of cattle breeds and providing extension services closed citing low returns on investment (ROI) due to lack of willingness to pay (low purchasing power) for herd health services by livestock farmers. The farmers cited lack of resources to pay for herd health services. A key informant stated that:

“Then infrastructure both market infrastructure and production infrastructure are nowhere to be seen, so there are no water troughs feeding troughs, no paddocking system, water supply is not there, so animals are made to change like the weather when its rainy season they are happy, animals need to be provided for. So based on that we have found ourselves in a situation where we forsake what would be the most profitable industry to the province. Why? Because we do not want to provide, we do not want to narrow these gaps; the knowledge gaps, the management gaps, infrastructure, we do not want to invest in all these things. We want an animal to drive itself and provide maximum returns, and so on. So those are some of the key elements of the value chain that I would identify as lacking and that need addressing, not in a harsh way but quite vigorously, then we will start getting the results

Much as there is a lack of supportive production infrastructure, farmers also lack the willingness to invest in production infrastructure. This also points to the lack of a business mindset and being used to a traditional way of keeping cattle as earlier stated.

4.1.7 Seasonality of milk production in Transhumance cattle herding systems

Grazing areas in Western Province are a common property under the custody of traditional leaders, making private investments difficult. Internalising the returns on public goods is impossible hence making productivity a challenge among traditional livestock farmers. Under the transhumance cattle herding system, animals move from the floodplains where there is plenty pasture to the upper land where there is not enough pasture. Movement of animals to the upper land occurs around March to August when they start getting back into the Zambezi floodplain when the water levels would have gone low. So milk production will again start from August, September to January. There is no paddocking system both in the floodplain and upper land. There is no water supply in the upper land in the dry season, meaning that you cannot leave animals for milking in the upper land. This also implies that you need to employ two cattle herders; one who goes with animals in the floodplain and one who remains with animals in the upper land. This, however, increases the cost of production, which has to be passed onto the milk consumer. This system affects farmers' participation in livestock markets. A key informant and beneficiary of Musika dairy intervention had this to say:

“I think the major factor is seasonality, in Western Province, the animals move away from the plain, to the upland during this rainy season. Much of this upland does not have feeder roads, much of this upland, lies in sand tracks, so where the animals go, you cannot go and collect the milk. So the transhumant, the movement of cattle from the floodplain on the upland is a big factor. Now the solution to that would have been to keep the productive animals by the plain edge under zero grazing. That would have been the solution, keep the productive animals by the plain edge, under zero-grazing”.

Transhumance cattle herding systems also make farmers move from one dairy cooperative to another. For example, you may belong to Mongu dairy cooperative, but when animals go far in the floodplains, the nearest MCC maybe Nalolo dairy so you have no option but to negotiate to deliver your milk the nearest MCC during the period when your cattle are grazing in that area. This, however, reduces membership at the primary cooperative paralysing the operations.

To deal with the problem of moving from one cooperative to another due to transhumance cattle herding system, there is a need for interventions in centralized digital systems where farmers' supply of milk is monitored regardless of which MCC they supply to.

4.1.8 Livestock ownership

The owners of livestock in Western Province are mostly in Lusaka and other cities making adoption of interventions by custodians of the animals difficult. The one who keeps the animals is paid through the manure and milk from animals but cannot make decisions on the adoption of interventions without the owner's consent. Even if you give him or her an idea like we will improve milk production on your farm, they will not follow whatever you say because they are not the owner. If he adopts interventions without the owner's consent, when the owner comes the following week, he or she grabs the animals and gives them to someone else, meaning that the extension workers have to start again talking to another person to implement the interventions. For instance, there was a farmer who was given animals by the sister who is in Lusaka, and he joined a dairy cooperative where he raised about k9000 from milk sales, but when the owner of the animals heard about the success story, she came to grab the animals and gave them to someone else. This practice makes participation in livestock markets difficult.

Another factor affecting participation in dairy markets is that animals also change hands from one cattle keeper to another. During this time, the initial keeper, who is a dairy cooperative member, surrenders his milk and manure to the other keeper. One key informant stated that:

“And to make it worse, sometimes, the animals when they go especially in upland, they change hands. The owners remain in the plains because animals leave earlier than the people. Normally when someone wants to use those animals for manuring his field whatever, they give them to somebody else at that time; I think that also needs to be improved. I think they should not do that, but I think they have gotten used to, part of the year, the animals go to somebody else”.

Another cultural practice, which may affect participation in milk production, is Mafisa. A key informant described Mafisa as, “Mafisa is when you have animals you give, because here, what it is that it is challenging to keep many animals in the same place, like 500, 600 cattle because

of the communal system of grazing. So if you have got a lot of animals you would get some, part of it, maybe about 10, 20, you give somebody else who will be looking after them for you. In the process, you give him one animal per 2 years.

So the owner can give another family 40 cattle to keep, but he does not surrender decision making to that family. This limits the current keeper from participating in dairy markets and the adoption of animal health management interventions. This finding also speaks to the lack of willingness to pay for extension services, because the one who is only keeping animals on behalf of someone cannot pay for artificial Insemination on animals, which are not his. This practice also hinders private sector investment in extension services in the Western province because it slows returns on investment. Mafisa is also a cultural determinant of anthrax in the Western province (Sitali et al., 2017).

These developments mean that dairy development interventions should look at two critical owners of livestock, the owner who remains in the floodplain, and the owner who is in the city out of Western Province. The urban owner must be linked to the traditional leadership for a smooth implementation of livestock interventions.

4.1.9 Consumption habits and beliefs

In some parts of Western Province, sour milk serves as a relish, a primary protein source. So it becomes difficult for farmers to sell the little milk they have, which is their primary source of animal protein in place of meat, which they cannot afford. In these areas, they also believe that when the calf is born, the mother should not be milked up to somewhere close to a year, until the calf grows, that is when they can start milking. This is because they believe that the calf will not have food, and if you milk the mother immediately after birth, it means you are killing the calf. This also speaks to inadequate extension services and poor animal health management systems in Western Province.

4.1.10 Sparsely located livestock population and markets

A milk collection centre must be in the radius of at least 10km to where animal production is taking place. This is not the case in the Western Province, where milk collection centres are as

far as 70km away from the communal grazing areas in the floodplains. The sparse location makes it difficult for a processor to get good quality of milk. A key informant stated that:

"Because a dairy collection point you need a radius of about 10km at least, outside that what you get is B grade to C grade, and usually the processor cannot get that quality because of the distances to the milk collection point".

Livestock are also sparsely populated and not centralised in all districts of Western Province, and they can move from one district to another along the floodplain, making it difficult to pool milk from each stratum of cattle in the Zambezi floodplain.

The sparse location of milk collection centres increases the cost of transportation to the central processing plant. For instance, the Senanga MCC is about 110km away from Mongu, and for you to put up a collection point, you need volume to offset the cost of transportation. It only makes an economic sense if there are 3-4 milk collection centres each producing about 2500L per week along the way so that the truck can collect from all the milk collection centres in one trip as is the case in Southern Province. For example, the truck will collect milk from five milk collection centres in Namwala, two in Choma, Monze, Magoye and Mapepe. Similarly in Western Province, if well planned the truck can collect milk from yet to be established viable milk collection centres in Sesheke, Sioma, Senanga, Nalolo, Mongu, and Limulunga. This will need holistic interventions along the livestock value chains.

For beef, some farmers and traders in Kaoma, Lukulu and Mitete walk for four days to sell cattle to the nearest abattoir in Limulunga where lucrative prices exist. The new beef processor has set up a loading point for cattle at Tapo along Mongu-Kalabo road and collects cattle from Shang'ombo, Sikongo and Kalabo. ETP Company supported by Musika dairy intervention programme was also using Tapo as a collection for milk to the Zammilk Processing Plant.

4.1.11 Lack of knowledge and sensitisation

There is a lack of knowledge about producing and handling milk among traditional dairy farmers in Western Province. This has resulted in low-quality milk in Western Province due to lack of technical know-how. Culturally, people of the Western Province are used to handling

highly sour milk, so fresh milk handling will need training and sensitisation. Because of this cultural background, farmers take milk to the milk collection centre at any time they prefer, mostly 3-4 hours after milking resulting in rejection of soured milk. Rejection of sour milk at the milk collection centre discourages members from production.

4.1.12 Lack of transport

Long-distance to sparsely located milk collection centre requires reliable transportation. Transportation from the production site in the Zambezi floodplain to the nearest milk collection point and the milking processing plant. Western Province is peculiar because of its sandy terrain, which requires full-time 4x4 transport. This affects participation in markets.

For traditional cattle farmers, it does not make an economic sense to cycle 70 km to supply the only 7.02L per day of milk to the milk collection centre be it on the motorbike or bicycle because the opportunity cost for delivering this small volume of milk is high. So interventions on the provision of transport must not overlook volumes of milk when conducting due diligence. A focus group discussant had this to say:

“To connect the whole story, transhumance systems has affected us, animals are very far, poor genetics of our local breed leads to low milk volumes, low milk volumes which are far and need reliable transport, but again reliable transport like a motorbike is not economically viable due to high cost of fuel. That is why I say we have a lot of activity without productivity. I now have a bike, I can be bringing milk everyday here using a motorbike, but you know the litres I produce. Is it viable for me to ride a bike for the little volume? People can be bringing milk on bikes every, but will they really get more than the cost of fuel at the end of the month?”

4.1.13 Poor governance of dairy cooperatives

Poor governance systems of cooperatives in Western Province discourage members from joining or indeed continuing supplying milk. Cooperatives are highly dominated by cooperative members of the executive who feel that they own the cooperative. They do not hold annual general meetings (AGM), and some have been there for a long time, with some thinking that the cooperative was donated to them. The MCCs are run by an executive composed of the chairperson, vice-chairperson, secretary, vice-secretary, treasurer, vice treasurer, and a varying number of committee members. Apart from Mongu dairy cooperative, whose executive is just composed of men, others had a mix of one or two women with the rest

being men. There is a tendency to select those who can communicate in English with a reasonable level of education. However, focus group discussants reported the absence of unity of purpose in all dairy cooperatives as quoted below:

“So again the issue of working together, us here in the Western Province coming up with a cooperative, work together, is a problem compared to our friends in Southern. We are very far from seeing the benefits of coming up with a group and working together, there is jealousy in there and no my friend will also buy this, so they have not seen the benefits of working together as a group”.

In all the dairy cooperatives, membership reduced from over 80 members to less than 20 members who are attempting to resuscitate operations of MCCs. All dairy cooperatives in Western Province are currently unable to meet overhead costs because they are not in production.

The movement of the directorate of cooperatives from the Ministry of Agriculture to the Ministry of Commerce, Trade and Industry is an essential move towards strengthening the governance of cooperatives. There should be a deliberate policy to fund and support capacity building and categorisation of cooperatives.

4.1.14 Traditional governance system

The governance system in Western Province starts from the village that forms a Silalo. The Silalo reports to the district Kuta and the district Kuta to the Ngambela Kuta. The entry point in terms of mobilising the farmers to supply to collection points must not leave out the traditional governance systems. All interventions in the province must start from the King through the Ngambela Kuta going down to the local Indunas at the village level. This hierarchy is highly respected and very critical to the successful implementation of interventions in the livestock sector. Communal grazing areas for animals in the Zambezi floodplain are under the leadership of this traditional governance system. A key informant stated that:

“Indunas can affect participation in livestock markets, especially if they themselves are not involved. An intervention on livestock can come, but if the village Induna is not an interested party, he can advise his subjects not to adopt market interventions”.

The BRE needs to strengthen its structures and systems on the ground; instead of the Kuta just presiding over civil disputes, they must make a deliberate effort to discuss development by bringing private sector, farmers and public sector to harmonise livestock value chain development activities.

4.1.15 Lack of a holistic approach to value chain development

Livestock value chains remain underdeveloped in Western Province. Poor value chain linkages, coordination, and governance disadvantages traditional cattle farmers of their market bargaining power. It also gives them either limited or no access to affordable credit, which results in limited opportunity to improve production and value addition at group or farm level. The lack of a sustainable and holistic livestock value chain development from those who intervene has affected participation in livestock markets in Western Province. A key informant had this to say:

“The past interventions in Western Province missed out on people that can be used as models in livestock production. Interventions in Western Province tend to look at the value chain in terms of interests and only focus on an area they know best. Funders sometimes only look at an area they can manage well. However, if you know you are looking at value chain holistically, from production inception to end-user, there could be so many players on the market. For instance, to focus on the milking plant, do nothing about the production-end, where will the milk come from? So you need to play a balanced game you need to make sure that the production will feed the market. That, to me, is a very realistic approach rather than doing blanket appeasement of whatever and end up achieving nothing. So have it on record that the value chain must be looked at in all in total and people to be empowered must be provided with the necessary skills to manage what we are promoting. Here and there we do a bit of infrastructure we hold some workshops to teach on management skills we even do demos and let us do these things at the right time.”

4.1.16 Lack of grading system in beef markets

The lack of a grading system for beef does not motivate the farmer to sell the best animals. This is because the one who is selling an almost dead animal gets the same price as one who sells a fattened animal in Western Province. This affects participation in livestock markets. There is a need to develop standards for grading meat not only in Western Province but Zambia so as to incentivise production. However, weak and lack of enforcement of standards in informal beef markets may affect grading systems. Meat from informal markets is sold at lower prices. The lower prices may threaten market competition with large processors who may observe acceptable meat grading standards. A Focus Group Discussant had this to say:

“But if our animals were graded like, from this weight to that weight this will be the price. That one can motivate farmers, because like I have seen across Namibia, that is what is happening, the animals are graded. As you are doing ante mortem, you must have a grade and tag a price to that, so that farmers are competing for a high value. So on that one farmer are competing for a high value and because they are competing for a high value, even their investment is much more, in terms of management of their livestock. A culled animal and one from a feedlot must not get the same price.”

4.1.17 Uncompetitive pricing

The prices for livestock in Western Province have been very uncompetitive until recently when a new player (Termite) came on the beef market. This development has seen the dressed weight increase from K18.00 in 2019 to K35.00 per kg dressed weight in 2020. The monopsony type of market in Western Province has played a significant role in discouraging participation in beef markets. A monopsony is a market structure in which a single buyer substantially controls the market as the major purchaser of goods and services offered by many producers or sellers), meaning that buyers have all the freedom to set price and thrive on trends in producer financial needs. For a long time, Western Province has had seven processors but with one processor dominating with more than 50% of the market share until the 8th processor who came on the market and made prices competitive. The new entrant on the beef market seems to have brought competition to the beef industry in Western Province, although they cite tough competition as one of the challenges they face. The key informant stated that:

The first one is competition; we have got a lot of abattoirs and beef traders in the province. I think that is the major challenge. In fact, the majority of those people who could supply those animals here are traders, than those who are getting from their own.

4.1.18 Lack of dairy markets (dairy processor)

Currently, the closure of the milk processing plant in Mongu has discouraged participation in dairy markets. The presence of the market stimulated production with farmers planning to acquire dairy breeds so that they can produce more volumes. The closure of the milk plant has somehow shuttered these gains. A key informant stated that:

“Now the only thing that can cause this to happen is to have a reliable market, because if there is a market that will continuously buy milk from the farmers, then they can invest in improved animal health management because they know that they will get the returns. So if there is an assured market, farmers will make the investment, but if there is no assured market, farmers will be afraid to make these investments. So for me, what is required is a continuous market to allow farmers to say okay, even if I make this investment, I will get it back. Now we provided transportation aspect of milk, we invested in trucks, we invested in vehicles and Musika invested in the tanks, but when this project closed it meant that these vehicles purchased for milk collection, now had a problem. These vehicles now are loafing, so you can imagine, we invested in two small trucks, we invested in a van, plus the van that we got from Musika, we have four vehicles and three tractors. Obviously, they gave us a mower hoping that we will be cutting grass and selling to these people who will be practising zero grazing, but unfortunately, when the market closed, we could not make any movement, because even if you cut the grass, you give it to who, for what purpose?

4.1.19 Continuous reduction in cattle population over the past five years

The cattle population in the province has been reducing in the past five years. From 711,070 in 2015, to 450,949 in 2018 and 480,500 in 2020. This reduction is attributed to a number of factors among them: animal disease, sales, drought and cattle prices.

Regarding disease, Western Province is endemic to anthrax and CBPP, with sporadic outbreaks of FMD, which have continuously reduced annual population growth rate due to high mortality rates. Cattle herd depopulation (the test and slaughter policy) as a control measure for CBPP have affected cattle population growth in the past years. Liver flukes have also negatively

impacted animal production and reproduction, which has also affected population growth rates. More than 90% of the bovine liver is condemned due to infestation by liver flukes (Simwanza et al, 2012). Heavy infestation of liver flukes affects growth rate, reproduction and milk production, affecting participation in formal off-take markets.

Regarding cattle sales affecting population growth, there are no other major agricultural activities in Western Province as is the case in other provinces like Southern and Eastern where crop production is massive. Other than rice production and fishing, which were all affected by the drought, which Zambia has experienced the past three years, the only primary livelihood source has been cattle sales. The price of cattle per has been low, averaging about K10-12 dressed weight in the past five years, so farmers had to sell more to raise more money, thus reducing the cattle population. This is different now; with prices at K35, farmers will only have to sell fewer animals to raise the required funds. This, however, is affected by an increase in inflation rate as it means that farmers still have to sell more.

4.2 Relationship between household herd size and participation in cattle markets

The median age for the cattle producers was 50, with a household size of 8 and owning 39 cattle per household. Each household was selling a median of 3 cattle per year out of the 39 cattle owned, representing an annual off-take rate of 7.7%. Of the 39 cattle owned, on 36% are milking cows according to the study by Lubungu et al. 2015. Farmers showed a willingness to sell more when both herd size and price increased, as shown in table 4.

Table 4: Mean and Median parameters for cattle producers in Western Province

Parameter	Mean	Median
Age	50.5	50.5
Number of cattle owned	60.21	39.00
Household size	8.64	8.0
Cattle sold per year	3.77	2
Cattle sold when herd increases by 25%	4.52	3
Cattle sold when herd increases by 50%	7.13	4
Cattle sold when herd increases by 75%	9.68	5
Cattle sold when herd increases by 100%	14.95	6
Cattle sold when price increases by 25%	7.5	3
Cattle sold when price increases by 50%	8.93	4
Cattle sold when price increases by 75%	9.65	5
Cattle sold when price increases by 100%	11.55	7

Linear regression analysis was conducted to determine the relationship between herd size and beef and dairy market participation. Quantitative results revealed that there was a statistical relationship between herd size and number of cattle sold (Table 5). However, this does not translate to participation in livestock markets. Qualitative key informant interviews and focus discussion revealed that farmers would always sell beef cattle when there are pressing financial needs in the household. However, for participation in dairy markets, the study revealed that these farmers do not primarily produce milk for sell but rather for consumption and excess is the one that is sold. This is the peasant type of farming which is not different from most crop farmers anywhere else in Zambia. However, this means that volume is important because the more the volume of milk, the more the willingness to participate in dairy markets as it has been shown during the rainy season when there is abundant grass.

Table 5: the relationship between the number of cattle owned and participation in beef sales

Coefficients						
Model		Unstandardized Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.567	3.706		5.010	.000
	Cattle sold per year	11.192	.588	.779	19.029	.000
a. Dependent Variable: Number of cattle owned						

4.3 Key players in the dairy and beef markets for Western province

Key players in the dairy and beef value chains were identified and grouped using a stakeholder matrix shown in table 6. The stakeholders were categorised based on their power and level of interest in the livestock value chains. These include:

- Stakeholders with **high power** and **high interest** are major stakeholders that are heavily invested in the project. They must be actively managed, e.g. livestock farmers.
- Stakeholders with **high power** but **low interest** must be kept satisfied. They can derail the project over seemingly minor issues, e.g. Traditional leadership
- Stakeholders with **low power** but **high interest** must be kept informed. They can create significant influence (i.e. raise a stink) if they do not get what they want, e.g. politicians.
- Stakeholders with **low power** and **low interest** must be monitored, in case they become more powerful and affect the project in the future, e.g. transporters.

The key players in the dairy and beef markets in Western Province include the following:

Cattle producers, cattle processors, cattle transporters, cattle traders, milk traders, traditional leaders (BRE), extension service providers, cattle association, information providers (government marketing department), AGROVET input suppliers, politicians, non-governmental organisations. The BRE has **high power** but **low interest**, thus they must be kept satisfied by following their protocol. They can derail the project over seemingly minor issues.

Table 6: stakeholder matrix of key players in the dairy and beef value chains

Power	High	-Barotse Royal Establishment	-Processors -Producers (Farmers)
	Low	-Transporters -Agrovet suppliers -Traders	-Mayor of -Member parliament -Cattle association -Extension (public and private) -Non-Government Organisations
		Low	High
		Level of Interest	

4.4 Status and adequacy of the existing supportive infrastructures

The entire Western Province only has six milk collection centres (Mwandi, Senanga, Sioma, Nalolo, Nanjucha, and Limulunga) and eight abattoirs in Senanga, Sesheke, Mongu, Limulunga) and others under construction in Shang’ombo, Lukulu, Sesheke and Limulunga) as shown in table 7. Most of these livestock markets are placed along the tarred road away from where animals graze under the transhumance cattle herding system. Long distance to livestock markets discourages participation.

Table 7: milk collection centres and abattoirs in Western Province

District	Milk Collection Centres	Abattoirs
Senanga	Senanga dairy, Nasla dairy	Nasla, Zamzam, Dayow Beef
Sesheke		Native Bantu Botatwe, 2 under construction
Mongu	Mongu dairy	Zambeef, Star Beef, Aluyi
Limulunga	Limulunga dairy	Termite, 1 under construction)
Mwandi	Mwandi dairy	
Nalolo	Nalolo dairy and Nanjucha	

The existing supportive infrastructure for beef is adequate regarding the current demand for services by traditional cattle farmers because of the underperformance of livestock markets. However, the supportive infrastructure is not adequate with successful and effective interventions in the livestock value chains. The market infrastructure for dairy markets is tricky to assess for now because there is no production after the closure of the milk processing plant. All dairy cooperatives are not using the cooling tanks due to lack of milk and market. This, however, cannot be described as adequacy.

4.5 Existing risks as well as opportunities for embedding other agricultural services

4.5.1 Existing risks for embedding other agricultural services

4.5.1.1 Marketing risk

Market risk is the possibility of an investor experiencing losses due to factors that affect the market's overall performance. A private sector investor in dairy processing in Western Province must make a proper plan. If there is no proper market plan, there is a risk that the collected milk might overwhelm the province and lead to a loss. A key informant had this to say:

“Let me start first on the marketing side. If there is no proper market plan, the collected milk might overwhelm Western Province, so now to transport processed milk to Lusaka may be expensive than the milk produced by Kalundu dairy. So there must be a very good marketing plan looking at maybe Angola because Angola takes up everything, but I do not know how the marketing arrangements are. There is a risk of loss because I do not think it is very transparent there, but the market is there. The issue of offloading huge quantities of processed dairy products might be a challenge; it might be a risk in terms of offloading because if you look at the population of Western Province and the people with the disposable income, it is not so much.

Another Key informant had similar thoughts on market risk. He had this to say

“The Angolan market is a very lucrative market, but we are not helping our farmers because up to now, I do not know our position as Government as regards the Angolan market. So most animals that go there are illegal, and because they go in as illegal, I do not know the reception there. But those that have made arrangements for the Angolans to come closer say it is very lucrative, it fetches you foreign exchange straight away and very good prices. It be eggs, nowadays they are taking a lot of chibwantu, Maheu. Because we have not really formalised, we do not really need to have road infrastructure to allow trade to go on; we can have agreed upon entry points and exit points and station an officer or so. But because we have not done that, animals find themselves in our country through whichever small crack they can penetrate and carry with them all sorts of diseases.

4.5.1.2 Animal disease risk

Diseases that affect livestock are a significant risk in private sector livestock investment. Anthrax and Contagious Bovine Pleuropneumonia (CBPP) are endemic in Western Province with sporadic outbreaks of Foot and Mouth Disease (FMD). The diseases cause regular shocks in the livestock supply chain on the local market through repeated trade restrictions associated with veterinary quarantine measures. A case in point is the Chisamba FMD outbreak in 2019, where milk could not leave the district for fear of spreading the disease? The impact of such an outbreak on private sector investment will be severe. Another case in point in the livestock movement ban instituted in December 2020 after the outbreak of FMD in Western Province. All abattoirs were closed until the disease is contained and this may take longer. After closing, one processor relocated to Mbala so that they can access cattle from Tanzania. A key informant stated that:

“You know there is an outbreak of FMD in Western Province, so we had to switch to Mbala to access cattle from our neighbour Tanzania. In Western Province, they will only open when they do a ring vaccination and review the situation after every two weeks, which is not good for business”.

On the part of the farmer, the high burden of trans-boundary animal diseases is one of the risks to invest in improved breeds. These diseases affect productivity directly through mortality and decreased production and indirectly through constrained trade and draught power. So for a farmer, if exotic breeds are introduced in Western Province without adequate animal health management systems, they risk losing the animals. It is better to start by improving the Barotse breed with dairy bulls and artificial Insemination, and slowly introduce exotic breeds when farmers can handle them. One of the control measures for CBPP on Western Province is Test and Slaughter; thus, if one animal tests positive, all may be slaughtered. So a farmer can lose all his huge investment in exotic dairy animals because of animal disease.

4.5.1.3 Risk of loss

When dairy interventions are put in place, there might be high interest in producing milk but delivering the milk to the processing plant may be a challenge unless you are using 4x4 vehicles or tractors that can drive up to the Zambezi flood plain. Failure to deliver milk on time may lead to loss of quality leading to rejection by processors who need good quality milk to process. Constant rejection of high volumes of milk may lead to loss of satisfaction of farmers. The risk

of loss will be avoided by providing reliable and competitive transport services and identifying the niche products that processors can make. This, however, increases the cost of production.

4.5.1.4 Risk of losing land

Land ownership is under the Barotse Royal Establishment, which has a special type of ownership, which does not permit the investors to change it to statutory land. The fear with such type of land ownership is the risk of losing land and all the investment on it if you differ with the people. Thus, even if you wanted to invest in some areas, you may not be allowed to fence off your area.

4.5.2 Opportunities for embedding other agricultural services that are currently lacking

The Zambezi floodplain is under-stocked which serves as an opportunity for investment in interventions along the entire value chain. The Zambezi floodplain extends from Lukulu in the north to Nangweshi in the south and is approximately 240km long and up to 35km wide, covering an area of 7500 square kilometres, which is equal to 750,000 hectares (ha). With a stock density of 1 mature beef animal per ha, the floodplain can carry 750,000 cattle against the current population, which stands at 480,000 cattle. Interventions in the livestock sector must look at how the floodplain can be utilised to its capacity under controlled grazing and formal off-takes. Several opportunities do exist but currently lacking at livestock markets. Some of the opportunities include:

4.5.2.1 Bailing natural grass

There is an opportunity for bailing natural grass through dairy cooperatives and private investors linked to dairy cooperatives. Cattle remaining paddocked in the upland for milk production will need to be supplemented with fodder and concentrates. Bailing natural grass and exotic grass by private investors, dairy cooperatives, and individual farmers is an excellent opportunity for livestock development in Western Province. The BRE offered their support for such an initiative. A former beneficiary to Musika intervention attempted this opportunity, but the closure of a processing plant affected the little gains that were scored. This is the risk of only having one processor without competition from small-scale processors, as is the case of Choma Dairy cooperative

4.5.2.2 Value addition

There are opportunities for value addition at milk collection centres, especially those with an urban setup, e.g. Mongu dairy cooperatives. Value addition, such as the manufacture of yoghurt and packaging of sour milk can improve market access and incomes for livestock farmers in Western Province. There is a need to support SMEs and MCCs in value addition of milk in Western Province.

4.5.2.3 Transportation of milk as a youth empowerment programme

There is an opportunity for embedding transportation services at milk collection centres. This is where youths can be contracted to collect milk from the floodplain using motorbikes and

tricycles and be paid at the end of the month. This, however, means that the cost of milk production in Western Province will be too high compared to Southern Province. Again a former beneficiary to Musika intervention attempted this opportunity using 4x4 motor vehicles and tractors, but the closure of a processing plant affected the little gains that were scored.

4.5.2.4 Diversification to goat farming

Besides dairy farming, there is an opportunity for dairy cooperatives to diversify to goat production, which is taking a centre stage in Western Province due to the presence of forests with abundant browse for goats. There are currently goat production interventions under the Pilot Program for Climate Resilience (PPCR), which can be integrated with already existing structures in dairy cooperatives. Diversification at milk collection centres ensures financial sustainability, as is the case of some milk collection centres in Southern province.

4.5.2.4 Feedlotting

There is an opportunity to feedlot and fatten beef cattle in Western Province. There is an absence of choice beef in the province due to lack of feedlots. The opportunity for bailing can also be connected to feedlotting because the animals in feedlots will need both grass and concentrate feeds. Feedlots can also run as demonstration centres to showcase good animal husbandry to traditional cattle farmers in Western province.

4.5.2.4 Information dissemination

There is an opportunity for private sector investment into information dissemination. Private information disseminators in the livestock value chain can be linked to farmers through the cattle association, and processors, with subscriptions so that market information can be constant through all media platforms, i.e. radio, street shows, televisions, social media. These should also be supported by interventions by MUSIKA and other stakeholders in livestock value chain development. Previous interventions by Musika through private extension providers concentrated on information provision only at the production level and not the entire dairy and beef value chain. Such approaches do not help with value chain coordination and governance.

Private sector investors should note that these opportunities are also affected by the risks that have been described earlier.

4.6 Key constraints faced by the key players in putting in place information systems.

Information systems are essential for livestock value chain development as they provide a platform for easy coordination and governance. The livestock value chains are underdeveloped not only in the Western Province but the entire country. Some of the constraints faced by key players in putting information systems in place include:

4.6.1 Lack of information providers in the livestock markets

Other than the Government marketing department, which has its own challenges, there are no information providers in the livestock value chain in Western Province. This is a serious oversight because the commercialisation of the livestock value chain will need coordination of all value chain actors and information providers to transform market information from one actor to another. The marketing department produces quarterly bulletins to disseminate information, but these do not reach all stakeholders, e.g. farmers in the rural areas. A key informant had this to say:

“I think that information provision is supposed to be under the marketing department. In terms of the radio programme at the moment, it is not there, but the good thing is there are quarterly bulletins which give the picture of the current prevailing prices of maybe milk per litre and maybe the price of the meat per kg. In terms of having radio programmes I will be open those we do not have, I think we have had maybe once, but that is not consistent. I think that needs to be beefed up; we need to have bulletins every month that compares the prices in all districts of Western Province, e.g. Kaoma, Mongu, Senanga ”.

4.6.2 Lack of resources for insemination dissemination

There is a lack of resources as there is no budget line towards information dissemination in the livestock value chain. Each actor just stumbles upon the information as they move around. Producers in remote areas find it difficult to know what obtains in livestock markets with cattle traders sometimes taking advantage of the situation. This makes value chain value coordination and governance almost impossible.

4.6.3 Information asymmetry among livestock value chain actors

Information asymmetry occurs when one party has more information than the other. There is no coordination among value chain actors with one having more livestock market and production information than the other, which makes information gathering and dissemination by information providers very difficult, e.g. a trader does not tell the farmer current market prices of beef so that he or she can maximise profits.

4.7 Prospects for research and development in technology innovations

There are still gaps in research in the Western Province regarding research and development in technology innovation. Some of the gaps identified include:

4.7.1 Research on dairy and beef breeds that can adapt to Western Province

Regarding productivity and production, there is a need to research which dairy breed is suitable with the prevailing terrain and climatic conditions. For instance, is it a Jersey or Friesian or multipurpose breed that is suitable for the Zambezi flood plains? Western Province is very hot in the dry season, which may affect the production and productivity of exotic dairy animals. This could also be key in gaining traction in artificial Insemination since improved breeds may respond differently to the local breeds. For beef breeds, the Barotse breed seems to be well adapted to the transhumance cattle herding system, but there is also a need for research since farmers have already started introducing bulls of different breeds without informed research suitability.

4.7.2 Nutrition Research

Regarding nutrition, there is a need to research the types of grass and their nutritional contents so that we can supplement the nutrients that are lacking in the grass. Is there a need to improve the grass that is in the flood plains? Western Province is endowed with a lot of pasture, which is a key input in the livestock production process. There is a need to explore local materials on how we can use them to produce feed and fodder for livestock instead of heavy dependence on imported concentrates.

4.7.3 Research on information communication technology

There is a need to research the technology to track the production, supply and collection, which should result in payment and ensure that people are paid according to the volumes. There is also a need to research the use of technology to monitor the cows properly so that small-scale farmers can efficiently track the animals to ensure that there are reasonable conception rates following artificial Insemination. However, this should come with an improved veterinary extension service province to build capacity in farmers to be able to make use of ICTs.

4.7.4 Research on holistic and sustainable livestock market models

There is a need for research and development in holistic and sustainable livestock market models. This is to understand market dynamics and pricing policy in the beef and dairy sector. Livestock markets, particularly for beef, have been uncompetitive in monopsony markets for a long time. Thus, there is a need to understand the drivers the uncompetitive nature of livestock markets despite the presence of several players on the market not only in Western Province but the entire nation?

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The feasibility study revealed that Livestock farming is the most important agricultural activity in Western Province because crop farming is seasonal and limited by flooding soils in the Zambezi floodplain, which favours rice farming to a larger extent. However, livestock farming in Western Province is characterised with low productivity levels, low participation rates in both the dairy and beef markets by traditional farmers and limited access to formal off-take markets. The factors affecting traditional dairy and beef farmers' participation in livestock markets include the absence of commercial farmers; lack of improved dairy breeds; lack of a business mindset and skills; poor and lack of road infrastructure; inadequate supportive infrastructure; livestock ownership; cultural practices and beliefs; sparsely located livestock population and markets; lack of knowledge and sensitisation; lack of transport; underdeveloped value chains; poor governance of dairy cooperatives; lack of grading system in beef markets; and uncompetitive pricing. These factors also affect private sector investment in Western Province. Therefore, no market intervention and livestock development programme will be successful without attending to the highlighted factors.

5.2 Recommendations

This study makes the following recommendations based on the findings:

Resuscitate the milk processing plant in Mongu as it is an important asset for poverty reduction, which has already stimulated farmers even to acquire dairy animals to improve their Barotse breeds. However, this must be approached in a much more scientific way, such as conducting a feasibility study to map where the animals are, their movement patterns, herd structures, distances from milk collection centres and processing plant, market size and market preferences.

Milk production is costly in Western Province, making it difficult for private sector investment because the returns on investment are low and long-term. An industry where private sector investment is not profitable becomes a public good which should continue being funded despite being unprofitable but with a goal of poverty reduction and economic development. There are two options to developing dairy value chains in Western Province amid the highlighted factors:

1. Government through a Private Public Partnership must come on board resuscitate the milk processing plant in Mongu as it is an important asset for poverty reduction, which

has already stimulated farmers even to acquire dairy cows and bulls to improve the Barotse breeds.

2. The second option would be incentivising private sector investment in the milk processing plant in Mongu with the Government, non-governmental organizations, donors, and other stakeholders holistically and sustainably supporting each component of the value chain such as;
 - a. Supporting livestock production through the provision of adequate extension services by the private sector and the Government. The two must complement each other in livestock development. The best is attaching extension service provision to the processor and dairy cooperative but with other stakeholders' support because past experience has shown that it is not economically viable for private sector investment due to the earlier highlighted limitations.
 - b. Establishing more milk collection centres along the tarred road with mobile satellites in the floodplains and closely provide technical support in their operations until the farmers are ready to run them on their own. The then Golden Valley Agricultural Trust (GART) model under the directorship of the late Dr S. Muliokela of continued support even in the governance of dairy cooperatives must be replicated in all interventions. For instance, supplying livestock to the farmers and abandoning them without technical support does not help the farmers out of poverty.
 - c. Establishing practical dairy learning farms in the Western province to continuously expose farmers to comprehend the animal management practices championed by interventions in the livestock value chain. These practical dairy-learning farms can be strategically embedded in already existing and newly established milk collection centres to be run by private investors. This will cover up for the absence of commercial farmers in Western Province.
 - d. Supporting milk transportation through youth empowerment programme by embedding transportation services at milk collection centres and processors. This is where youths can be contracted to collect milk from the floodplain using motorbikes and tricycles, tractors and be paid at the end of the month.
 - e. Support value addition at milk collection centres and Small and Medium Enterprises (SMEs). Value addition, such as the manufacture of yoghurt and

packaging of sour milk can improve market access and incomes for livestock farmers in Western Province.

- f. Supporting information dissemination by the private sector in livestock value chain development through radio, street shows, televisions, social media. Previous interventions by Musika through private extension providers concentrated on information provision only at the production level and not the entire dairy and beef value chain. Such approaches do not help with value chain coordination and governance.
- g. Incentivising dairy products consumption with SMEs, MCCs and dairy processors in urban areas by improving access, tractability, quality and consistency of supply. Consumers wish to find the product they require now (regularity of stocking), on the shelf where they found it previously, equal in appearance to the previous purchase (branded), similar in quality to the previous purchase (consistency), and feel satisfied that they can trust its safety for consumption. If proved unsafe, the consumer would wish to have some form of recourse, which is enabled through the mechanism of tractability back to the source. There are no doubts that commercialising the dairy value chains in the Western province will increase access to milk and milk products through local shops and other markets in shopping malls. This will stimulate consumption by most Zambians and eventually have a pull and push effect on production and eventual supply of dairy products in Western Province.

Holistic and sustainable commercialisation of dairy value chain means developing a well-organised and integrated system with capital resources, infrastructure, institutions, legal frameworks and markets as highlighted under option two of operating the defunct Mongu milk processing plant.

5.3 Rank of the critical factors affecting the beef and dairy interventions

Despite all the highlighted factors, three critical points have put be attended to revamp dairy farming in Western Province in the interim as all other factors are being attended to. The critical factors currently paralysing dairy farming in the Western province are low milk volume, lack of reliable transport to Bulking points or MCCs, and lack of markets. A key informant summarises the current problem as, *“To connect the whole story, transhumance systems has*

affected us, animals are very far, poor genetics of our local breed leads to low milk volumes, low milk volumes which are far and need reliable transport, but again reliable transport like a motorbike is not economically viable due to high cost of fuel. That is why I say we have a lot of activity without productivity”.

To unbundle these critical issues and make recommendations on interventions:

1. Low milk volume: as earlier stated the Barotse breed has the low genetic potential for milk production, but it can still produce 2-3 litres if interventions can be put in place to improve animal health and nutrition. There is a need to improve the availability of adequate nutrition (grass and concentrates) and clean water when milking cows are in the upland. The extension services must be provided to the cows in the upland, thus deworming against liver flukes and other endo/ectoparasites will improve milk production. Artificial insemination will be successful in the upland since animal movement and nutrition will be controlled. The cows in the upland will belong to the cooperative members who should be assisted with fencing materials. These units should run as practical dairy learning farms (PDLFs) or demonstration centres that will solve seasonal milk production and reduce distance due to transhumance cattle herding systems. These interventions will improve milk production (volumes).

2. Transportation of milk: There will be a need to intervene in milk transportation from these several practical learning dairy farms owned by MCCs to the milk collection centres. The Musika intervention through ETP in providing transportation/bulking milk from the floodplains and bailing of grass will need to be revamped and extended to all districts where milk collection centres are available or where dairy activities take place.

3. Provision of the sure market: high volumes of milk produced through practical dairy learning farms will need a sure market that will process it. For starters as efforts to revamp the defunct milk processing plant are being put in place, SMEs and MCCs should be linked to PDLFs and add value to the milk and market it. The SMEs and MCCs will need to be trained in food-chain supply management, i.e. tractability, quality, labelling, branding, marketing, food safety.

6.0 REFERENCES

- ACF, (2012). Agricultural Consultative Forum. The Dairy Value Chain Study in Zambia
- Anonymous, (2014). *Revised Sixth National Development Plan 2013-2016*, Available at www.wayforward2014.com/.../3-revised-sixth-national-development-plan/.
- CSO 2018. Ministry of Fisheries and Livestock, and Central Statistical Office. The 2017/18 livestock and aquaculture census summary report.
[file:///Users/Sabe/Downloads/The%202017-18%20Livestock%20&%20Aquaculture%20Census%20Summary%20Report%20\(1\).pdf](file:///Users/Sabe/Downloads/The%202017-18%20Livestock%20&%20Aquaculture%20Census%20Summary%20Report%20(1).pdf)
- Kaguongo, W.N.W., Staal, S. and Ackello Ogutu, C. (1997). Smallholder adoption of dairy technologies: Effect of risk with management strategies in a liberalising economy. In: Fungoh P O and Mbadi G C O (Editors) *Focus on Agricultural Research for Sustainable Development in a Changing Environment: Proceedings of the 5th Kari Scientific Conference*, Nairobi, Kenya, pp 243-251.
- Lubungu, M., Sitko, N.J. and Hichaambwa, M. (2015). Analysis of beef value chain in Zambia: challenges and opportunities of linking smallholders to markets, Lusaka.
<http://fsg.afre.msu.edu/zambia/wp103.pdf>
- Muma, J., Mwacalimba, K.K., Munang'andu, H.M., Matope, G., Jekins, A., Siamudala, V., Mweene A.S., and Marcoty, T., (2014). The contribution of veterinary medicine to public health and poverty reduction in developing countries. *Veterinaria Italiana*, 50(2), pp.117–29. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24981913>.
- Mumba, C., Hasler, B., Muma, J.B., Munyeme, M., Sitali, D.C., Skjerve, E. and Rich, M.K. (2018). Practices of traditional beef farmers in their production and marketing of cattle in Zambia. *Tropical Animal Health and Production*, 50(1), pp. 49–62. doi: 10.1007/s11250-017-1399-0.
- Mumba, C., Rich, M., and Rich, K.M. (2017). Application of System Dynamics and Spatial Group Model Building in the Animal Health Sector-A case study of East Coast Fever Interventions in Lundazi and Monze Districts of Zambia. *PLoS ONE* 12(12): e0189878. <https://doi.org/10.1371/journal.pone.0189878>
- Mumba, C., Samui, K. L., Pandey G. S., Hang'ombe, B. M., Simuunza, M., Tembo, G. and Muliokela, S.W. 2011. Economic analysis of the viability of smallholder dairy farming in Zambia. *Livestock Research for Rural Development*. Volume 23, Article #137. Retrieved March 6, 2012, from <http://www.lrrd.org/lrrd23/6/mumb23137.htm>
- Muuka, G., Songolo, N., Kabilika S., Hang'ombe, B.M., Nalubamba, K.S. and Muma, J.B., (2012). Challenges of controlling contagious bovine pleuropneumonia in sub-Saharan Africa: A Zambian perspective. *Tropical animal health and production*, 45, pp.9–15.

Mwacalimba, K.K., Mumba, C., Munyeme, M., (2012). Cost benefit analysis of tuberculosis control in wildlife–livestock interface areas of Southern Zambia. *Preventive Veterinary Medicine*. Volume 110, Issue 2.

Poate, C.D and Daplyn, P.F. (1993). Data for agrarian development. *Wye Studies in Agricultural and Rural Development*. Cambridge: Cambridge University Press, U.K.

Simwanza, C. Mumba, C., Pandey, G.S., Samui, K.L., (2012). Financial Losses Arising From Condemnation of Liver Due To Fasciolosis in Cattle from the Western Province of Zambia. *International Journal of Livestock Research*. 2 (3): 133-137.

Sinkala, Y., Simuunza, M., Pfwiffer D.U., Munang’andu, H.M., Mulumba, M., Kasanga C.J., Muma, J.B., Mweene, A.S., (2014). Challenges and Economic Implications in the Control of Foot and Mouth Disease in Sub-Saharan Africa: Lessons from the Zambian Experience. *Veterinary Medicine International*, 2014(Article ID 373921), p.12.

Sitali, D.C., Mumba, C., Skjerve, E., Mweemba, O., Kabonesa, C., Mwinyi, M.O., Nyakarahuka, L., Muma, J.B., (2017). Awareness and attitudes towards anthrax and meat consumption practices among affected communities in Zambia: A mixed-methods approach. *PLoS Negl Trop Dis* 11(5): e0005580. <https://doi.org/10.1371/journal.pntd.0005580>

Strauss, A and Corbin, J., (1990). Basics of Qualitative Research. Grounded Theory Procedures and Techniques. Newbury Park, California. SAGE Publications.

World Bank, 2011. What would it take for Zambia’s beef and dairy industries to achieve their potential? Finance and private sector development Unit, Africa Region. <https://openknowledge.worldbank.org/bitstream/handle/10986/2771/623770ESW0Gray000public00BOX361530B.pdf?sequence=1>