

Analysis of Constraints and Opportunities in Dairy Production in Botswana: Producer's Perspectives

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Abstract

Dairy enterprise has been a major source of employment and income generation in most of the economies worldwide. Botswana government has also identified dairy as one of the agricultural sub-sectors towards diversification of the mineral dependent economy of the country. Despite the government's efforts, dairy sector in Botswana has not grown satisfactorily and therefore the local demand of milk and milk products is met by imports which increase the import bill of the country by millions per annum. The huge gap between local demand and production of milk and milk products clearly indicated that there are not only constraints but also; opportunities exist in this sub sector of agriculture. Therefore, this study was an attempt to identify constraints and opportunities in dairy production in Botswana. The possible strategies to mitigate the constraints were also identified. This quantitative study adopted an exploratory survey research design. A pilot survey followed by a final survey was conducted for data collection. Based on the information from pilot survey, a four point likert's scale type questionnaire was constructed, validated and tested for its reliability to be used in final survey. The data for the final survey was collected from purposively selected twenty five dairy farmers in Botswana. The statistical analytical tools of mean, standard deviation and Chi Square test were employed to analyze data. Among the twelve constraints identified; high feed costs, feed shortage and unavailability, lack of technical support, lack of skilled manpower, high prevalence of pests and diseases and, lack of dairy related technologies were the major constraints in dairy production. Grain feed production, roughage feed production, manufacturing of dairy feed, establishment of milk processing industry and, development of transportation systems were the major opportunities among the eight opportunities identified. Increasing production of animal feed locally, increasing roughage feed production locally, provision of subsidy on animal feed, easy access to sufficient financial support, training of the farmers and, effective control of pests and diseases were identified as the major strategies to mitigate the constraints. Moreover, the opportunities can be realised by adopting the strategies to mitigate the constraints in the dairy production. It was recommended that the identified constraints and opportunities as well as the strategies to mitigate the constraints need to be carefully considered by the stakeholders especially, policy makers during the formulation and implementation of the policies for the sustainable growth and development of dairy sector in Botswana.

Keywords: Botswana, dairy enterprise, milk production, opportunities, production constraints, strategies

1. Introduction

At the time Botswana got independence in 1966, the contribution of agriculture to GDP was 40%. It continued to drop over the years and agriculture contributed only 1.7% (NDP 10, 2009). This decline in the contribution of agricultural sector to the national economy of Botswana was mainly due to the discovery and subsequently, the extraction of diamonds which lead to lack of focus on the agricultural sector. In the light of the recent decreasing demand of diamonds in the world market as of slow down of the economies worldwide, the government of Botswana has identified the agriculture sector as one of the key area for diversification of the mineral dependent economy. Within the agriculture sector, livestock sub-sector is very important as the government has included dairy in the five priority areas of agriculture which are referred to as Economic Diversification Derive (EDD). Other priority commodity areas are cereal grain, horticulture, honey and small stock (sheep and goats) (Moreki

at al, 2011). A large number of the world dairies consist of small farmers (IDF World Dairy Submit, 2007) and this is a common scenario in most African countries including Botswana. The main livestock population in Botswana is cattle (2.5 million) and small stock (1.5 million). The production rate of cattle and small stock has not been able to reach the target levels set in the NDP 9 and consequently, the milk production has not been increased. There is general increase in demand for dairy products worldwide due to rapid population growth as well as purchasing power of the consumers.

Milk has been identified as a major source of protein, which could increase protein availability and consumption in Africa (Meyer & Denis, 1999). According to Yigrem et al. (2008), among the 20 major food and agricultural commodities ranked by value in 2005, whole fresh cow milk ranked third. Usually, milk is used as a food in its raw form or is processed into milk products which can be consumed and/or sold to earn income. Milk can be used as a supplement to breast milk and as an additional protein and vitamins source to children, hence reducing child malnutrition, which is of high prevalence in Africa (World Bank, 2004). It is also an important source of employment with many traders, processors and retailers earning part or all of their income from the dairy chain. Livestock farming in Botswana is an important source of income at individual, household and national levels (Nsoso et al., 2009). The demand of milk is growing at a higher rate than milk production in Africa. Milk imports have also been increasing over the years, showing that the gap between domestic production and consumption is also widening up (FAO Statistics, 2014). According to Botswana Press Agency (BOPA) (2010), only 10% of milk is produced locally. Moreover, milk production in Botswana is decreasing at alarming rate. In 2008, a total of 8.3 million liters of milk was produced which reduced to 7.7 million liters and 5.2 million liters in 2009 and 2010, respectively. The decrease in milk production has resulted Botswana a net importer of milk and milk products with a demand of about 48 million liters per annum (MoA, 2009). Thus, the milk and milk products import bill has been increasing every year. Powdered milk, fresh milk, flavoured milk and a variety of dairy products such as cheese, whey, butter, dairy spreads, fats and oils derived from milk form part of the milk and milk products imports (Aganga et al, 2010). The value of imported milk and milk products increased from P285 million in 2006 to about P423 million in 2010 (CSO, Trade Statistics Data, 2011). This is due to high demand of milk and milk products which indicates that Botswana is not sufficient in dairy products. "If we continue to import milk and milk products, we will forever continue to export revenue and jobs. Therefore, we call upon all of you to play their vital roles in making the dairy industry tick and become more competitive," said Samuel Segotso, Risk and Internal Audit Director.

Dairy production is defined as a biologically efficient system that converts large quantities of roughage, the scarcest feed in the arid tropics, to milk, the most nutritious food (de Leeuw et al., 1996). The dairy production in Botswana can be categorized into commercial and subsistence sectors. The commercial sector is further sub-divided into small-scale dairy farms that keep 1 to 50 milking dairy cows; medium-scale with 51 to 100 milking dairy cows and, large-scale with more than 100 milking dairy cows. Dairy animals are either kept under intensive, semi-intensive or extensive systems (Ministry of Agriculture, 2013). Mahabile (1997) reported that semi-intensive system predominately used and, Gaborone Agricultural Region (Botswana) reported adopted the semi-intensive system by both small-scale and large-scale dairy farmers (Mahabile & De Waal, 2010). Dairy production in Africa particularly, Botswana has a potential for development which can be justified by the facts among others; the existence of a potential market for milk and dairy products due to high demand and high import; the availability of large fields of idle land which could serve as a potential source of forage production; the presence of research and teaching institutes as well as veterinary and extension staff capable of providing the dairy sector with knowledge; and, the presence of policy makers and donors with interest in the dairy sector. Considering the potential for dairy development, Botswana government has developed and executed a number of programs and policies over the years, to improve the agricultural sector with special emphasis on dairy subsector. Among the other such developmental programs, recently in 2008, government introduced additional subsidy scheme in the agricultural sector for assisting all subsectors including dairy. The subsidy program includes the Livestock Management Infrastructure Development (LIMID) and the Integrated Support Program for Arable Agriculture Development (ISPAAD).

Dairy production is very crucial for Botswana where livestock and its products are important sources of food and income, and dairying has not been fully exploited, promoted and adopted in the country. With the available resources and the government efforts to develop dairy sector, one would expect Botswana to be self sufficient in milk production. Yet, there is still a huge gap between the demand and local production of milk and milk products which is being narrowing down through the import of dairy products. This gap do not only indicate that there are constraints but, also indicates that there are also opportunities in the dairy sector in the country. Therefore, this study was an attempt to tap the possible opportunities and constraints in dairy industry in

Botswana so as to make recommendations for the improvement in the dairy production in Botswana.

The purpose of the study was to explore the opportunities and constraints in milk production and dairy enterprise in Botswana. The specific objectives of the study were:

- i). To identify the business opportunities in dairy production in Botswana;
- ii). To identify the constraints in dairy production in Botswana;
- iii). To identify the strategies to mitigate the constraints for improvement in dairy production in Botswana.

2. Methodology

2.1 Research Design

An exploratory survey research design was adopted for this quantitative and descriptive study. This quantitative study was designed to investigate and describe the perception of the small scale dairy farmers towards the constraints and opportunities in dairy production in Botswana, thus making the study design an exploratory and descriptive in nature. According to Gray et al (2006) exploratory studies seek to examine what is happening and to ask questions about it. This descriptive study was designed to obtain a complete and accurate description of a situation without showing a direct cause and effect relationship. "Descriptive research studies are designed to obtain information concerning the current status of phenomena which direct the researchers toward determining the nature of the situation as it exists at the time of the study" (Ary, Jacobs, & Razavich, 1990; p. 286). The study used a descriptive survey method and designed a survey instrument that collected the information on the perception of dairy farmers. The survey was found the best method to explore the facts as the study was to explore the perception of dairy farmers because survey entails the hidden truth and facts about any social aspect and perception is a social aspect (Babbie, 2007). The survey was completed in two phases. First phase was a preliminary survey and the second phase was the final survey.

2.2 Instrumentation and Data Collection

2.2.1 Pilot Survey

This survey consisted of raw information collected at first hand in order to satisfy the purpose of a particular enquiry. A key-informant survey was carried out among the five dairy farms through personal interviews using a questionnaire mainly included open-ended questions on constraints in dairy production, opportunities in dairy production and the possible ways to mitigate the constraints in dairy production in Botswana. This pilot survey was conducted on five respondents and the information obtained was used to construct the data collection instrument for the final survey. The interview was conducted to gather preliminary data because interview is considered as an important tool to collect data on perception of the respondents (Robson, 2002). The use of interviews can help the researcher to gather valid and reliable data that are relevant to the research questions and objectives (Saunders et al., 2003).

2.2.2 Final Survey

A four point likert scale type of instrument (questionnaire) was developed for the final survey. The raw information from the pilot survey was used to develop a questionnaire for the final survey. The questionnaire was composed of four parts. The first part of the questionnaire was designed to obtain demographic information about the respondents. The second, third and fourth part of the questionnaire were to obtain the responses of respondents on constraints, opportunities and the ways to mitigate the constraints in dairy production, respectively. All the items in part two, three and four were rated by the respondents on a four response scale categories namely; Most Important = 4, More Important = 3, Less Important = 2 and Not important = 1. The questionnaire was pretested for its validity and reliability. Three experts in the field of animal production validated the questionnaire for its contents and accuracy. The reliability was calculated using Chronbach reliability coefficient which was .82, .84 and .81 for the constraints, opportunities and the ways to mitigate the constraints in dairy production, respectively.

For the final survey, a purposive sampling method based on active production of milk and possession of dairy cows was employed to select 25 dairy farms and milk vendors found in surrounding areas of Gaborone; the capital city of Botswana. The purposive selection method was found appropriate because mostly dairy farms are concentrated in Central and South East districts of Botswana. The South East district alone accounts for 60.1% of the total dairy herd in Botswana (Moreki et al., 2011). The dairy farms found were identified with the help of the extension officers. The survey instrument was distributed to the sampled respondents to indicate their responses on the importance of the opportunities, constraints and ways to mitigate the constraints in dairy farming in Botswana.

2.3 Data Analysis

The data were entered in to the SPSS 22 software package for the analysis. Descriptive statistics was employed whereby mean and standard deviation were calculated. An average response mean value of 2.5 and above (2.50-4.0) indicated that the item is important whereas an average response mean value of lower than 2.5 (1.0-2.49) indicated that the item is not important for the respondents. The identified opportunities, constraints and ways to mitigate the constraints in dairy production were ranked based on the means of the responses of the respondents. Chi Square test was also performed to test the significance of the mean of each of the factor/item of the opportunities, constraints and ways to mitigate the constraints in dairy farming.

3. Results and Discussion

The data were analyzed according to the objectives of the study. The results of the study are presented and discussed as follows.

3.1 Opportunities in Milk Production

Eight business opportunities in dairy production were identified and ranked based on their importance. Table 1 presented how respondents ranked the importance of opportunities on a 1 to 4 Likert scale (1= Not important and 4= Most important). The results reflected that the identified eight opportunities in dairy production were ranked according to their importance included; the grain feed production, roughage feed production, manufacturing of dairy feed, establishment of milk processing industry, development of transportation system, dairy cattle breeding, milk collection centers and, establishing AI centers. All the opportunities as well as the average mean value for the opportunities were found to be statistically significant (Table 1).

The results indicated that among the eight identified opportunities in dairy production in Botswana are grain feed production ($X = 3.68$), roughage feed production ($X = 3.59$), manufacturing of dairy feed ($X = 3.52$), establishment of milk processing industry ($X = 3.45$) and, development of transportation system ($X = 3.32$) were the major opportunities with a mean of 3 and above ($X \geq 3.00$). Chi Square tests showed that all the identified opportunities, regardless of their level of importance to the respondents, were found to be statistically significant.

Table 1. Mean and standard deviation of opportunities in dairy production

Opportunities in dairy production	Mean	SD
1. Grain feed production	3.68*	1.01
2. Roughage feed production	3.59*	1.06
3. Manufacturing of dairy feed	3.52*	1.25
4. Establishment of milk processing industry	3.45**	1.24
5. Development of transportation system	3.32*	1.21
6. Dairy cattle breeding	2.91**	1.22
7. Milk collection centers	2.84*	1.53
8. Establishing AI centers	2.56**	1.61
Mean	3.23*	

* Chi Square statistical significance, $p < .05$.

** Chi Square statistical significance, $p < .01$.

3.2 Constraints in Milk Production

Dairy sub-sector does not make a substantial contribution to the economy of Botswana because of number of limiting factors. The poor performance of the dairy sub-sector is attributed to socio-economic, infrastructure and technical constraints in the development of the dairy industry. Table 2 presented identified twelve constraints in milk production in Botswana which were ranked based on their importance to the respondents. Table 2 presented how respondents ranked the importance of constraints on a 1 to 4 Likert scale (1= Not important and 4= Most important). These factors were identified and ranked in descending order of their importance which included namely; high feed costs, feed shortage and unavailability, lack of technical support, lack of skilled manpower, high prevalence of pests and diseases, lack of dairy related technologies, difficult access to feed, high transportation costs, difficult to acquire land for establishing dairy, lack of finance, high electricity connection charges and, lack of institutions providing relevant information. Table 2 indicated that high feed costs ($X = 3.59$), feed shortage and unavailability ($X = 3.47$), lack of technical support ($X = 3.41$), lack of skilled manpower ($X = 3.34$), high prevalence of pests and diseases ($X = 3.28$) and, lack of dairy related technologies ($X = 3.19$) were

the top six major constraints with a mean of 3 and above ($X \geq 3.00$) among the twelve identified constraints in dairy production in Botswana.

Table 2. Mean and standard deviation of production constraints in dairy production

Production constraints	Mean	SD
1. High feed costs	3.59*	1.21
2. Feed shortage and unavailability	3.47*	1.02
3. Lack of technical support	3.41**	0.92
4. Lack of skilled manpower	3.34*	1.25
5. High prevalence of pests and diseases	3.28*	1.04
6. Lack of dairy related technologies	3.19*	1.11
7. Difficult access to feed	2.96**	1.27
8. High transportation costs	2.87*	1.05
9. Difficult to acquire land for establishing dairy	2.72**	1.19
10. Lack of finance	2.68*	1.37
11. High electricity connection charges	2.59**	1.28
12. Lack of institutions providing relevant information	2.54**	1.14
Mean	3.05*	

* Chi Square statistical significance, $p < .05$.

** Chi Square statistical significance, $p < .01$.

The results clearly indicated that feed related problems whether it is feed cost, feed quantity or the feed availability has been found a problem of paramount importance. Chi Square tests indicated that all the identified constraints were found to be statistically significant. Contrasting the results in Table 1 and Table 2, It is observed that the top three opportunities namely, grain feed production, roughage feed production, manufacturing of dairy feed in dairy production (Table 1); can also lead to the solution to the major constraints in milk production namely the high feed costs and the feed shortage and unavailability (Table 2). At present, most of the feeds are imported which are not only costly but the supply and availability also is very much unreliable. Once the existing opportunities of grain feed production, fodder production and manufacturing of feed are realized in the country, this will reduce imports enabling the reduction in price as well as ensuring the availability of dairy feeds in the country.

These results are similar to the findings of Boitumelo and Mahabile (1991) who reported that inadequacy of feed (quantity and quality) to sustain milk production is one of the major constraints in dairy farming in Botswana, particularly during the dry season. The findings reported by Pelaelo-Grand et al. (2010) that milk production in Botswana has not increased over time due to *inter alia* feed shortages are also similar to the findings of this study. This may be attributable to unreliable rainfall and recurring droughts which result in seasonal pasture variations which are not able to sustain the livestock sector throughout the year. These results are also similar to the findings of Geleti et al. (2014) and Galmessa et al. (2013) who reported that the problem of feed shortage is one of the major factors that hinders urban and peri-urban dairy development in Western Ethiopia which is of similar climate as Botswana. Inadequate supply of quality feed has been reported as the major factor limiting dairy productivity in Ethiopia (SNV, 2008). The most important reason for unpredictable availability of feed and high feed cost in Botswana can be because most of the feeds are imported from neighboring countries. Supplementary feeding in dairy farming is important if animals are to produce a good quantity and quality of milk throughout the year. If farmers are supplementing the feeding of their dairy animals with these expensive feeds, it increases the cost of milk production which dairy farmers can not afford and thus, forces to shut down the milk production units. Therefore, it is suggested that all the efforts should be made to ensure the availability of enough quantity of dairy feed at reasonable prices all the times.

Lack of technical support and lack of skilled manpower were also identified as the fourth and fifth top most production constraints. Dairy farming requires good management but dairy farmers do not have the skill and knowledge to run dairy production enterprises and they also do not get enough technical support which makes the dairy farming fail to continue a profitably enterprise. There are many parasites and diseases affecting dairy cattle. For example ticks, worms, heart water, gall sickness and so on. It is important for dairy farmers to control

parasites and diseases before they negatively affect the milk production of animals as animals affected by parasites and diseases tend to produce less milk than their usual production. Lack of dairy technologies such as storage and cooling facilities contribute to spoilage of the milk after milking. The lack of adequate transportation and cooling infrastructure in rural areas accounts for a loss of large volumes of milk in developing countries (Ndambi et al., 2007). Due to high costs incurred in collection and cooling of milk, it is important that larger volumes are handled at a time to reduce unit costs of transactions. A common means of doing this is the installation of cooling centres for milk in production areas and the organisation of farmers into dairy cooperatives (D'Haese et al., 2005). A well organized dairy infrastructure especially, storage facilities and transportation of milk and milk products is needed to support the growth and development of dairy production.

3.3 Strategies to Mitigate the Existing Constraints in Milk Production

The respondents suggested ten strategies to improve the dairy production in the country which are presented in Table 3. Table 3 presented how respondents ranked the importance of the strategies to mitigate the constraints in dairy production on a 1 to 4 Likert scale (1= Not important and 4= most important). Chi Square tests showed that all the strategies to mitigate the constraints were found statistically significant.

Table 3. Mean and standard deviation of possible strategies to mitigate the constraints in dairy production

Strategies to mitigate the constraints	Mean	SD
1. Increasing production of concentrate feed locally	3.78*	1.21
2. Increase in local roughage feed production	3.64*	1.07
3. Provision of subsidy on animal feed	3.57*	1.02
4. Easy access to sufficient financial support	3.42**	1.25
5. Training of dairy farmers	3.29*	1.20
6. Effective control of pests and diseases	3.22*	1.03
7. Ensure scientific dairy cattle breeding	2.92**	1.01
8. Development of transportation system	2.85*	1.29
9. Establishing milk collection and AI centers	2.68**	1.19
10. Introduction of government policies for dairy development	2.53*	1.41
Mean	3.19*	

* Chi Square statistical significance, $p < .05$.

** Chi Square statistical significance, $p < .01$.

Table 3 reflected that the ten possible strategies to mitigate the constraints in dairy production which were identified and ranked according to their importance included increasing production of animal feed locally, increase in local roughage production, provision of subsidy on animal feed, easy access to sufficient financial support, training of dairy farmers, effective control of pests and diseases, ensure scientific dairy cattle breeding, development of transportation system, establishing milk collection and AI centers and, introduction of government policies for dairy development (Table 3). Table 3 indicated that the important strategies to mitigate the existing constraints in dairy production were increasing in local production of animal feed ($X = 3.78$), increase in local roughage feed production ($X = 3.64$), provision of subsidy on animal feed ($X = 3.57$), easy access to sufficient financial support ($X = 3.42$), training of the farmers ($X = 3.29$) and, effective control of pests and diseases ($X = 3.22$) were the major strategies to mitigate constraints with a mean of 3 and above ($X \geq 3.00$) among the twelve identified constraints in dairy production in Botswana. The results highlights that the three major strategies to mitigate the constraints are related and confined to the feed and fodder for dairy animals. These ways are correlated with the top three constraints which were also related with the animal feed and fodder. These results also indicted that the three opportunities namely, grain feed production, roughage feed production, manufacturing of dairy feed in dairy production; can also provide solution to the major constraints in milk production namely the high feed costs and the feed shortage and unavailability. At present, most of the feeds are imported and therefore cost and availability is also very much unreliable. Once the existing opportunities of grain feed production, fodder production and manufacturing of feed are realized in the country, it will reduce

imports enabling the reduction in price and ensuring the availability of feeds in the country. It was suggested that animal feeds should be available at lower cost, funds should be available and farmers should be trained to improve their skill in dairy farming.

Dairy cows have to be provided with fodder to produce milk throughout the year; therefore, the farmers need to ensure production of fodder crops for feeding cows especially, during the summer seasons when the availability of natural grazing grass is poor. Botswana's climate is considered subtropical and dry. Rainfall is largely erratic and unreliable resulting in droughts being common (Moreki & Tsopito, 2013). Because of erratic rainfall and high incidence of droughts that detrimentally affect crop production including fodder (Musemwa et al., 2012). Mpapho (2000) stated that rainfall is unpredictable in both timing and quantity leading to seasonal quantitative and qualitative feed shortage which contributes to low milk production. As a result, natural pastures cannot adequately support livestock throughout the year. Generally, shortage of water also contributes to the poor production and unavailability of fodder. Dairy cows need a lot of drinking water in order to produce milk as 87% of the milk is composed of water. Therefore, a good source of clean drinking water is important in order for the dairy enterprise to be successful. Furthermore, unreliable rainfall and the poor availability of ground water, makes water a very scarce resource in the country. Therefore, it is important to suggest that government and dairy farmers should ensure the availability of fodder and water through the year. However, the availability of fodder, especially seasonal availability can be minimized through feed conservation practices like hay making and silage making so that roughage feed supplies would continue throughout the year. The availability and cost of concentrate feeds and other inputs could be alleviated through formation of producer groups, which could transport it from long distances and store for the next seasons. It was also observed that the average mean of opportunities is higher ($X = 3.23$) (Table 1) than the average mean of the strategies to mitigate the constraints ($X = 3.19$) (Table 3) followed by the average mean of constraints ($X = 3.05$) (Table 2) which indicated that the opportunities existed in dairy production are more and significantly important to the respondents than the constraints in dairy production in the country. These findings also suggested that the opportunities can be realised by adopting the ways to mitigate the constraints in dairy production in the country.

4. Conclusion and Recommendations

The purpose of the study was to explore the opportunities and constraints in milk production and dairy enterprise in Botswana. Based on the findings it is concluded that among the eight identified opportunities, grain feed production, roughage feed production, manufacturing of dairy feed, establishment of milk processing industry and, development of transportation system were the major opportunities in dairy production in Botswana. The findings indicated that high feed costs, feed shortage and unavailability, lack of technical support, lack of skilled manpower, high prevalence of pests and diseases and, lack of dairy related technologies were the top six major constraints among the twelve identified constraints in dairy production in Botswana. These results clearly indicated that feed related problems whether it is feed cost, feed quantity or the feed availability has been the problem of paramount importance in the dairy production. The results also indicated that the important strategies to mitigate the existing constraints in dairy production were increase in local production of animal feed, increase in local roughage feed production, provision of subsidy on animal feed, easy access to sufficient financial support, training of the farmers and, effective control of pests and diseases were the major strategies to mitigate constraints among the twelve identified constraints in dairy production in Botswana.

These results also indicated that the three opportunities namely, grain feed production, roughage feed production, manufacturing of dairy feed in dairy production; can also provide solution to the major constraints in milk production namely the high feed costs and the feed shortage and unavailability. Once these opportunities of grain feed production, fodder production and manufacturing of feed are realized, it will reduce imports of dairy feeds enabling the reduction in price and ensuring the availability of feeds as well. Therefore, it was suggested that animal feeds and fodder production should be produced locally and the government may consider providing subsidy on animal feed and fodder production.

The findings also revealed that the opportunities in dairy production are significantly important than the constraints in dairy production in the country. Moreover, the opportunities can be realised by adopting the strategies to mitigate the constraints enabling the improvement in the dairy production in the country. It was recommended that the identified constraints and opportunities as well as the strategies to mitigate the constraints need a careful consideration by the stakeholders especially, policy makers during the formulation and implementation of the policies for the development of dairy sector in Botswana.

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