LOCAL ENTERPRISE AUTHORITY

Botswana Meat Commission by-products Study

RESEARCH AND DEVELOPMENT DIVISION

DATE: SEPTEMBER 2015

1 EXECUTIVE SUMMARY

The LEA mandate requires the organization to identify business opportunities for uptake by SMMEs. In addition, the LEA's 2014- 2017 strategy has opened up its assistance and services to cover all sectors of the economy. As a result, the Botswana Meat Commission (BMC) by-products were identified as one area that needed exploration to identify potential business opportunities from which SMMEs can benefit. This was at the backdrop that the beef industry is the largest contributor to the GDP within the Agriculture sector. It is estimated to account for less than 2% of Botswana's GDP.

A Feasibility study for the 'Manufacturing of beef products and by products in Botswana' commissioned by BEDIA in 2006 identified some of the by-products from the Botswana Meat Commission as being suitable for exploitation by SMMEs due to the investment values required for their uptake. The study also reported that some of the by products such as blood, hooves and condemned meats were being disposed to effluent and landfills as there was no recovery and processing of these bye products.

The intended purpose of this study is to explore further business opportunities from the by-products which SMMEs can invest in. The uptake of business opportunities identified from this study will then assist Local Enterprise Authority (LEA) to promote use of local raw materials in the manufacturing sector. In addition, establishment of new industries will support the Botswana Government's priority of job creation and expand its economic diversification.

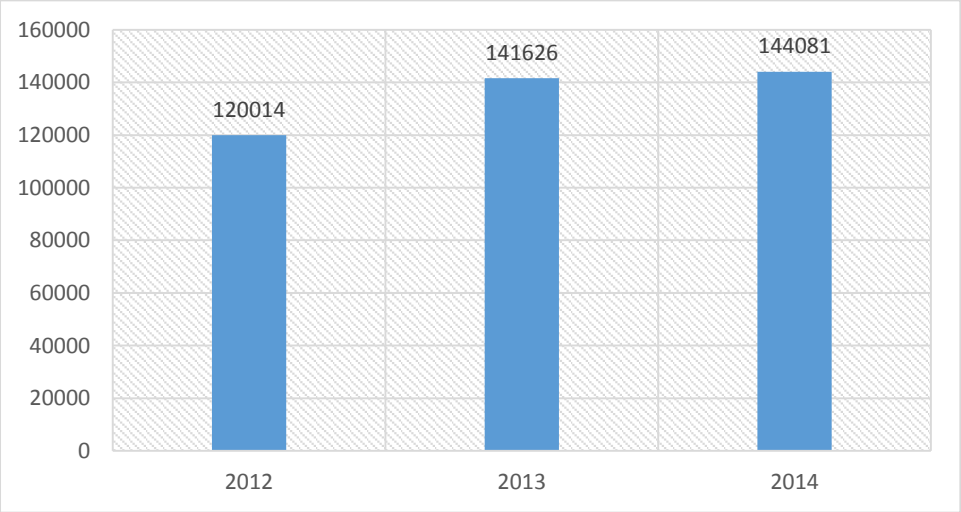
Overall Survey Objective

The main objective of the study was to identify potential uses of beef by-products produced by the Botswana Meat Commission that could be exploited by SMMEs for business opportunities.

Summary of Findings

Botswana has a total cattle population of 2,554,364 with 294,102 produced in commercial farms and the remaining 2,260,262 in communal land. BMC remains the main market for both commercial and communal cattle farmers in the country. During 2013, the total number of cattle slaughtered at BMC accounted to 3.5% of the total number of cattle in the country. The Botswana beef is one of the few locally produced export-oriented products that has been able to penetrate the international markets including the lucrative European Union market. Figure 1 shows the number of cattle slaughtered at BMC over the three years. The number of cattle slaughtered has increased steadly over the years from 120 014 in 2012 to 144 081 in 2014.

Figure 1.*Total number of cattle slaugheterd at BMC plants over the three years.(2012-2013)*

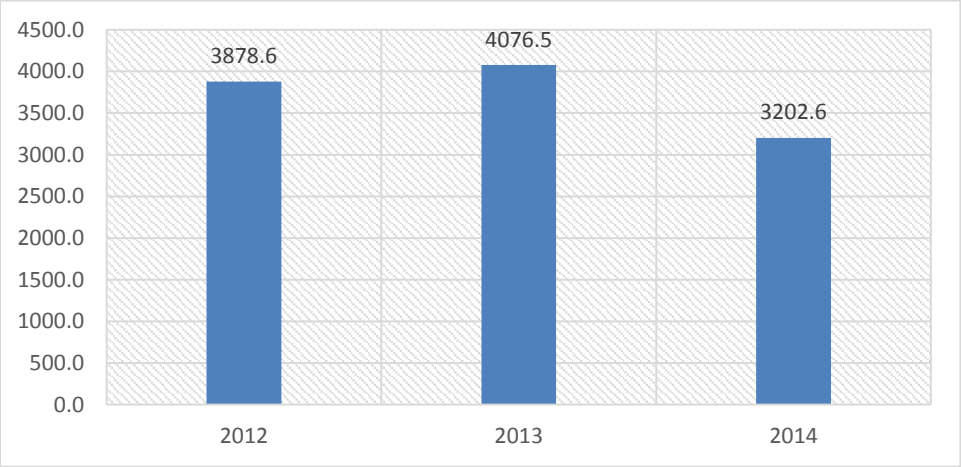


Beef by-products play an important role in the production of variety products. Beef by-products have found economic usage in the industrial, pharmaceutical, food manufacturing, leather and animal feed applications. The use of beef by-products in animal feeds is one of the most significant applications in the utilization of carcass

meal and bone meal. The manufacturing of animal feeds from carcass meal and bone meals is an expanding market in the country. Local feed manufacturing companies purchase carcass meal and blood meal from BMC in large quantities but still, local consumption of these two by products is far below exports. The LEA Agriculture Value Chain Studies conducted between 2010 and 2013 pointed out the insufficient and high costs of imported animal feeds in the country. Carcass meal in the local market is used for the production of poultry, pig and pet foods. By utilizing the exported quantities of carcass meal and blood meal from the BMC for the manufacture of animal feeds, the country will eventually decrease its reliance on imported feeds.

A total of 3,879 tonnes of carcass meal was produced by the BMC plants in 2012, while in 2013 and 2014 the production stood at 4,077 tonnes and 3,203 tonnes respectively, Figure 2 refers.

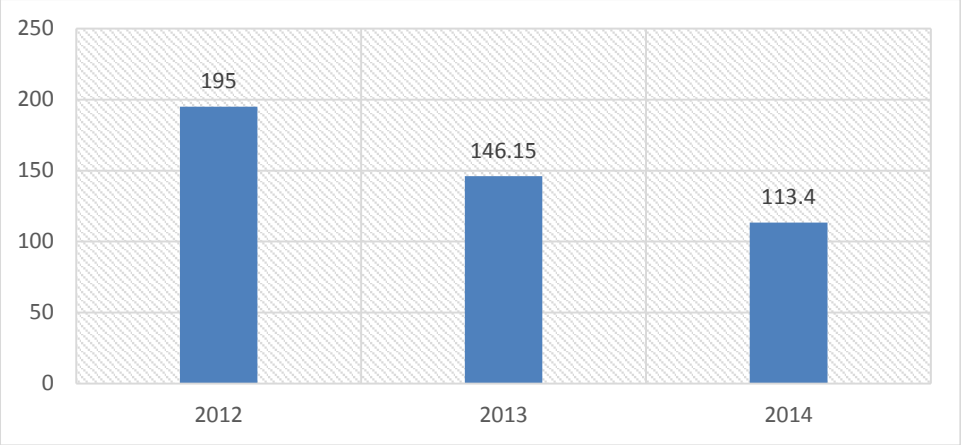
Figure 2. *Quantities of carcass meal (in tonnes) produced at BMC.*



Large quantities of carcass meal, 72.8%, were exported to the SADC region. A total of 62.9 % of carcass meal was exported to RSA while locally consumption accounted for 27.2 % of total production on average in a year. Zimbabwe and Malawi procured 8.5% and 1.4% of carcass meal respectively. The local companies use carcass meal mainly to make poultry feeds.

Blood meal is one of the BMC by-products where local consumption exceeds exports. A total of approximately 455 tonnes of blood meal was produced at BMC over the three years. Large quantities of 195 tonnes blood meal were produced in 2012, followed by 2013 production of 146.2 tonnes. As can be seen from Figure 3, the production continued to fall to 113.4 tonnes in 2014.

Figure 3. *Quantities of blood meal (in tons) produced at BMC over three years.*



Tallow from the BMC is utilized in Botswana in large quantities by local manufacturers mainly for the production of soap, but significant amounts of tallow are still being exported to RSA. Tallow is mainly used for soap making but can be also used for candle making, biodiesel and medicines. For the period under review, BMC produced tallow amounting to 6,758 tonnes. Out of this; 82% was procured locally by soap making industries.

Botswana makes bath soap from tallow obtained from BMC and this soap is mainly consumed in the local market. However, soap and related products were imported into the country to the tune of P 547 million and P 521 million during the years 2013 and 2014 respectively, Table 1 refers. This is despite the fact that large quantities of tallow are exported to neighbouring countries. Tallow is also renowned for making candles and related products. The country, however, still remains highly dependent

on products made from tallow as evidenced by an import bill of P29 million and P 24 million for the years 2013 and 2014 respectively.

Table 1. *Trade data for products made from beef by-products for the years 2013 and 2014.*

Commodity	Import value(2013) in BWP	Exports value(2013) in BWP	Import value(2014) in BWP	Exports value(2014) in BWP
Animal feeds	3,256,857	237,683	1,274,842	2,320
Soap & related products	547,455,330	22,306,570	521,877,983	48,839,060
Candles & related products	29,810,964	476,258	24,091,316	292,708

Data source: Statistics Botswana, 2015

The bile production data from the BMC shows that for the two years 2013 and 2014 the output amounted to 10.1 tons and 18.9 tons respectively. All the bile produced was exported to RSA.

Business opportunities identified

Carcass meal for the manufacturing of animal feeds

The quantities of carcass meal exported by BMC to the SADC region are far higher than those that are sold locally. For the period under review, 72.8% of carcass meal was exported as compared to 27.2% sold locally, Table 2 refers. The use of carcass meal for the manufacturing of feeds is permitted in the country, but the sale of animal manufactured feeds made from carcass meal for consumption by cattle, sheep and goats is prohibited because of the potential to transmit diseases to those animals. However, entrepreneurs can still purchase BMC carcass meal for the manufacturing of animal feeds for pigs, chickens and pet animals as well as for the export market.

Blood meal for the manufacturing of animal feeds

In the local market, blood meal is used in combination with other ingredients for the manufacturing of animal feeds. For the period under review, local consumption of blood meal from BMC exceeded exports. Table 2 shows that 90.6% of blood meal was sold locally as compared to 9.4% that was exported. The quantities of blood meal exported to SADC countries can be used by local entrepreneurs for the production of feeds and also for production of fertilizers to achieve net local consumption of blood.

Tallow for the manufacturing of soap and related products.

Tallow in the local market is mainly used for the manufacturing of soap. The soap manufacturing industry in the country is still at an infant stage, and as such, does not satisfy the local market as evidenced by high import values of P522 million in 2014 for soap and related products. For the period under review, 18% of BMC tallow was exported to SADC countries as compared to 82%, which was sold locally. These quantities of exported tallow signal business opportunities that can be up taken by

local companies for the production of soap and related products. Tallow can also be used for the production of other products such as candles, creams and lotions.

Bile for pharmaceutical use

All bile produced at BMC is exported to RSA. This beef by-product can be used in the pharmaceutical industry for the production of powder, pills or capsules for the treatment of liver diseases.

Table 2. *Uses of beef by-products and proportions of local and export market for BMC over the three years.*

By-product	Local consumption	Exported	Uses
Carcass meal	27.2%	72.8%	Animal feed (feeds for cattle, pigs, poultry, pet food)
Blood meal	90.6%	9.4%	Animal feed (blood meal), Fertilisers, Edible sausages, Dyes and Inks, Pharmaceuticals
Tallow	82%	18%	Soap making, Candle making, Leather Conditioner, biodegradable motor oil, biodiesel, Paint, Rubber, Medicines, creams and lotions
Bile	0	100%	Pharmaceutical industry use as treatment of liver diseases
Gallstones*	-	-	Medicines
Calf serum*	-	-	Pharmaceuticals, cell- culture
Hairball*	-	-	Brushes, Textiles, air filters
Horns*	-	-	Plastics, Pet food, Plant food, Photo film, shampoo and conditioner, laminating paper, wallpaper, buttons, glue.

**Recovery of these by products could not established.*

Other products such as gallstones, calf serum, hairball and horns recovery could not be established an indication that they are either going to waste or are not efficiently collected.

The main beef by-products used by Visual artists were found to be horns, bones, teeth and hooves. Among the products that artists have produced from beef by-products, include electric study lamps, paraffin study lamps, earrings, necklaces, smoking pipes, Pen and pencil holders, fish carvings, scorpion carvings, salt and pepper shakers, taxidermy products. Most of the by-products used are from cattle with very few components of goats and sheep being minor decorators of cattle products. Entrepreneurs were found to be very innovative and creative in the type of products they designed and produced.

Conclusion

The study has shown, through high import bills of animal feeds, soaps & related products and candles & related products that the country is highly dependent on products made from beef by-products even though high quantities of raw materials from the BMC are being exported to neighbouring countries. The main products that are exported in large quantities are carcass meal, tallow, blood meal and bile. Apart from utilizing tallow in the soap manufacturing industry, and carcass meal and blood meal in the manufacturing of animal feeds, the local utilization of all other by-products from BMC is at minimal, as some are not even recovered during the slaughtering. The fact that these by-products are not wholly utilized in the country is a clear sign that the country's manufacturing sector is still below par.

Beef by-products are used by visual artists to develop various products some of which are used for domestic, decorative, beauty and ornamental purposes. The artists were found to be very innovative and creative in the type of products they

designed and produced. They have a great potential to grow if they can be afforded the necessary mentoring and financial support.

Recommendations

i. LEA should promote animal feed manufacturing for uptake by local enterpreneuers, to utilize the large quantities of carcass meal and blood meal currently exported, for the support of the chicken, pig and pet feed industries.

ii. LEA should promote the manufacturing of soap and other potential tallow related products by local entrepreneurs to utilize the large quantities of tallow exported from BMC.

iii. LEA should lobby the Ministry of Health for the promotion of drug manufactured products made from bile. This will open up opportunities that can be taken by SMMEs for the utilization of bile which is currently being exported.

iv. LEA should lobby the BMC to contract process suet into tallow from the council abattoirs and other private slaughter facilities for the benefit of the local tallow beneficiation outside the BMC.

v. LEA should lobby the BMC to efficiently recover all by-products of economic value from their abattoirs to stimulate and support local manufacturing industries dependent on the cattle by products

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Definition of terms

By-product:

A by-product is a secondary product that is produced in addition to the principal product.

Bile:

Bile is a complex mixture of conjugated bile acids, bile pigments, fatty acids, phospholipids, proteins, cholesterol and other minor components. Bile extract is used to increase the secretory activity of the liver. Ox bile primarily consists of water, salts, cholesterol, and lecithin, a fatty substance.

Calf Serum:

Calf serum (bovine serum) is a by-product of the meat industry collected from prime cattle 12- 36 months old, but typically less than 24 months old. It is used mainly in the field of pharmaceuticals where it is used in research, manufacture and control of human and veterinary vaccines and of drugs.

Tallow:

Tallow is hard fat rendered from the fatty tissues of cattle. It is used mainly in producing soap and animal feed among other uses.

Carcass meal:

Carcass meal is a by-product from beef parts which are not suitable for human consumption and used in combination with other ingredients to make animal feeds other than cattle.

Blood meal:

Blood meal is a dry, inert powder made from blood used as a high-nitrogen fertilizer and a high protein animal feed. It is produced from clean, fresh animal blood, exclusive of all extraneous material such as hair, stomach belching, and urine.

Gallstones:

Gallstones is a stone formed within the gallbladder as a concretion of bile components. They come in a variety of shapes and sizes. They may be round, egg shaped, square or pyramid shaped or as tube from the bile ducts.

Hairball:

A hairball is a small collection of hair or fur formed in the stomach of animals that is occasionally vomited up when it becomes too big. Hairballs are primarily a tight elongated cylinder of packed fur, but may include bits of other elements such as swallowed food.

1 Introduction

1.1 *Background*

The LEA mandate requires the organization to identify business opportunities for uptake by SMMEs. In addition, the LEA's 2014- 2017 strategy has opened up its assistance and services to cover all sectors of the economy. As a result, the Botswana Meat Commission (BMC) by-products were identified as one area that needed exploration to identify potential business opportunities from which SMMEs can benefit. This was at the backdrop that the beef industry is the largest contributor to the GDP within the Agriculture sector. It is estimated to account for less than 2% of Botswana's GDP (ICT, 2014).

Botswana Meat Commission (BMC) is the main market for cattle in Botswana. The country has a total cattle population of 2,554,364 with 294,102 produced in commercial farms and the remaining 2,260,262 in communal land (Statistics Botswana, 2013) The BMC buys cattle from the local farmers through its procurement Department, which is responsible for cattle throughput. During 2013, the total number of cattle slaughtered at BMC accounted to 3.5% of the total number of cattle in the country. The Botswana beef is one of the few locally produced export-oriented products that has been able to penetrate the international markets including the lucrative European Union market. The BMC has three product range, namely, fresh beef, canned products and by-products from its slaughter. The BMC operates three plants, namely Lobatse, Francistown and Maun. The Lobatse plant remain the biggest abattoir in the country and also acts as the headquarters of BMC.The BMC was established in 1965 upon which it started producing some by-products which were sold to the regional market. These by-products include carcass meal, blood meal and tallow (BMC Annual Report, 2003). The regional primary market for these products has been Botswana, Republic of South Africa (RSA),

Zimbabwe and Malawi. In realizing the importance of its by-products to the regional market, BMC established a fully-fledged by-product plant at its headquarters in Lobatse in 1998 (BMC Annual Report, 1999). With this development, other by-products such as tail hair, ox gall, horns and gallstones were later produced as well (BMC Annual Report, 1999).

1.2 *Literature Review*

The utilization of beef by-products has been significant throughout much of human history and continues to be an important contributor to a variety of economic activities in the world. In the ancient history in Africa, many animal by-products have been used as weapons, shelter and storage facilities.

According to Ockerman (1988), the economics of the world's meat industry demand that animal by-products be utilized so that the livestock industry can stay economically competitive with vegetable protein sources. If animal by-products are not effectively utilized, a valuable source of potential revenue is lost, and the added and increasing cost of disposal of these products is incurred by the industry. Today the cost of the live animal often exceeds the selling price of its carcass; therefore, the value of the by-products must pay the expense of slaughter and generate the profit for the meat-slaughtering operation.

Uses of beef by-products

According to Ockerman (1988), in the past, animal by-products had been a concern for legislators due to their peceived impression of polluting the environment. Nearly everything that was not edible was thrown away. By-products provide a valuable source of income not only for the BMC, slaughter facilities and butcheries but also for the individuals since enterpreurship opportunities can arise from the utilisation of the by-products.

Uses of bile

According to Ockerman (1988), one of bile's main roles in a living ox is to help the animal absorb vitamins from food that has been ingested, and these properties hold true when the substance is processed and prepared for human consumption, too. One of the primary ways it can be used is to assist the body in the breaking down of fats and the assimilation of vitamins A, D, E, and K.

According to www.wiseGEEK.com, the liver stores bile in a small sac called the gallbladder, from which it is distributed to the body. A lack of bile or a production imbalance may lead to wide swings in cholesterol and fat levels in the bloodstream. This is a contributing factor in the formation of gallstones, or calcified obstructions of the gallbladder. People who are prone to this condition sometimes supplement with bile from cattle as a way of restoring proper liver functionality and preventing painful stones. The bile extract can also sometimes speed recovery in people who have undergone a cholecystectomy, which is the surgical removal of the gallbladder. Bile can also be used for constipation relief as it affects intestinal motility and absorption of nutrients in the colon.

The bile supplement can also help treat certain liver diseases, particularly cirrhosis. Cirrhosis happens when the liver's tissues stop regenerating and begin turning to thick scar tissue. This impedes the liver's ability to do much of anything, including bile regulation.

According to Conjecture Corporation (2015), bile is typically prepared for medicinal use in a two-step process. It is first extracted from the animal and sterilized, usually with heat, and then the manufacturers dry and crush it to prepare it for market either as a loose powder or in pill or capsule form.

Uses of calf serum

According to www.serumindustry.org, Serum is the centrifuged fluid component of either clotted or defibrinated whole blood. Bovine blood may be taken at the time of slaughter, from adult cattle, calves, very young calves or (when cows that are slaughtered are subsequently found to be pregnant) from bovine foetuses.

There is a wide range of applications for processed bovine serum. Perhaps the most important is in the field of pharmaceuticals where it is used in the research, manufacture and control of human and veterinary vaccines and of drugs ("biopharmaceuticals") derived using "biotechnology" (in other words techniques involving living organisms) many of which are at the cutting edge of drug development. Foetal bovine serum is also used extensively in research. A technique known as "cell culture" is widely applied in the manufacture of both vaccines and biopharmaceuticals and bovine serum is extensively used in cell culture.

According to www.serumindustry.org, cell culture is the process by which cells - human, animal or even insect- are grown under controlled conditions in vitro (outside the body). Another significant and growing application of cell culture is in the safety testing of widely used products such as cosmetics and household chemicals. As the use of live animals for the safety testing of such products (cosmetics especially) has come increasingly under the political and ethical spotlight, cell culture technology has been used more and more to reduce or eliminate testing in animals. Cell culture techniques are an essential tool, and have made, and will continue to make, a very significant contribution in many of those areas of biomedical science and research that will benefit humans and animals.

Uses of tallow

According to Ockerman (1988), tallow is referred to as the rendered fat of cattle and sheep. It is the animal fat with a titre of greater than 40°C (104°F) (Austin, 1949). Titre refers to the softness or hardness of animal fats expressed as the temperature

at which the fatty acids of the given fat solidify. Typically, tallow starts with the extraction of suet from a carcass. Suet is hard fat found in the neighbourhood of the kidneys and around some other internal organs. While suet can be used as-is, rendering it removes the impurities and also extends the shelf life. Once suet is rendered, it becomes tallow. As long as it is stored in an airtight container in a cool environment, it can be kept for an extended period of time, unlike suet, which will become rancid.

According to Conjecture Corporation (2015), tallow is used to produce both edible and inedible products. Edible tallow products include margarine, cooking oil, and baking products. Inedible tallow products include soap, candles, and lubricants. It is also used in combination with other ingredients for the manufacturing of livestock feed.

Botswana is renowned for utilizing greater quantities of tallow produced at BMC to make bath soap. According to Statistics Botswana (2015), Botswana exported tallow and animal fats to the value of P312, 775 which was an equivalence of 62 metric tonnes. The country makes bath soap from tallow obtained from BMC and this soap is mainly consumed in the local market. However, soap and related products were imported into the country to the tune of P 547 million and P 521 million during the years 2013 and 2014 respectively, Table 1 refers. This is despite the fact that large quantities of tallow is exported to neighbouring countries. Tallow is also renowned for making candles and related products. The country, however, still remains highly dependent on products made from tallow as evidenced by an import bill of P29 million and P 24 million for the years 2013 and 2014 respectively.

Uses of carcass meal

Carcass meal is a by-product from beef parts which are not suitable for human consumption and used in combination with other ingredients to make animal feeds. In Botswana carcass meal is mainly used for poultry and pig feeds. This meal is produced in animal factories by collecting residue, or in butcher's shops with bones and tissues, after the complete removal of bones from the carcass of bovine cattle. These bones and tissues are grounded, cooked and pressed for the extraction of fat and then cooked again. Cattle are not permitted to be fed any beef by-product because of the potential to transmit diseases to live animals.

Carcass meal is used in combination with other products for the production of a range of animal feeds, which includes pig feeds, poultry feeds, pet feeds as well as cattle feeds. However, in Botswana, cattle are not permitted to be fed any beef by-product because of the potential to transmit diseases to live animals. Hence, entrepreneurs can utilize BMC produced carcass meal to make products mainly for the poultry feeds, pig feeds and for the export market.

Uses of blood

According to Ockerman (1988), Blood in food is used as a protein supplement, as a textured meat protein, to clarify liquid foods (e.g. wine), as a stabilizer (e.g. cheese), as an emulsifier (e.g. butter) and as a colouring agent for meat (particularly poultry) items. Blood albumin has been used as a substitute for egg albumin in food, utilized in making sausage casing and incorporated into bread flour. Most of the blood used in livestock feed is in the form of blood meal used as a protein supplement. Production of blood meal consists of cooking the blood, expressing the excess water and drying to obtain a granular product. Blood meal has also been found to be useful as a stabilizer for fat in bone meal and in livestock rations and is an excellent source of most of the trace minerals. In the laboratory, there are many uses of blood products and the most common ones would include uses as a nutrient for tissue

culture media and as a necessary ingredient in some agar for bacteriological use. Many blood components are isolated and used in chemical analysis or as nutritive supplements. Modified blood components are also used in the biological assay of heparin and used as standard solutions in the calibration of instruments used in haematology. Blood plasma has also been used as a diluent for semen from boars and bulls. (H.W. Ockerman, 1988.)

Industrial uses of blood include as an adhesive and for its film-forming properties in the paper, lithographic, plywood, veneering, fibre, plastics, and glue industries. It also finds use in insecticide and fungicide formulations, in foam fire extinguishers, in moulded ceramic products, in leather finishers, in cork crowns, in porous concrete and as a stabilizer for biological material and drugs. Blood is also useful as a fertilizer and, in addition to contributing nitrogen; it aids in humus formation and improves the soil structure. Blood is also useful in seed coating and regulating soil pH.

Uses of bones

Due to its calcium content, some bone meal is fed to poultry for bone growth and to provide necessary calcium for eggshells. It is also used to add phosphorus and calcium to livestock and pet foods. Balanced mineral composition is necessary for good feed utilization. Some animals, i.e. those pregnant or lactating, require higher levels of minerals in the diet. The mineral content of bone makes it useful as plant fertilizer. However, modern farming techniques favour fertilizer with high phosphorus and nitrogen concentrations, which bone meal does not have. Therefore, the market for ground bone as a fertilizer is a relatively small. Animal glue, useful for wood, leather, paper, etc., is made from bones by extracting the collagen by heating in water. The water is evaporated to yield glue. Although animal glue usage decreased considerably due to synthetic adhesives, there is still a limited market (Teachman, 1981).

Uses of gallstones

Gallstones are stones formed within the gallbladder as a concretion of bile components. They come in a variety of shapes and sizes. They may be round, egg shaped, square or pyramid shaped or as tube from the bile ducts. They are used extensively in oriental medicine, particularly in the treatment of hepatitis and other liver and gallbladder related ailments among other things. According to *brisbanetimes.com.au*, the stones are used in traditional Chinese medicine under the belief they can treat hepatitis and other liver and heart-related diseases.

Uses of hairball

Hairball (bezoar stones) is composed of undigested or partially digested plant residues, mucilage, animal hairs, precipitated salts, lime deposit containing phosphoric acid, and other foreign bodies, is in fact a pseudo-stomach stone. As a result of bowel movements, it is compacted, becomes round, gets a polished surface, and a brownish or blackish colour. It occurs especially in the rumen and honeycomb stomach of ruminants (cattle, chamois, bezoar goat), and in size is comparable to either a hen, or even an ostrich egg. Hairball as well as tail hair are mainly used for manufacturing of brushes, textiles and air filters.

Table 3. ***Uses of beef by-products***

By Product	Uses
Bile	Treatment of liver diseases
Calf serum	Pharmaceuticals, cell- culture
Tallow	Soap making, Candle making, Leather Conditioner, biodegradable motor oil, biodiesel, Paint, Rubber, Medicines, creams and lotions
Carcass meal	Animal feed (feeds for cattle, pigs, poultry, pet food)
Blood	Animal feed (blood meal), Fertilisers, Edible sausages, Dyes and Inks, Pharmaceuticals
Suet	Makes tallow
Hooves/ Horns	Plastics, Pet food, Plant food, Photo film, shampoo and conditioner, laminating paper, wall paper, buttons, glue.
Gallstones	Medicines
Tail Hair & hairball	Brushes, Textiles, air filters
Ox gall	Mixed with alcohol to make a wetting agent for paper marbling, engraving, lithography and watercolour painting

1.3 *Rationale*

A Feasibility study for the 'Manufacturing of beef products and by products in Botswana' commissioned by BEDIA in 2006 identified some of the by-products from the Botswana Meat Commission as being suitable for exploitation by SMEs due to the investment values required for their uptake. The study also reported that some of the by products such as blood, hooves and condemned meats were being disposed to effluent and landfills as there was no recovery and processing of these bye products (abelprojects 2006).

The intended purpose of this study was to unearth and expand the business opportunity prospects from which SMMEs can invest. The uptake of business opportunities identified from this study will assist Local Enterprise Authority (LEA) to promote use of local raw materials in the manufacturing sector. In addition, establishment of new industries will support the Botswana Government's priority of job creation and economic diversification drive.

1.4 *Structure of report*

This report consists of three (3) chapters, with the first chapter introducing the study, chapter 2 outlining the research objectives and methodology while chapter 3 presents findings. The findings section is further divided into two main parts. The first part deals with beef by-products produced at BMC, the second part deals with current uses of BMC by-products locally, focusing on visual artists and manufacturers.

2 Objectives

2.1.1 General Objective

The main objective was to identify potential uses of beef by-products produced by the Botswana Meat Commission that could be exploited by SMMEs for business opportunities.

2.1.2 Specific objectives

a. To establish all beef by-products produced by the Botswana Meat Commission.

b. To determine annual outputs of the by-products produced at BMC plants.

c. To establish current uses of beef by-products produced by BMC.

2.2 Methodology

2.2.1 Scope and units of research

This study concentrated on by-products produced by the three BMC plants being Lobatse, Francistown and Maun abattoirs over the three years 2012, 2013 and 2014. The study also interviewed the BMC by-products customers.

Key informants were used in this study including the BMC head office and the Ministry of Agriculture (MoA). The study did not cover hides and skins by-products since the LEA has covered it in the previous studies and successfully advocated for the construction of the leather park in Lobatse which is expected to consume all hides from the BMC.

For purposes of this study the following by-products were the main area of focus; Tallow, carcass meal, bile, serum, hairball, blood meal, gall stones, bones and horns. This is so because these by products are the ones mainly produced by BMC and other local producers.

2.2.3 Data collection

Primary data was collected using three questionnaires that were administered to BMC, four (4) Visual Artists and one (1) soap Manufacturer. The data was collected through face-to-face interviews. Extensive document review was used to establish literature pertaining to the current study.

2.2.4 Data management and analysis

Primary quantitative data was analysed using graphs, charts and tables created in Microsoft excel spreadsheet. Rapid analysis was used to analyze qualitative data from key informants.

2.2.5 Limitations of the study

a. The study is based only on BMC beef by-products even though there are other sources of beef by-products in the country.

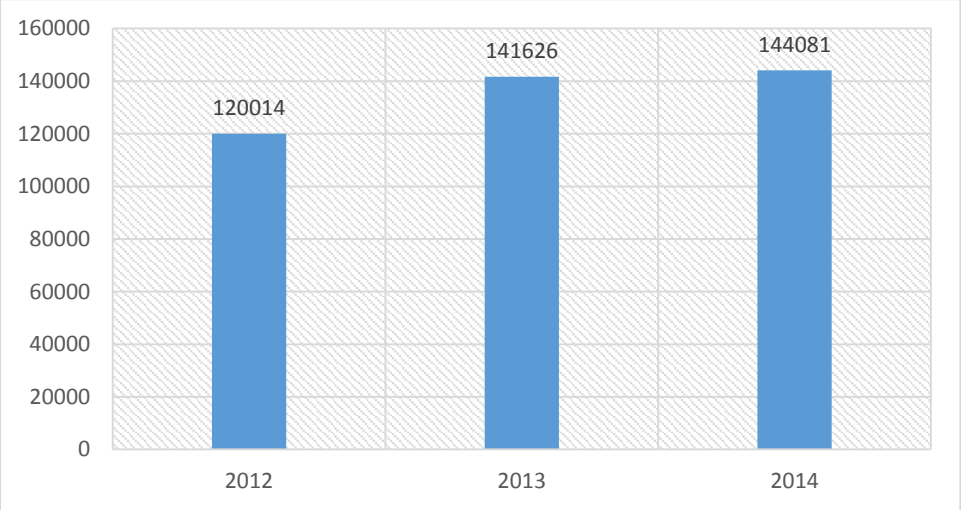
2.2.6 Challenges

a. Refusal by some business people to divulge information they regard as confidential such as their market and finacial resources.
b. The data provided by BMC had some gaps for the Francistown and Maun plants.

3 Findings

According to Figure 4, the number of cattle slaughtered has increased steadly over the years from 120 014 in 2012 to 144 081 in 2014.

Figure 4. *Total number of cattle slaugheterd at BMC plants over the three years.(2012-2013)*



3.1 *Products produced from beef by-products.*

BMC considers all edible parts of a cow as main products; these being sold to different customers for consumption. The remaining products are considered as by-products and these include Carcass meal, Blood meal, Tallow, Bile, Gallstones, Horns, Calf serum and Hairball. These by-products provide a valuable source of income for the BMC and are consumed mainly by the international market though a few of them are sold locally.

3.1.1 Carcass meal

According to Table 4, Botswana is a net importer of animal feeds. The country imported feeds to the value of P 3.3 million and P 1.3 million during the years 2013 and 2014 respectively, while on the other hand exporting very little quantities of feeds despite the country producing large quantities of carcass meal through BMC.

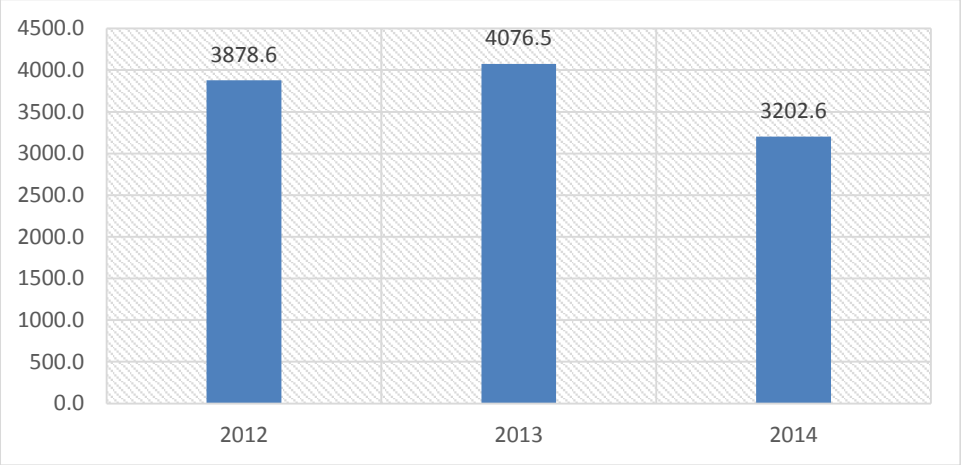
Table 4. *Trade data for products made from beef by-products for the years 2013 and 2014.*

Commodity	Import value(2013) in BWP	Exports value(2013) in BWP	Import value(2014) in BWP	Exports value(2014) in BWP
Tallow & animal fats	115,709	0	1,330,175	312,775
Animal feeds	3,256,857	237,683	1,274,842	2,320
Soap & related products	547,455,330	22,306,570	521,877,983	48,839,060
Candles & related products	29,810,964	476,258	24,091,316	292,708

Data source: Statistics Botswana Trade Statistics Unit, 2015

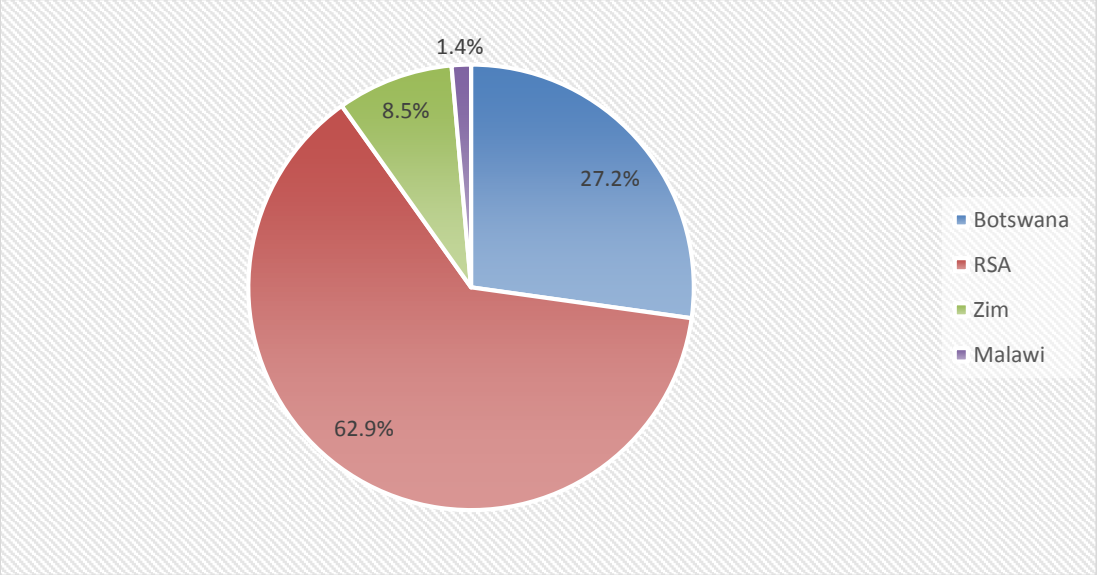
A total of 3,879 tonnes of carcass meal was produced by the BMC plants in 2012, while in 2013 and 2014 the production stood at 4,077 tonnes and 3,203 tonnes respectively, Figure 5 refers.

Figure 5. *Quantities of carcass meal (in tonnes) produced at BMC.*



Large quantities of carcass meal, 72.8%, were exported to the SADC region. A total of 62.9 % of carcass meal was exported to RSA while locally consumption accounted for 27.2 % of total production on average in a year. Zimbabwe and Malawi procured 8.5% and 1.4% of carcass meal respectively, Figure 6 refers. The local companies use carcass meal mainly to make poultry feeds.

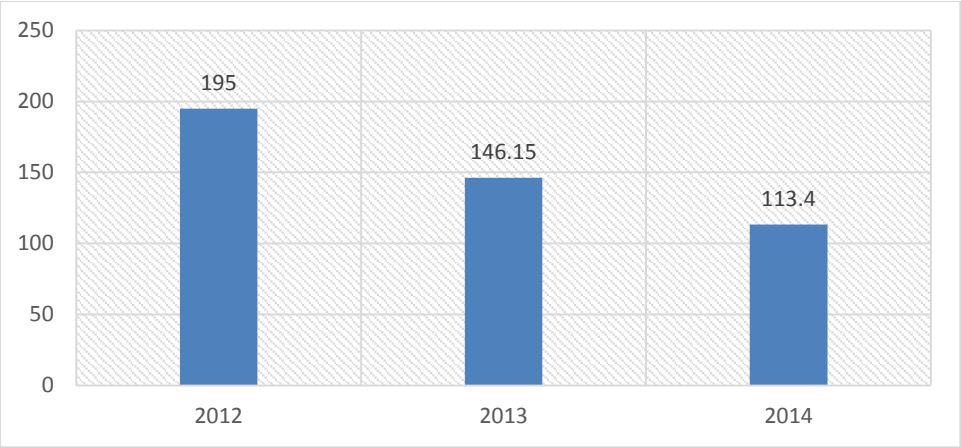
Figure 6. *Proportions of carcass meal sold by BMC to regional countries.*



3.1.2 Blood meal

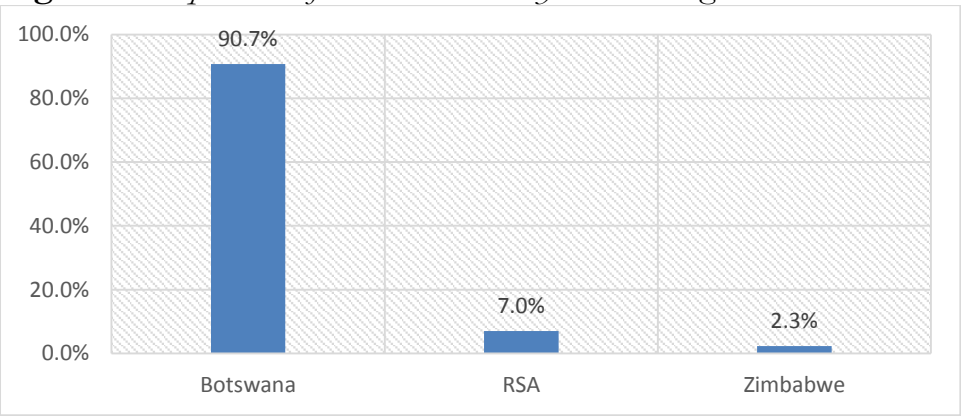
Blood meal is one of the BMC by-products whose local consumption exceeds exports. A total of approximately 455 tonnes of blood meal was produced at BMC over the past three years. Large quantities of 195 tonnes blood meal were produced in 2012, followed by 2013 production of 146.2 tonnes. As can be seen from Figure 7, the production continued to fall to 113.4 tonnes in 2014. This downward trend was caused by the inefficiency at collection points by BMC.

Figure 7. *Quantities of blood meal (in tons) produced at BMC over three years.*



Botswana consumes 90.7% of blood meal produced at BMC, with RSA and Zimbabwe consuming 7% and 2.3% respectively. None of the blood meal is consumed beyond the SADC region.

Figure 8. *Proportions of blood meal sold by BMC to regional countries.*



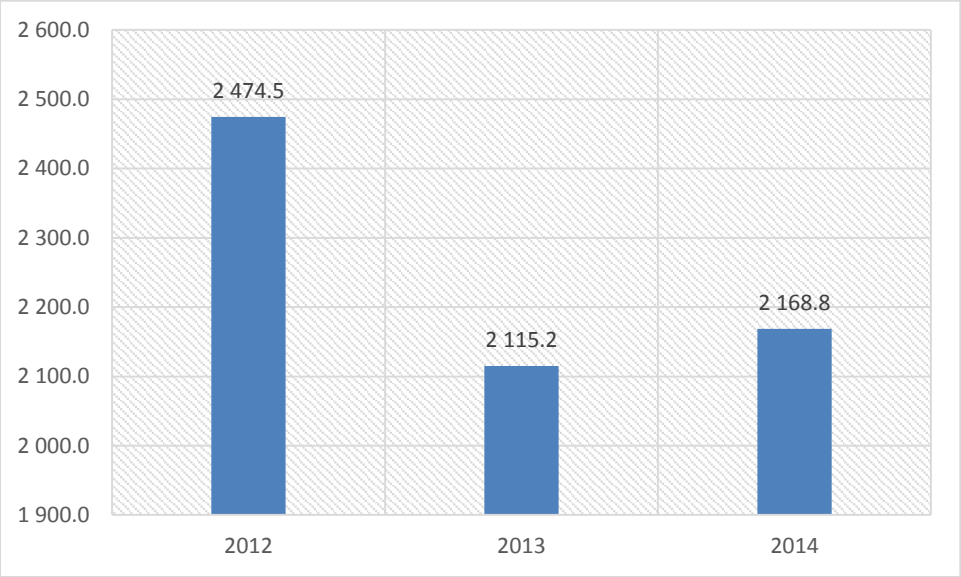
3.1.3 Tallow

Botswana is renowned for utilizing greater quantities of tallow produced at BMC to make bath soap. According to Statistics Botswana (2015), Botswana exported tallow and animal fats to the value of P312, 775 which was an equivalence of 62 metric tonnes. The country makes bath soap from tallow obtained from BMC and this soap is mainly consumed in the local market. However, soap and related products were imported into the country to the tune of P 547 million and P 521 million during

the years 2013 and 2014 respectively, Table 2 refers. This is despite the fact that large quantities of tallow is exported to neighbouring countries. Tallow is also renowned for making candles and related products. The country, however, still remains highly dependent on products made from tallow as evidenced by an import bill of P29 million and P 24 million for the years 2013 and 2014 respectively.

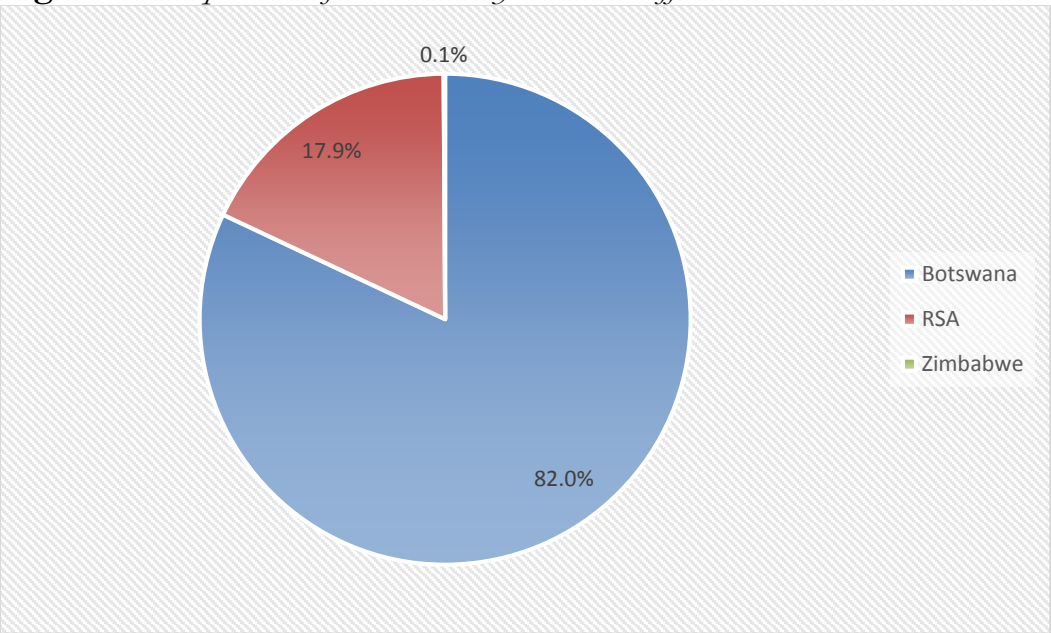
For the period under review, BMC produced tallow amounting to 6,758 tonnes. According to Figure 9, BMC produced tallow amounting to 2474.5 tonnes in 2012 while in 2013 production went down to 2115.2 tonnes.

Figure 9. *Quantities of tallow (in tons) produced at BMC plants over three years.*



The main customers of BMC tallow are Botswana companies in the soap manufacturing industry, who buy 82% of total tallow produced, followed by RSA at 17.9%. As can be seen from the Figure 10, Zimbabwe only buys an insignificant amount, 0.1%, of tallow from BMC.

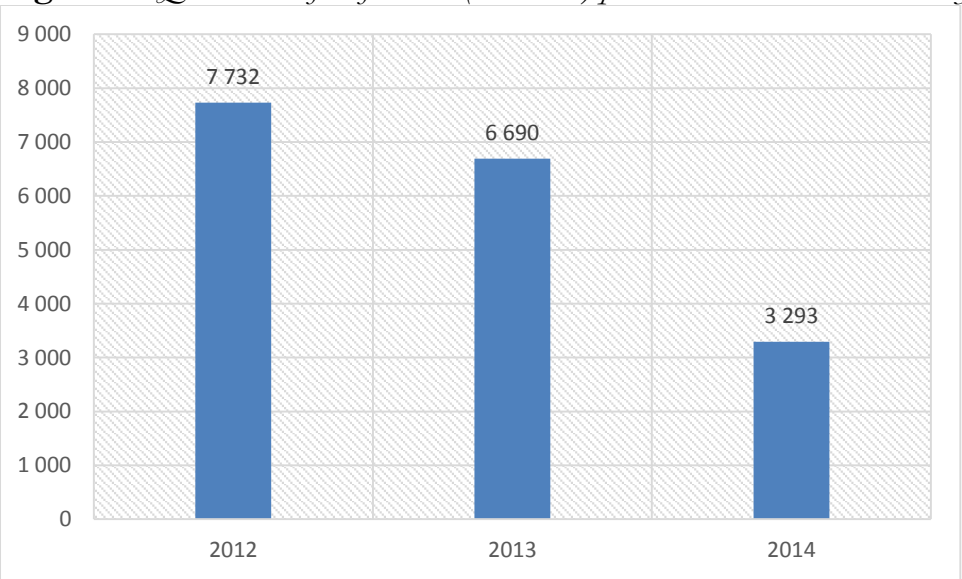
Figure 10. *Proportions of tallow sold by BMC to different customers.*



3.1.4 Calf serum

Calf serum data was obtained for the Lobatse plant only and as shown by Figure 11 a total of 18 tons was produced by the plant over the three years, with a yearly average production of 6 tons of serum. None of the calf serum produced at BMC is exported.

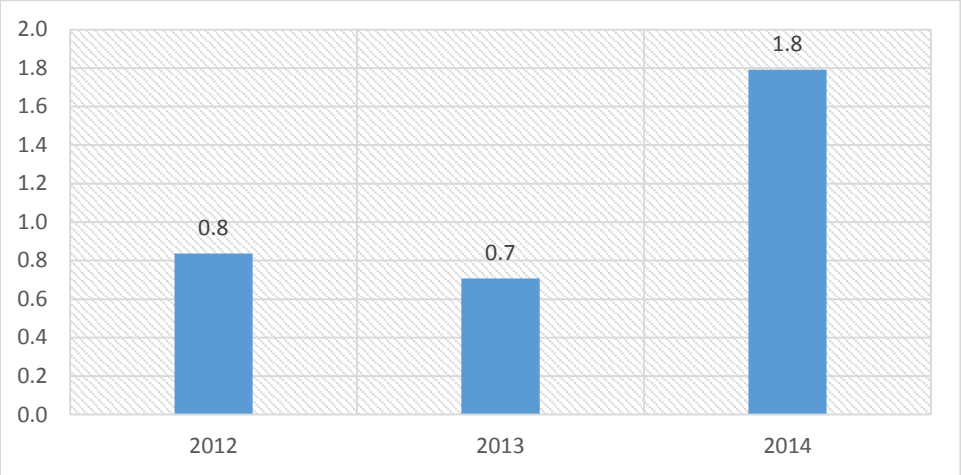
Figure 11. *Quantities of calf serum (in tonnes) produced at BMC over three years.*



3.1.5 Gallstones

Gallstones data was obtained for the Lobatse plant only and as shown by *Figure 12* a total of 3.3 tons was produced by the plant over the three years, with a yearly average production of 1.1 tons of gallstones. None of the gallstones produced at BMC is exported.

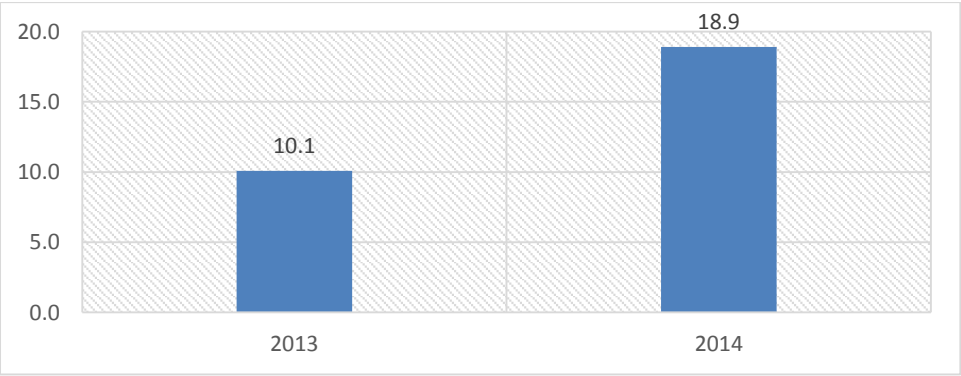
Figure 12. *Quantities of gallstones (in tonnes) produced at BMC over three years.*



3.1.6 Bile

The bile data available at the Lobatse plant was for the two years 2013 and 2014 which amounted for 10.1 tons and 18.9 tons respectively, Figure 13 refers. All the bile produced was sold to RSA.

Figure 13. *Quantities of bile (in tonnes) produced at BMC over two years.*



The 2012 data was not available

The only available data on hairball was from the Francistown plant, producing 0.126 tons of hairball in 2014. It was noted that none is exported outside the country.

3.1.8 Horns.

A total amount of 0.69 tonnes of horns had accumulated at the BMC Lobatse office over the years. The BMC had been struggling to find a market for these horns even though visual artists use them extensively in their art works. BMC has not been able to find a market for its horns in the international market. During the time of the study however, one local individual bought all the BMC horns. According to the BMC, the output of horns from their slaughter figures are also low because of good animal husbandry practices among cattle farmers which includes widespread dehorning. Dehorning significantly decreases the risk of injury to farm workers and other cattle. They also indicated that dehorned cattle are far easier to handle and transport, and command higher prices at BMC than cattle with horns.

3.2 *Current uses of by-products locally*

3.2.1 Visual Arts

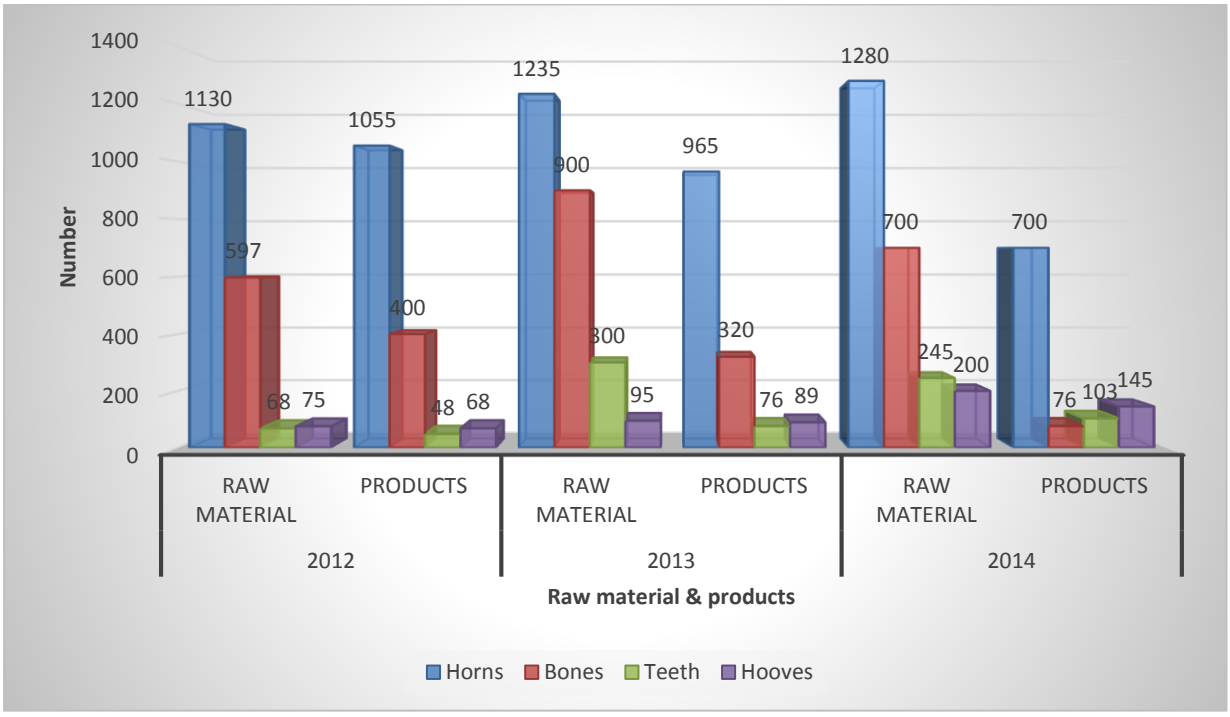
Among the potential uses of beef by-products, visual arts was found to be one area that have shown a good path through which beef by-products can be converted into business opportunities. The main beef by-products used by Visual artists were found to be horns, bones, teeth and hooves. This study followed four visual artists in the country who have found a niche market for products produced from beef by-products. Among these four artists, three of them were self-funded while one was funded by the Ministry of youth, sports and culture (MYSC) under the Youth Development Fund programme (YDF). The artists are mostly youth and employed from one to six employees including themselves.

3.2.2 Production

Among the products that artists have produced from beef by-products, include electric study lamps, paraffin study lamps, earrings, necklaces, smoking pipes, Pen and pencil holders, fish carvings, scorpion carvings, salt and pepper shakers, taxidermy products. Most of the by-products used are from cattle with very few components of goats and sheep being minor decorators of cattle products. Entrepreneurs were found to be very innovative and creative in the type of products they designed and produced. Such include a very huge iconic scorpion that was produced by one youth artist and bought by the Ministry of Sports, Youth and Culture (MYSC). It was produced from cattle horns and hooves.

According to Figure 14, respondents used more horns from various sources to produce various products including paraffin study lamps, electric study lamps and other decorative products. This was followed by bones, which also have various uses including earrings, pen and pencil holders. The use of cattle teeth and hooves was not so significant among the respondents.

Figure 14. *Quantities of raw material used and resultant products*



3.2.3 Source of Raw Material

During the period between 2012 and 2014 artists sourced their raw materials from municipal abattoirs, Street vendors who sell boiled fresh bones as relish, local meat processors and butcheries, traditional ceremonies and cattle posts. None of the four artists sourced raw materials from BMC. Though it was desirable to obtain figures of how much these sources have supplied in the past three years, it was not possible to obtain such as respondents did not keep records of their quantities of raw material. All the respondents expressed their satisfaction with their suppliers of raw material except one who could not get adequate supply of horns. This respondent sourced most of his raw materials from traditional ceremonies.

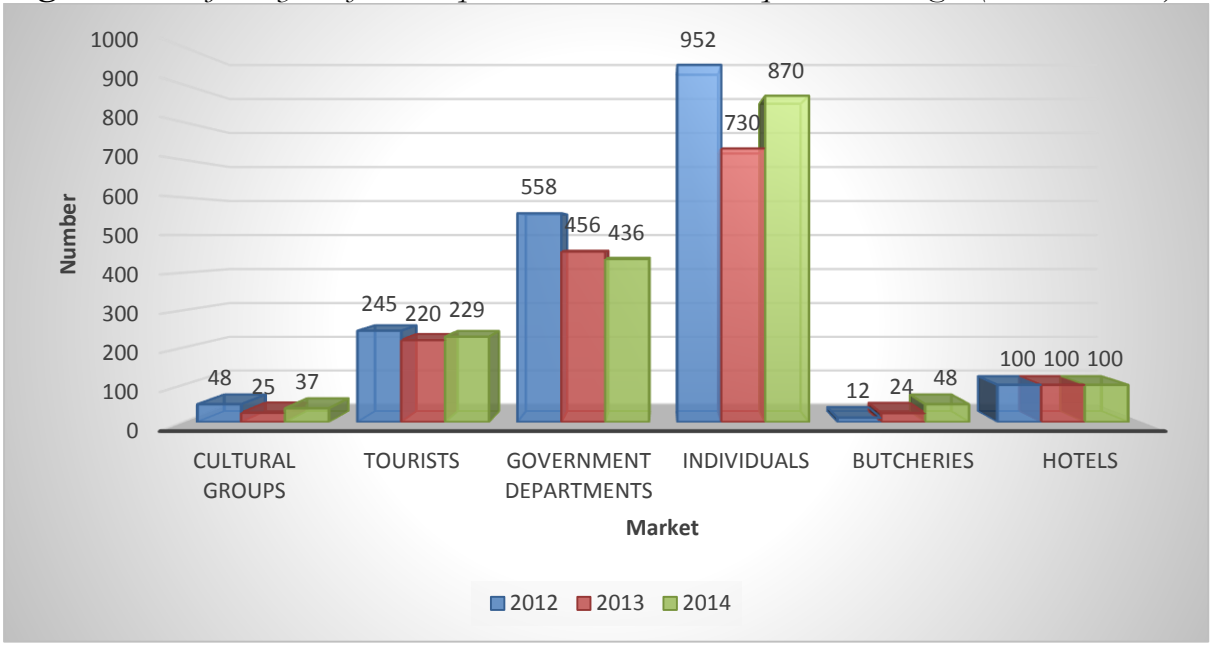
Three respondents were not aware of the potential to source their supply from the BMC plants. The one who was aware could not afford transport costs to obtain raw material from the Lobatse BMC plant. It should also be noted that bones and teeth at the BMC are crushed and mixed with other inedible meats and fats to form carcass meal. One of the respondents was of the view that although he could be supplied by BMC, he found BMC to be expensive compared to his usual suppliers (municipal abattoirs and vendors) of horns, who gave him the material at no or minimal cost.

3.2.3 Market

According to Figure 15, the major buyers of artistic work have been individuals, government departments and tourists respectively. This trend was consistent over the past three years (2012-2014) with hotels trailing behind the first three. Other buyers who include amongst others museums and cultural groups bought less than one hundred items from the artists. The artists also sourced some raw materials such as bones, hones and hooves from the butcheries hence the butcheries supported them by buying some of the artistic work. Prices of these products were from as little as twenty pula to as high as twelve thousand pula depending on the product, size, and purpose. On the contrary, the respondents could not give annual sales of

products they sold during the reporting period because they did not keep financial records nor did they have them. Again, the respondents did not have clear records of the exact products they have sold to various buyers but could only give information as to the number of items they sold during 2012 to 2014 period. Therefore, record keeping proved to be a serious shortfall that needs training among the respondents.

Figure 15. *Major buyers of artistic products and associated quantities bought (2012 – 2013)*



3.2.4 Institutional support

One respondent indicated that the Ministry of Youth Sport and Culture supports them through market days, which gives them an opportunity to advertise and sell their products. The same ministry also give training, market and funding to these artists. The Social and Community Development (S&CD) unit in local councils also reported to be assisting with mini shows and training. Additional support come from individuals who share ideas with artists on how they can best develop their products. The above was reported by one respondent while the other three did not receive any

institutional support from any organization. Some local business people have also pledged their support by giving money to individual artists to further develop their products. One respondent indicated that accessing funding from the YDF programme was difficult because he could not develop business plan on his own.

3.2.5 Business challenges

3.2.5.1 Production challenges

- Lack of transport to aid operations.
- Lack of machinery that can melt horns to produce buttons.
- Lack of buffing tools that allow smoothening of products.
- Unavailability of land to set up a production plant.
- Mentoring and coaching were also cited as pertinent factors that hamper development of entrepreneurs.

3.2.5.2 Marketing challenges

- Lack of transport to take goods to tourist rich areas such as Maun and Kasane.
- Very short market days that do not allow enough advertising of products.
- Absence of a body that protects artists on pricing.

3.2.5.3 Challenges on raw material acquisition

- At times raw material is not available when it is needed most.

3.2.5.4 Financial challenges

- Lack of finance to purchase machinery.
- Low working capital.

3.3 *Manufacturing*

The following BMC by-product is used in the local manufacturing industry to produce goods for the local and export market.

3.3.1 Tallow for the soap Manufacturing Industries

Tallow has been mainly procured by the soap manufacturing industries locally. The Soap manufacturing industries procured tallow from the BMC in the following quantities; 1484 tonnes in 2012, 2037 tonnes in 2013 and 2590 tonnes in 2014. The prices of buying tallow from BMC have ranged from BWP4.33/kg in 2012 to BWP4.27/kg in 2013 and finally BWP4.20/kg in 2014.

3.3.2 Market

The main market for the soap industries is all major supermarket chains in Botswana. The chain stores were supplied 869.2 tons of soap in 2012, 1 069.3 tons in 2013 with a reduction to 460.1 tons in 2014.

3.3.3 Institutional Support

The soap industry receives general business support by the Botswana Investment Trade Center (BITC), which assists acquiring of export permits.

3.3.4 Challenges

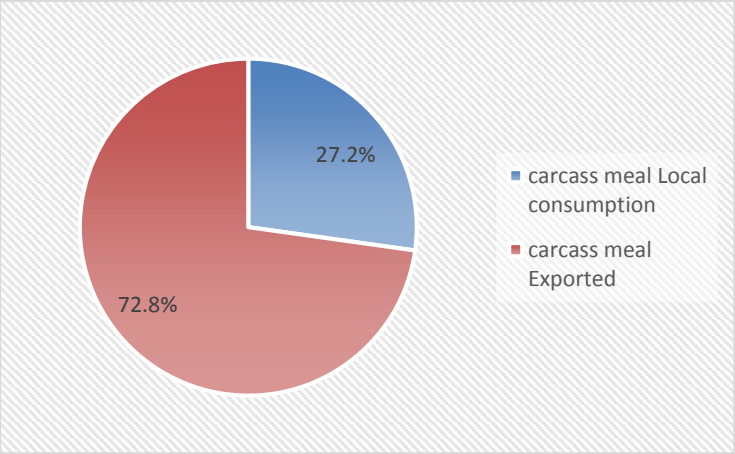
The main production challenge faced by the soap manufacturing industry is lack of skilled manpower for efficient production. They also face market challenges in that Botswana has a small population of about 2 million people and hence very small market.

3.4 Business Opportunities identified

3.4.1 Carcass meal for the manufacturing of animal feeds

The quantities of carcass meal exported by BMC to the SADC region are far higher than those that are sold to local companies. For the period under review, 72.8% of carcass meal exported as compared to 27.2% sold to locally, Figure 16 refers. There is only one local company that buys BMC carcass meal, while other feeds manufacturing companies use different ingredients for feeds formulation. The use of carcass meal for the manufacturing of feeds permitted in the country but the sale of animal manufactured feeds made from carcass meal is prohibited because of the potential to transmit diseases to live animals. However, entrepreneurs can still BMC carcass meal for the manufacturing of animal feeds for the export market. During 2014, the country only exported animal feeds to the tune of P2 320 while at the same time importing quantities of animal feeds equivalent to P1.3 million.

Figure 16. *BMC carcass meal showing local consumption versus exports for the three years.*

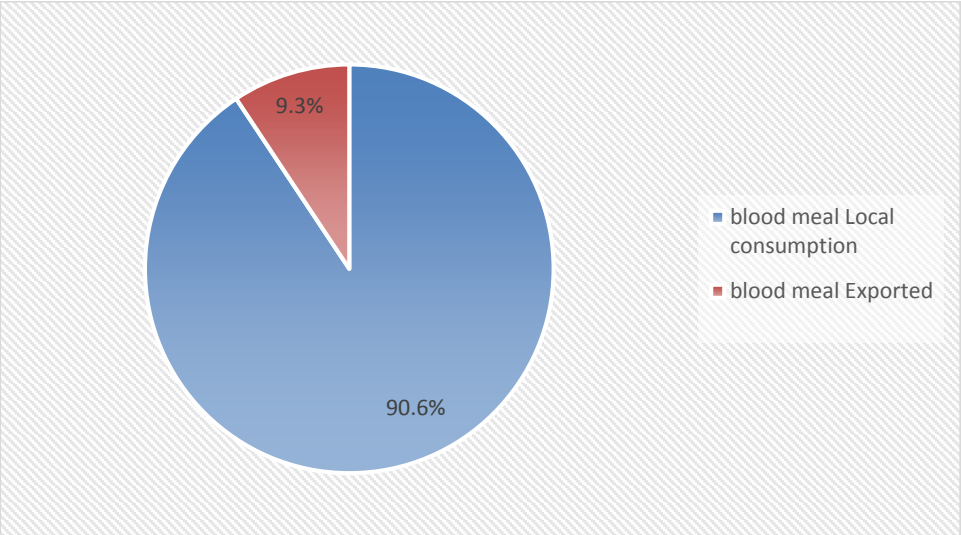


3.4.2 Blood meal for the manufacturing of animal feeds

In the local market, blood meal is used in combination with other ingredients for the manufacturing of animal feeds. For the period under review, local consumption of blood meal from BMC exceeded exports. Figure 17 shows that 90.6% of blood

meal was sold by BMC to locally as compared to 9.4% that was exported. It is also worth noting that method of collecting blood during slaughter at BMC is not efficient hence, blood from Maun office was accounted for during the period under review. The quantities of blood meal exported to SADC countries can be used by local entrepreneurs for the production of feeds for the export market.

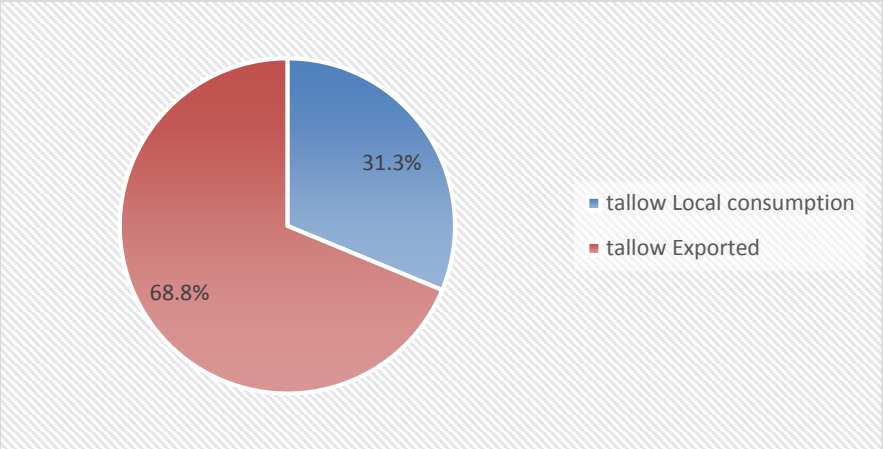
Figure 17. *BMC blood meal showing local consumption versus exports for the three years.*



3.4.3 Tallow for the manufacturing of soap and related products.

Tallow in the local market is mainly used for the manufacturing of soap. The soap manufacturing industry in the country is still at an infant stage, and as such, dose not satisfy the local market as evidenced by high import values of P522 million in 2014 for soap and related products. For the period under review, 18% of BMC tallow was exported to SADC countries as compared to 82%, which was sold locally. These quantities of exported tallow signal business opportunities that can be up taken by local companies for the production of soap and related products. Tallow can also be used for the production of other products such as candles creams and lotions.

Figure 18. *BMC tallow showing local consumption versus exports for the three years.*



3.4.4 Bile for pharmaceutical use

All bile produced at BMC is exported to RSA. This beef by-product can be used in the pharmaceutical industry for the production of powder, pills or capsules for the treatment of liver diseases.

Table 5. *Uses of beef by-products and proportions of local and export market for BMC over the three years.*

By-product	Local consumption	Exported	Uses
Carcass meal	27.2%	72.8%	Animal feed (feeds for cattle, pigs, poultry, pet food)
Blood meal	90.6%	9.4%	Animal feed (blood meal), Fertilisers, Edible sausages, Dyes and Inks, Pharmaceuticals
Tallow	82%	18%	Soap making, Candle making, Leather Conditioner, biodegradable motor oil, biodiesel, Paint, Rubber, Medicines, creams and lotions
Bile	0	100%	Pharmaceutical industry use as treatment of liver diseases
Gallstones*	-	-	Medicines
Calf serum*	-	-	Pharmaceuticals, cell- culture
Hairball*	-	-	Brushes, Textiles, air filters
Horns*	-	-	Plastics, Pet food, Plant food, Photo film, shampoo and conditioner, laminating paper, wallpaper, buttons, glue.

**Recovery of these by products could not established.*

Other products such as gallstones, calf serum, hairball and horns recovery could not be established an indication that they are either going to waste or are not efficiently collected.

4 Discussion

BMC remains the main market for both commercial and communal cattle farmers in the country. The Botswana beef is one of the few locally produced export-oriented products that has been able to penetrate the international markets including the lucrative European Union market. Beef by-products play an important role in the

production of variety products. In today's modern world, beef by-products have found economic usage in the industrial, pharmaceutical, food manufacturing, leather and animal feed applications.

Local feed manufacturing companies purchase carcass meal and blood meal from BMC in large quantities but still, local consumption is far below exports. The LEA Agriculture Value Chain Studies conducted between 2010 and 2013 pointed out the insufficient and high costs of imported animal feeds in the country. Carcass meal and blood meal in the local market are used for the production of poultry, pig and pet foods. By utilizing the exported quantities of carcass meal and blood meal from the BMC for the manufacture of animal feeds, the country will eventually decrease its reliance on imported feeds. Figures from Statistics Botswana indicate that Botswana imports large quantities of animal feeds from the neighbouring South Africa. The country however, exports some animal feeds albeit in very small quantities.

Tallow from the BMC is utilized in Botswana in large quantities by local manufacturers mainly for the production of soap, but significant amounts of tallow are still being exported to RSA. Tallow is mainly used for soap making but can be also used for candle making, biodiesel and medicines. The locally manufactured soap is mainly consumed by local supermarkets and retailers and it is not enough to satisfy the market. This is demonstrated by large quantities equivalent to P 547 million and P 521 million of soap and associated products imported into the country in 2013 and 2014 respectively. The country also rely on imports for candles and related products as shown by import bills of P29 million and P24 million respectively for 2013 and 2014.

Beef by-products can be used by visual artists to develop various products some of which are used for domestic, decorative, beauty and ornamental purposes. These by-

products include bones, horns, teeth and hooves. These products have found markets in individual buyers, government, tourists, museums, cultural groups and private business entities. Support to further develop visual artists who use beef by-products together with their products has been obtained mostly from government, government business partners and some few elements from the private sector. As far as artists are concerned, the market for their products is available while their capacity to serve it is minimal due to lack of mentorship, funding and coaching from professionals. The beef by-products visual arts sector have shown that it has the potential to grow judging by the market it serves and the availability and low costs of raw material used. Facilitating access to funding to procure the right machinery and equipment would promptly enhance the growth of the sector.

4.1 Conclusions

The study has shown, through high import bills of tallow & animal fats, animal feeds, soaps & related products and candles & related products that the country is highly dependent on products made from beef by-products even though high quantities of raw materials from the BMC are being exported to neighbouring countries. The main products that are exported in large quantities are carcass meal, tallow, blood meal and bile. The latter has not found use in the local market as all quantities of bile produced at BMC are exported to South Africa. Apart from utilizing tallow in the soap manufacturing industry, and carcass meal and blood meal in the manufacturing of chicken feeds, the local utilization of all other by-products from BMC is at a minimal. The fact that the above-mentioned by-products are not wholly utilized in the country is a clear sign that the country's manufacturing sector is still below par.

Beef by-products are used by visual artists to develop various products some of which are used for domestic, decorative, beauty and ornamental purposes. The artists were found to be very innovative and creative in the type of products they

designed and produced. They have a great potential to grow if they can be afforded the necessary mentoring and financial support.

4.2 Recommendations

1. LEA should promote animal feed manufacturing for uptake by local entrepreneurs, to utilize the large quantities of carcass meal and blood meal currently exported, for the support of the chicken, pig and pet feed industries.

2. LEA should promote the manufacturing of soap and other potential tallow related products by local entrepreneurs to utilize the large quantities of tallow exported from BMC.
3. LEA should lobby the Ministry of Health for the promotion of drug manufactured products made from bile. This will open up opportunities that can be up taken by SMMEs for the utilization of bile which is currently being exported.

4. LEA should lobby the BMC to contract process suet into tallow from the council abattoirs and other private slaughter facilities for the benefit of the local tallow beneficiation outside the BMC.

5. LEA should lobby the BMC to efficiently recover all by-products of economic value from their abattoirs to stimulate and support local manufacturing industries dependent on the cattle by products

5 REFERENCES

1. Grummer, R.R. (1992). *Inedible fats and greases.*
2. Ockerman, H.W. 1980. *Animal By-Product Processing*
3. International Serum Industry Association (2011). *A report in the website* *www.serumindustry.org*
4. South African International Business Linkages Programme (SAIBL). (2007). *Market research and business opportunities study in Botswana.*
5. ABEL PROJECTS. (2006). *Feasibility study for the manufacturing of beef products and beef by-products in Botswana.*
6. United Nations Industrial Development Organization (2010). *Future trends in the world leather and leather products industry and trade,* Vienna.
7. Statistics Botswana (2013). *Annual Agriculture Survey Report.* Gaborone
8. Botswana Meat Commission (1999). *Botswana Meat Commission Annual Report.* Gaborone
9. Botswana Meat Commission (2003). *Botswana Meat Commission Annual Report.* Gaborone