

Final Status Report



Agro-Processing Competitiveness Fund (APCF)

Report :	Final close-out report
Report Date :	30 June 2016
Project Driver :	Blue Karoo Trust (BKT)
Initiative :	Camdeboo Satellite Aquaculture Project (CSAP)
Proposed Research Topic :	Post-harvest value addition for catfish (<i>clarias gariepinus</i>) <i>Focus</i> : development of the 15% waste into a marketable by-product.
Implementation Period :	June 2014 – June 2016
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A. INTRODUCTION

Background information :

The Camdeboo Satellite Aquaculture Project (CSAP) initiative has been developed under the guidance of the Blue Karoo Trust (BKT) which aims to establish a preserved freshwater fish industry (initially in the Eastern Cape, and later to be duplicated throughout South Africa - SA) using a farming method called aquaculture – ie. “the rearing of aquatic organisms in captivity, and implies interventions in the growth of the organism and ownership of the organism being cultivated.”

The overall concept centres on the establishment of aquaculture clusters which comprise a central support farm and a network / cluster of approximately 60 farming systems. Each aquaculture cluster is designed to produce 1 320 tons of fish per month, providing direct permanent, full-time employment to 958 people, primarily rural women, as well as 2 112 indirect & 1 169 induced jobs, and feeding 1,4 million people. The aquaculture clusters benefit through economies of scale as a result of their collaboration as well as from the support, training, mentorship, and access to markets provided by the central structure. The freshwater fish produced by the aquaculture clusters will be processed, packaged and sold locally at an affordable price to bulk markets including caterers and public sector kitchens. The intention initially is not to compete with established brands in formal markets but rather to provide a sustainable and cost-effective bulk source of protein and essential micronutrients directly to kitchens.

Over the past 10 years, the model has been refined, processed freshwater fish products developed, secondary by-products identified and developed, independent market acceptance surveys conducted, and a business plan compiled, indicating huge potential for the successful farming, processing and marketing of preserved freshwater catfish as an alternative to ocean harvested fish. Parallel to this, a structured training programme, which was compiled based on the needs identified during the socio-economic analysis conducted, has been successfully piloted, resulting in empowered and self-reliant individuals who have the competence and confidence to gain employment and serve as responsible role models within their families and communities.

The recently commenced commercial phase includes the establishment of the first commercial scale central support farm, inclusive of the first 15 community-operated aquaculture production systems, a commercial scale hatchery, training facilities and a fish processing facility with one production line operating at full capacity.

In terms of the specific project (part of the CSAP initiative) which has been supported by the IDC APCF :

The BKT processing facility has been designed to accept and process catfish, and will focus on manufacturing catering size, bulk products as a primary product for human consumption. The initial primary product range will consist exclusively of chunks / pieces of fish in brine or tomato sauce, sterilised and packaged in 2 kg retort pouches, thus offering a sterile, shelf-stable (18-24 months) fish product, as source of protein and essential micronutrients, at an affordable cost. The first order for primary product has been secured for 10 tons of fish per month over 12 months.

Heads, tails and viscera (offal or waste) will account for 15 - 25% (depending on whether the collar bone may be included in the primary product) of the raw material processed in the factory. The heads in particular still contain a very large amount of edible meat. A range of secondary products were thus identified as a potential income source.

The financial support provided by the IDC APCF has been specifically utilised to explore and develop these secondary product options with the aim of securing a market for these by-products.



B. TIMELINE

ACTIVITY #	TASK	TIMELINE (2014 - 2016)				
		Preparation	2014	2015	Jan – May 2016	June – July 2016
	Preparation	Report				
1	Proximal analysis of raw by-product material	# 1				
2	Analysis of by-product options					
3	Liaison with relevant authorities in terms of their requirements					
4	Contracting of service providers :					
4a	☐ OABS - Financial & market analysis					
4b	☐ Melnychuk R&D - Product development					
	Project Meeting # 1 : Confirm tasks & timeline		Report			
5	Development of 5 potential by-products		# 2			
6	Nutritional value analysis of the 5 potential by-products					
7	Project Meeting # 2 : Prepare for liaison with potential markets		Report # 3			
7a	☐ Project overview					
7b	☐ Products developed (why & how)					
7c	☐ Market Demand (quantity and price of indiv products)					
7d	☐ Provisional pricing of individual products (excl equipment)					
	Project Meeting # 3 : Potential Customer # 1 - MONTEGO		Report			
8	Outcome of meeting with potential customer :		# 4			
8a	☐ Product selection (based on visual, nutri, finance, market DD)					
8b	☐ Suggested survey method & instrument					
9	Product refinement inclusive of :					
9a	• Product adjustments / improvements (if deemed necessary)					
9b	• Manufacture of required samples					
9c	• Submit samples for full nutritional value analysis					
10	Conduct palatability trials / market demand assessment					
11	Financial analysis					
12	Secure Off-take Agreements					
	Project Meeting # 4 : Potential Customer # 2				Report	
13	Outcome of meeting with potential customer :				# 5	
13a	☐ Product selection (based on visual, nutri, finance, market DD)					
13b	☐ Suggested survey method & instrument					
14	Product refinement inclusive of :					
14a	• Product adjustments / improvements (if deemed necessary)					
14b	• Manufacture of required samples					
14c	• Submit samples for full nutritional value analysis					
15	Conduct palatability trials / market demand assessment					
16	Financial analysis					
17	Secure Off-take Agreements					
	Project Meeting # 5 : Final Report					
18	Payment will be made for :					
	Financial analysis					
	Secure Off-take Agreements					



C. ACTIVITY REPORT

1. PROXIMAL ANALYSIS OF RAW WASTE BY-PRODUCT

The raw waste was tested by Swift Silliker (which is a SANAS accredited testing laboratory). These results differ very slightly from the results included in the original funding application. The reason for this slight variation is believed to be a change in the fish food manufacturer since moving all the fish to the new commercial farming site.

These results formed the basis for the by-product recipe development in order to be in line with the standard nutritional value of similar products which are already in the market.

Table 1 : *Proximal analysis of raw waste*

ANALYTICAL RESULTS			
Tests	Analysis Date:	Results [±uncertainty]	
✓ Moisture METHOD: SWM.CHEM.010	11-12/12/2013	63.19 [±0.70]	
✓ Ash METHOD: SWM.CHEM.026	19-20/12/2013	12.53 [±0.63]	
✓ Total Fat METHOD: SWM.CHEM.025	18-19/12/2013	4.16 [±0.25]	
✓ Nitrogen METHOD: SWM.CHEM.004	11/12/2013	2.55	
✓ Protein By Dumas (N x 6.25) METHOD: SWM.CHEM.004	11/12/2013	15.95 [±0.80]	
→ *Calcium	12/12/2013	4570 [±366.0]	
✓ Carbohydrate by Difference Calculation: SWP.CHEM.030 (Fiber not subtracted)	23/12/2013	4.17	

2. ANALYSIS OF BY-PRODUCT OPTIONS

Various by-product options were then explored, and a decision was made to commence with the following items :

- FISH MEAL
- PET FOOD :
 - Pouched cat food (85g)
 - Pouched dog food (85g)
- TREATS :
 - Dog treats - polony type sausage
 - Cat treats – dry fish shapes

3. LIAISON WITH THE RELEVANT AUTHORITIES IN TERMS OF REQUIREMENTS

Mr Mike Melnychuk of Melnychuk R & D spent a considerable amount of time liaising with both the Pet Food Association of South Africa and Mr Carlos Neves, who is the nutritionist for Montego Pet Nutrition. Advice received in terms of the following guided the development of the abovementioned products :

- Types of products that would be of interest
- Nutritional value requirements
- Recommended ingredients
- Popular / fast moving flavours

4. CONTRACTING OF SERVICE PROVIDERS

A service level agreement was then compiled between BKT and the following service providers in order to implement the project supported by the IDC APCF :


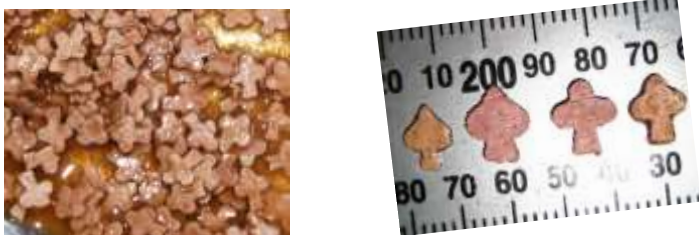



- Melnychuk R & D in terms of Product Development
- OABS in terms of Financial viability analysis and Market liaison



5. DEVELOPMENT OF 5 POTENTIAL BY-PRODUCT OPTIONS

The following by-product variations were developed and presented to Potential Customer # 1 (ie. Montego Pet Nutrition) for feedback in terms of which 5 products to proceed with.

Table 2 : *By-product variations presented to Montego Pet Nutrition*

Product	Photographs showing variations developed for each product
PRODUCT # 1 Fish meal	
PRODUCT # 2 Pouched dog food (85g unit) <ul style="list-style-type: none"> Bone-like shapes in a sauce 	
PRODUCT # 3 Pouched cat food (85g unit) <ul style="list-style-type: none"> Fish-like shapes Bolognese Pellets - all in a sauce 	
PRODUCT # 4 Dog treats <ul style="list-style-type: none"> Shelf-stable polony (various size units) Dried treats – flat / round sticks & cubes 	
PRODUCT # 5 Cat treats of varying thickness and shapes	



6. NUTRITIONAL VALUE ANALYSIS OF THE 5 POTENTIAL BY-PRODUCTS

Samples of all of the above by-products were submitted to an accredited laboratory for nutritional value testing. The following tables include the results of the laboratory testing. These results were then compared with the raw material as well as similar products which are currently on the market so that we were able to evaluate as to whether our product could be acceptable to the market from a nutritional value (NV) point of view. A conclusion, in terms of the acceptability / suitability of each product, has been summarised at the bottom of each table.

Table 3 : Proximal analysis of fish meal

FISH MEAL		Raw Product	Our sample	Market sample
Moisture	g/100g	63.19	9.5	3
Ash	g/100g	12.53	29.3	15
Fat	g/100g	4.16	16.6	8
Nitrogen	g/100g	2.55	6.15	
Protein	%	15.95	38.41	65
Calcium	mg/100g	4570		
Carbohydrates	%	4.17	6.2	
Conclusion : When compared with the fish meal market sample (wild harvested fish) which is currently used as a feed ingredient by Montego Pet Nutrition, it can be seen that the protein content of the fish meal manufactured from catfish is much lower as only "waste" is used, and not whole broken fish as well. While Montego are able to source the higher protein content fish meal, they would thus not be interested in purchasing the catfish fish meal. We will thus not proceed with further fish meal development under the IDC APCF. Although not viable at this stage, it can be concluded that fish meal can be manufactured from the catfish waste and is a product option should the wild fish stocks continue to decline.				

Table 4 : Proximal analysis of pouched dog food

POUCH (DOG)		Raw Product	Our sample	Market sample
Moisture	g/100g	63.19	80.2	82
Ash	g/100g	12.53	5.8	3.5
Fat	g/100g	4.16	3.3	4
Nitrogen	g/100g	2.55	1.3	
Protein	%	15.95	7.8	7
Calcium	mg/100g	4570	1650	
Carbohydrates	%	4.17	0.1	
Conclusion : The nutritional value analysis for the pouched dog food shows that the catfish product is very much in line with the market sample (Pedigree), with the only exception being the ash content. Further analysis of this ash content may be required when samples are submitted under activity 9c, and as well as consultation with the Montego Pet Nutrition nutritionist in terms of whether the slightly higher ash content is actually problematic. This is definitely a product option to be further developed.				



Table 5 : Proximal analysis of pouched cat food

POUCH (CAT)		Raw Product	Our sample		Market sample
			pieces	boll.	
Moisture	g/100g	63.19	80.2	75.5	82
Ash	g/100g	12.53	5.8	6.7	2.5
Fat	g/100g	4.16	3.3	3.4	5
Nitrogen	g/100g	2.55	1.3	1.3	
Protein	%	15.95	7.8	8.1	7
Calcium	mg/100g	4570	1650	1680	
Carbohydrates	%	4.17	0.1	1.1	
Conclusion : Once again, although our sample is comparable with the market sample (Whiskers), the only component which is out of range is the ash. This is more than likely due to the high content of bone in the head material of catfish. Further analysis of this ash content may be required when samples are submitted under activity 9c, as well as consultation with the Montego Pet Nutrition nutritionist in terms of whether the slightly higher ash content is actually problematic. This is definitely a product option to be further developed.					

Table 6 : Proximal analysis of dog treats

TREAT (DOG)		Raw Product	Polony		Dry Treat	
			Our sample	Market sample	Our sample	Market Sample
Moisture	g/100g	63.19	64.7		13.2	21.5
Ash	g/100g	12.53	8.7		28.90	7.0
Fat	g/100g	4.16	5.5	8	12.7	5.5
Nitrogen	g/100g	2.55	1.9		4.84	
Protein	%	15.95	11.6	10	30.23	25.8
Calcium	mg/100g	4570	2460			
Fibre						4.0
Carbohydrates	%	4.17	4.5		15.00	
Conclusion : Two completely different dog treat options have been explored : polony and a dry treat. Limited information was available for the polony market sample as this product is not currently manufactured or sold in South Africa, and information thus needed to be obtained from the internet. Nutritional analysis does show that the protein and fat levels are within an acceptable range. Colourants and flavourants are now to be added and an attempt made to obtain shelf-stable casing so that the polony need not be refrigerated. In terms of the dried treats, market samples appear to contain a large amount of carbohydrates (we would estimate about 35% - although carbohydrate levels are not included on the label) whilst our product is almost pure catfish and thus only has a 15% carbohydrate count. We believe that our sample is suitable for the market. Both of the above treat options are worth exploring further. In addition, the polony option would also be suitable for cats.						



Table 7 : Proximal analysis of cat treats

TREAT (CAT)		Raw Product	Our sample		Market sample
			thin	thick	
Moisture	g/100g	10.2	10.2	13.4	12
Ash	g/100g	30.8	30.8	29.5	
Fat	g/100g	14.9	14.9	14.6	17
Nitrogen	g/100g	5.6	5.6	5.73	
Protein	%	34.8	34.8	35.82	30
Calcium	mg/100g		9440		
Carbohydrates	%	1.2	1.2	6.7	
<p>Conclusion :</p> <p>As can be seen from the pictures included above, various thicknesses and shapes have been explored for the cat treats which were manufactured, and the nutritional information shows that this is very much in line with other cat treats available in the market, which are in fact scarce and difficult to find.</p> <p>Although this is an attractive product a decision has been made to focus mainly on dog treats at this stage as the market is much larger and our potential customer # 1 (Montego Pet Nutrition) have expressed much more interest in the dog treats. This is however a product which could potentially be explored again once the business is established.</p>					

7. PREPARE FOR LIAISON WITH POTENTIAL MARKETS

The objective of Activity 7 was to ensure that we have all the information necessary before engaging with potential customers so that these customers are able to give us constructive and informed feedback. The information gathered and refined is included in the points below :

7a. Project overview

Climate change, over-fishing and pollution are rapidly depleting fish stocks worldwide. To protect water resources and ensure sustainable fishing production, quotas and restrictions on ocean fishing have been implemented, further decreasing the availability of valued fish species to the commercial market and increasing consumer prices for fish products. Simultaneously, world demand for fish is increasing in both developed and developing countries due to population growth and the realization that white meat, specifically fish, is a healthy source of protein and essential micronutrients.

The Blue Karoo Trust (BKT) aims to establish a preserved freshwater fish industry in the Camdeboo, a remote rural area of the Eastern Cape, to address fish supply shortfalls whilst simultaneously creating sustainable employment opportunities for rural women and promoting pro-poor economic growth and social equity. Once perfected and successfully implemented in the Camdeboo, the initiative will be replicated in other rural and remote areas of the country creating enormous social and economic benefits for thousands of South Africa's rural poor and a source of affordable protein and nutrients for millions of people and animals.

The initiative has developed a minced fish *primary product* which will be packaged in labelled 2kg retort pouches which have a shelf life that is comparable to other canned fish products. The primary target market is bulk markets including caterers and public sector kitchens (prisons, hospitals, schools, etc.). The intention is not to compete with established brands in formal markets but rather to provide a sustainable and cost-effective bulk source of protein and essential micronutrients directly to kitchens. This product has been quality approved by the National Regulator for Compulsory Specifications (NRCS).







With the primary product now in place, focus has shifted to the development of a *by-product* as 15 - 25% of the fish cannot be utilised in the primary product, and is thus referred to as 'waste'. Nutritional value analysis revealed that this 'waste' is in fact comparable to the main product, although it probably could not be utilised for human consumption due to small (0,1mm) bone fragments which are present when the by-product is passed through a comitrol.

The overall objective of this research is thus to identify the most profitable and sustainable by-product options, given the large volumes of fish which the initiative aims to produce, and then to secure off-take agreements for the product/s of choice.

7b. Products developed

Based on previous research and development activities (inclusive of product development and nutritional value assessment) the following products were then produced to present to the potential customers. Samples of these products were also opened during the IDC presentation.

Table 8 : *Products produced to present to potential customers (inclusive of refinement of those from Activity 5)*

#	Product	Animal	Packaging type	Packaging size	Flavour
1	Pouched food (fish shapes) 	Cat	Pouch	85g	Pink salmon
2	Pouched food (bone shapes) 	Dog	Pouch	250g	Hearty beef stew
3	Pouched food (chicken drumstick shapes) 	Dog	Pouch	250g	Roast chicken
4	Treat - shelf-stable Polony 	Cat / Dog	Plastic casing	100g	Ham / Original
5	Treat - dried salami type sausage 	Dog 	Sheep casing	50g	Beef (slight)



7c. Market demand

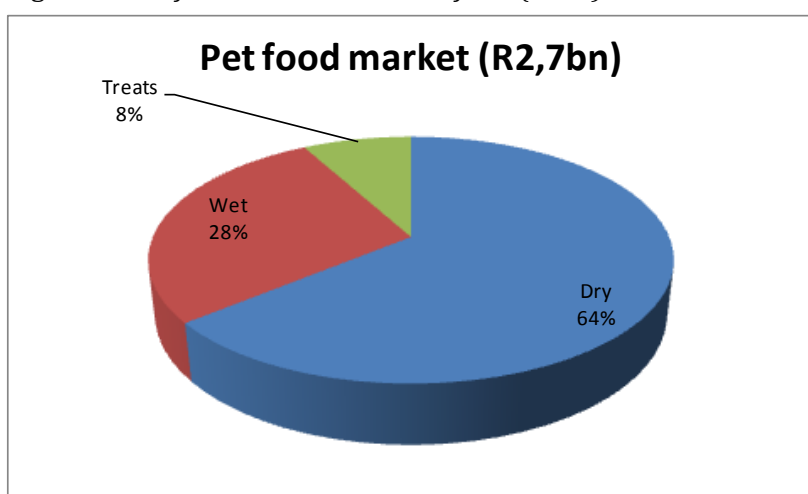
OABS conducted background research in terms of the market demand for both treats and pet food pouches. This background research gave us an indication of the size of the market, which was then compared against the production projections as the initiative ramps up in order to establish whether the manufactured product volumes may be of interest to the potential markets which we have identified.

Market Size

The total pet food sales in South Africa amount to approximately R2.7 billion per annum of which the dry pet food component constitutes 64%. Wet pet food amounts to 28% (R 756 million) of total sales and pet food treats 8% (R 211 million). The current annual growth rate of the market is 6.7%.

In terms of quantity, the market demand for pet food is estimated to be 18,900 tons per annum. If wet pet food is 28% of this, it will amount to approximately 5,292 tons. BKT projected production per aquaculture system could amount to 1% of this requirement, and commercial phase 1 could produce up to 19% of the wet pet food requirement assuming a straight conversion with raw product.

Figure 1 : *Pet food market in South Africa (2014)*



The annual market for pet treats is estimated at R211 million and growing by approximately 17% per annum. An estimated 125 tons of pet food treats are sold every month.

In terms of quantity, BKT projected production per aquaculture system could amount to 4%, and production from commercial phase 1 could amount to 65% of the treat market requirement assuming a straight conversion with raw product – which again varies from product to product, such as dried treats which actually reduce in weight due to water loss during processing.

Overall, the market for pet food (treats & pouches) in South Africa can be summarised as follows:

- Treats for cats & dogs has become a life-style purchase item
- The growing middle class contributes to increases in sales
- Niche opportunities exist for new manufacturers
- The six major retailers in SA which serve as outlets are :
 - Shoprite/Checkers
 - Pick & Pay
 - SPAR
 - Walmart/Massmart
 - Fruit & Veg City
 - Woolworths
- The mass market retailers for pet foods are dominated by :
 - Shoprite/Checkers
 - Pick & Pay
 - SPAR



Market Pricing

The table below shows the market survey results focussing specifically on *dog food pouches and treats*. Market selling prices vary between R29/kg and R58/kg with a median price of R 46.33/kg. Dog treats selling prices varies between R40/kg and R250/kg and even up to R850/kg.

Table 9 : Market pricing for DOG food pouches & treats

Dog pouches		Avg selling	Avg selling	Avg selling
Brand	(G)rams	R / unit	R / kg	bulk R/kg
Bobtail	85	2.86	33.61	29.40
Husky	85	4.09	48.12	
Avg	85	3.47	40.86	29.40
Bobtail	100	4.29	42.90	
Pedigree	100	5.32	53.23	58.33
Avg	100	4.81	48.07	58.33
Dogmor	150	4.99	33.27	
Woolworths brand	150	6.95	46.33	41.63
Posh Pets	150	7.95	53.00	48.25
Avg	150	6.63	44.20	44.94
Bobtail	250	12.99	51.96	
Avg	250	12.99	51.96	
Pedigree	300	14.49	48.30	
Avg	300	14.49	48.30	

Dog pouches		Dog treats
Lowest price/kg	29.40	R40 - R250/kg
Highest price/kg	58.33	
Highest price/kg (<= 150g)	53.23	
Median price/kg (<= 150g)	46.33	

R140/kg
Various products

The table below reflects the market survey results for *cat food pouches and treats*. Selling prices vary between R37/kg and R75/kg with a median price of R51/kg. Compared to dog treats, very few cat treat products are available on supermarket shelves. Selling price for cat treat products is approximately R100/kg.

Table 10 : Market pricing for CAT food pouches & treats

Cat pouches		Avg selling	Avg selling	Avg selling
Brand	(G)rams	R / unit	R / kg	bulk R/kg
Puddi Cat	85	3.45	40.59	
Kitekat	85	4.14	48.71	
Catmor	85	4.19	49.29	41.17
Nutri phase	85	4.49	52.82	
Whiskas	85	5.82	68.41	61.75
Friskies	85	5.84	68.71	62.41
Posh Pets	85	6.45	75.88	67.50
Avg		4.91	57.77	58.21
P&P	100	3.79	37.90	
Spar brand	100	3.99	39.90	
Petley's	100	4.39	43.90	
Woolworths brand	100	5.45	54.50	47.46
Bob Martin	100	5.86	58.57	41.66
Avg		4.70	46.95	44.56

Cat pouches

Lowest price/kg

37.90

Highest price/kg

75.88

Highest price/kg (<= 100g, excl bulk)

75.88

Median price/kg (<= 100g, excl bulk)

51.06

Cat treats

R100/kg

Few products



7d. Provisional pricing of individual products

The cost per unit calculations, and recipe formulations, to manufacture the proposed pouched and treat products were refined (per product) based on input from the potential customers during Activities 8 - 11.

However, prior to conducting these activities, we were able to do provisional costing, based on the available information. This provisional pricing provided us with a guide with which to approach potential customers in order to gauge whether the product pricing would be competitive. At this point in the project, it was decided that if the product pricing was way out of the current range it would either need to be sold as an exclusive product or excluded from future development activities.

The table below outlines the *provisional* BKT cost of production and proposed selling price (assuming that the 60% mark-up will be split between BKT, the customer and their sales point). In addition, it was assumed that BKT will sell the product on to a pet food company that will then distribute the product under their own brand name – eg. Montego Pet Nutrition.

Table 11 : Provisional pricing for manufactured products (pet food & treats)

** All prices are in South African Rand and exclude vat*

Item	Packaging size	BKT cost of production	Selling price assuming 60% mark up	Current market price AVERAGE	Current market price RANGE
Pouches - dog	1kg	31.76	50.82	46.33	R29 – R58
Pouches - cat	1kg	31.76	50.82	51.00	R37 – R 75
Treat – dry	1kg	60.00	96.00	145.00	R 40 - 250
Treat - polony	1kg	35.00	56.00	100.00	

8. OUTCOME OF MEETING WITH POTENTIAL CUSTOMER (MONTEGO)

8a. Product Selection

The primary objective when engaging with potential customer # 1 (Montego Pet Nutrition) at this point in the project plan was to obtain input with regards to the products which are of interest to them. A wide range of potential products, in 5 groupings, was presented, from which the table on page 14 provides a snapshot of the feedback / guidance received. In summary, from the initial 5 presented, 2 groups of products of interest were identified – these being sausages and pouches.

Group 1 (sausages) was then further divided into polony (moist) and salami (dry sausage) :

- The first samples of **polony** produced were very pale in colour, and it was thus decided to either make the sausage pink (similar to the polony which humans would buy) or a beefy brown colour – depending on which colourants were found to be most suitable. In addition, it was suggested that various flavours be experimented with, a range of which exist, depending on whether we are targeting dogs or cats. Montego expressed an interest in cat products, but said that dogs remain their primary target. In addition, the requirement for a shelf-stable casing seemed to be quite important as the shops from which Montego products are sold generally do not have additional refrigeration space available. At this stage, ColdPack is the only supplier of such packaging in South Africa, which is not ideal as their customer support in terms of developing the ideal packaging solution is limited. It was agreed that the packaging / casing would also need to be printable. A similar ‘hound log’ sample was found on the internet and Montego have since informed BKT that 80% of the New Zealand and Australia pet food market is these polony type products, which are sold as large units (1 – 2kg). The polony in these parts of the world is seen as a ‘complete meal’, but in the South African context it would be advisable to start out as a ‘complimentary meal’ which can be added to the standard dry pellets, or other food given to the dog, as this will be a relatively unknown product.

- At this initial meeting, Montego expressed a keen interest in this droe wors / **salami** type product, stating that it could be sold in various sizes – their initial preference being a 15cm stick that could either be individually wrapped or bulk packaged. Although it was agreed that a range of flavours should be tested, there was a tendency to lean towards beef as this product would definitely be formulated for dogs rather than cats, and resembles the beef droe wors available in the market for human consumption. The casing should also be natural hog or sheep casing, which is locally available, and a sample of a similar product was found at Woolworths, however the product was very light in weight due to the low meat content.

Group 2 (pouches) was then further divided into products best suited for dogs or cats. The pieces of meat in the first samples produced were quite ‘rubbery’ when compared with similar product on the market, which are soft and easily ‘mushed’. In addition, the sauce was very bland in colour and taste. However, this was merely a starting point, and given the potential size of this market when compared to that for treats, Montego were keen to pursue this option further.

- At this stage, it was believed that a 250g pouch, which could be sourced from Nampak, should be used for the **dog pouches**. There was much discussion around the shape, texture, colour, size and thickness of the ‘meat’ particles which were to be combined with sauce in the pouches - from this discussion, it was decided that the particle should be a light brown, beef colour, and that a beef flavour would be ideal, although something like roast chicken would also be popular. The bland catfish meat will take on any flavour, which makes this an ideal base product to work with. In addition, the thickness decided upon was 30mm, as opposed to the 18mm for cat particles, it was agreed that a bone shape would be desirable for dogs. There are no other shaped particles in pouches available on the market, which has the potential to make this a slightly more ‘upmarket’ product. Shape options provide a very exciting alternative that could even be tailor made for Christmas, Easter and other occasions. The human consumer buys with their eyes, to a large extent, and should thus find the shaped products appealing. All were in agreement that Pedigree is currently the top of the range in terms of pouched dog food. Subsequently, however, we have been advised that Pedigree will be switching to a 100% imported product which has a gel-like sauce. The Montego nutritionist’s comment was that this is a bad move on their part as the current product is fantastic, with the gravy being very popular. The exchange rate may also not move in their favour. The next best in line is Bobtail.
- The **pouched cat food** is generally sold in 85g or 100g pouches, with the top of the range being Whiskers. This product is far superior to others on the market, and we have thus used it as our guide throughout the product development period. The most popular flavours seem to be tuna, salmon or chicken. It was agreed that both the particles and the sauce needed to be more pink if a seafood flavour was used and a light brown if a chicken flavour is used. As pouches could be sourced from Nampak, the microbiology and shelf life studies could be conducted by them.

8b. Suggested survey method and instrument

The BKT team went into this meeting proposing a full **consumer survey** (ie. a placement of all 5 products was suggested for a total sample of 100 pet owners, whereby the five products were to be tested by each respondent through administration to their cat/s and/or dog/s). It was envisaged that products would be placed for testing within the pet households in a predetermined but randomized order (i.e. each pet will be assigned a specified order of tasting the individual products). It was also suggested that the product be tested in two different geographical areas (i.e. Cape Town and Johannesburg) and that the product may be tested amongst different population groups, according to the market expectations of the prospective client.

However, Montego rejected this idea and informed BKT that they would only consider products which had undergone **palatability testing** at the Animal Unit in Pretoria in order to confirm market acceptance in a more scientific manner.



Palatability refers to the ability of a product to be consumed rapidly and heartily by the dog or the cat, and determines the level of spontaneous consumption by the animal.

- Step 1 is 'perceived palatability' which is subjectively appreciated by observing the animal's behaviour when faced with a single pet food option.
- 'Real palatability', which is the second test, is measured by comparing the animal's response to 2 different pet food products.

All steps in the manufacturing process may have positive or negative consequences on the palatability, such as :




- choice of the ingredients
- quality controls
- method of cooking
- size, shape, and density of the product
- aromas, including the presentation (powder form, liquid form...)
- quality of the packaging... etc

In order to conduct the palatability trial, at least 6 dogs / cats are used in groups of the same size, to take into account differences of consumption, due the breed size. Beagles are generally used at the Pretoria Animal Unit. The test is generally done over 3 days, depending on the type of test. Animals have free access to the product/s for only 20 minutes. By weighing refusals, one can calculate the respective consumption of each product. The results are then statistically screened to study how much significant the observed preferences are.

The results can then be interpreted in one of two ways :

- The first method is where statistical treatment is performed on the total respective consumption of products A and B. For example, if 70 % of the consumed food was product A and 30 % was product B, we can therefore conclude that the product A is much more palatable than the product B. This is the method which we utilised.
- In the second method, no statistical test need be applied. The researcher will just consider that there is a clear preference for A when a dog has eaten twice as more of the product

Table 12 : Overview of feedback received from Potential Customer # 1 (Montego) in terms of product selection and adjustments required

	GROUP 1 - Sausage		GROUP 2 - Pouches	
	Polony	Salami	Dog	Cat
Colour	Brown & Pink	Similar to biltong	Brown	Pink / Salmon
Flavour	Test various	Test various	Beef	Carlos advise the flavour that sells most
Packaging Source	Cold Pack	Off the shelf	Nampak	Nampak
Packaging Details	Shelf stable (brown / printed)	Natural Hog Casing	250g pouch	85g pouch
Size of particle / piece	250g sausage OR 50g sausage x 5 on a string		30mm & thicker than the original sample	18mm
Guide (colour, size etc)	Hound Log	Woolies sample sausage	Pedigree	Whiskers
Shelf Life	Microchem to test		Nampak to test	
Pictures				

9. PRODUCT REFINEMENT BASED ON INPUT FROM PROSPECTIVE CUSTOMER (MONTEGO)

9a. Product adjustments / improvements

Product adjustments proceeded as per the suggestions included in the above table, with a few additional suggestions which were raised along the way. This resulted in many hours of testing, tasting and everyone working together in the laboratory, sometimes way into the early hours of the morning ... the level of commitment from all role players in order to make this work has really been fantastic !

The most challenging aspect of the product development has undoubtedly been access to fully functional equipment, and the fact that equipment that we can have access to is scattered across Cape Town. Currently, whole fish is delivered to the Cape Peninsular University of Technology (CPUT), where it is dissected and minced. The mince for human consumption is then transported to Le Cap Foods for contract packing. The minced head and gills, for pet food production, is transported to Form Foods in Stellenbosch where it is mixed with other ingredients, shaped (for the pouch pieces) and sliced whilst casings are filled for the 2 sausage options.

The pieces for pouches are then transported back to CPUT, where the sauce is made up, pouches are filled, sealed and retorted. The retort process was previously done at Le Cap Foods, but the cost of production and non-adherence to the cooking times on one occasion resulted in all our samples being thrown out. As a result, the pouches are now retorted at CPUT under the watchful eye of our contracting coordinator and Le Cap Foods will only focus on the main product.

The salami is made up at Form Foods and then hung out to dry for 7 – 14 days prior to packaging individually in pouches for palatability testing.

The polony was previously manufactured in a retortable shelf stable casing. However, the casing and the meat separated, allowing a lot of liquid to escape into the gap between the casing and the meat, which was not attractive, particularly as the casing is clear. Given that ColdPack do not have a back-up research & development facility, and the timeline for this project is extremely tight, a decision was made to proceed with normal polony casing until the product is perfected, after which packaging options can be explored, or imported if needs be. The Montego nutritionist has committed to trying to source a shelf stable casing, also used for pet polony, from India.

9b. Manufacture of required samples

The list of samples included in the table below were produced in February 2015, and submitted for palatability testing.

Table 13 : *Samples produced for palatability testing*

product #	product code	pet product	use	unit size	type of animal	# animals involved	# days per trial	# units fed per day	total # units required
1	D2 - 222	Pouch - bone shapes (beef flavour)	Food	250g	Dog	6	3	3	54
2	D2 - 333	Pouch - bone shapes (chicken flavour)	Food	250g	Dog	6	3	3	54
3	D2 - 444	Polony (ham flavour)	Food / Treat	150g	Dog	6	3	3	54
4	D - 777	Salami	Treat	50g	Dog	6	3	3	54
5	C2 - 666	Polony (original flavour)	Food / Treat	100g	Cat	6	3	3	54



9c. Nutritional value analysis

The raw material utilised for the pet food consists of catfish heads and gills that have passed through a 6mm mincer and then two different size comitrol blades in order to produce a paste which can be reformed. The gut and the gall bladder (waste) have deliberately been excluded from the pet food as there is a high risk of a bitter taste as a result of these components. This usable “waste” has now been submitted for fertiliser trials.

The tables below provide a comparison of the following variables :

- Raw 1 : Raw material, including gut and gall bladder – tested early in 2014
- Raw 2 : Raw material, excluding gut and gall bladder – tested in February 2015
- BKT 1 : samples produced prior to the meeting with Montego
- BKT 2 & 3 : samples produced for palatability testing – the pouch sauce : meat ratio is 60:40 and the product has only stood for a week prior to testing. The meat content will need to be increased in order to increase the protein content to be on par with Pedigree.
- Market sample : used as a guide

Table 14 : *Pouches (for dogs)*

		no gut			beef	chicken	market
		Raw 1	Raw 2	BKT 1	BKT 2	BKT 3	Pedigree
Moisture	g / 100g	63.19	59.8	80.2	88.2	88	82
Ash	g / 100g	12.53	14.1	5.8	3.23	3.64	3.5
Fat	g / 100g	4.16	6.41	3.3	2.16	2.36	4
Nitrogen	g / 100g	2.55		1.3			
Protein	%	15.95	14.80	7.8	3.7	3.76	7
Calcium	mg / 100g	4570	4320	1650	1010	1060	
Carbohydrates	%	4.17	4.71	0.10	2.58	1.85	
Fibre	g / 100g		0.18		0.13	0.39	
Phosphorus	g / 100g		2.13		0.43	0.45	
Energy	kCal / kg		1640		520	530	
Energy	Kj / kg		6980		2200	2220	
Taurine	mg / 100g		7310		1700	1750	

Table 15 : *Pouches (for cats)*

		no gut			fish	market
		Raw 1	Raw 2	BKT 1	BKT 2	Whiskers
Moisture	g / 100g	63.19	59.8	80.2	81.7	82
Ash	g / 100g	12.53	14.1	5.8	5.66	2.5
Fat	g / 100g	4.16	6.41	3.3	3.05	5
Nitrogen	g / 100g	2.55		1.3		
Protein	%	15.95	14.80	7.8	5.33	7
Calcium	mg / 100g	4570	4320	1650	1500	
Carbohydrates	%	4.17	4.71	0.1	3.06	
Fibre	g / 100g		0.18		1.2	
Phosphorus	g / 100g		2.13		0.64	
Energy	kCal / kg		1640		770	
Energy	Kj / kg		6980		3210	
Taurine	mg / 100g		7310		6210	



Table 16 : *Polony treat*

		no gut			original	ham	market
		Raw 1	Raw 2	BKT 1	BKT 2	BKT 3	HoundLog
Moisture	g / 100g	63.19	59.8	64.7	57.2	57.7	
Ash	g / 100g	12.53	14.1	8.7	12.8	12.3	
Fat	g / 100g	4.16	6.41	5.5	8.13	8.09	8
Nitrogen	g / 100g	2.55		1.9			
Protein	%	15.95	14.80	11.60	11.9	11.70	10
Calcium	mg / 100g	4570	4320	2460	3090	3140	
Carbohydrates	%	4.17	4.71	4.5	7.26	6.11	
Fibre	g / 100g		0.18		2.71	4.1	
Phosphorus	g / 100g		2.13		1.54	1.58	
Energy	kCal / kg		1640		1850	1840	
Energy	Kj / kg		6980		7770	7750	
Taurine	mg / 100g		7310		995	578	

Table 17: *Salami treat*

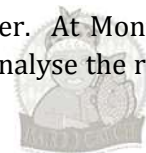
		no gut			market	
		Raw 1	Raw 2	BKT 1	BKT 2	Rollies
Moisture	g / 100g	63.19	59.8	13.2	22.2	21.5
Ash	g / 100g	12.53	14.1	28.9	16.6	7
Fat	g / 100g	4.16	6.41	12.7	19.7	5.5
Nitrogen	g / 100g	2.55		4.84		
Protein	%	15.95	14.80	30.23	24.70	25.80
Calcium	mg / 100g	4570	4320		4940	
Carbohydrates	%	4.17	4.71	15	15.9	
Fibre	g / 100g		0.18		0.86	4
Phosphorus	g / 100g		2.13		2.79	
Energy	kCal / kg		1640		3940	
Energy	Kj / kg		6980		16560	
Taurine	mg / 100g		7310		766	

It is worth noting that the Montego nutritionist provided BKT with a list of the parameters to test. He has had a look at the abovementioned results, and is satisfied that they fall within the required ranges for pet food.

10. OUTCOME OF PALATEBILITY TRIALS (Market acceptance testing)

Mr Carlos Neves of Nutri Se7en Advances is a technical consultant to the pet food industry, focussing on product development of pet food & animal feeds. Mr Neves consults to Montego Pet Nutrition, and is referred to as their nutritionist in this document.

In the scope of his work, Mr Neves works closely with Dr Wandrag of the the Animal Unit at the University of Pretoria in order to conduct the palatability trials in a scientific manner. At Montego's suggestion, BKT thus approached Mr Neves to coordinate the arrangements for, and analyse the results of, the palatability trials.



As mentioned above, palatability testing needs to take place in 2 steps prior to the customer being in a position to consider signing an off-take agreement.

Step 1 is 'perceived palatability' which means that the acceptance of one product is assessed based on an animal's behaviour when offered the food for 20 minutes. To date, 5 of the BKT products have undergone step 1. The graphed results for these 5 products were attached to the previous report, and a brief overview is provided below :

- The cat polony was not well received by the cats at the Animal Unit, and they refused to consume it on day 2 and 3. A decision was thus made not to proceed with this product for now as some additional R&D would be required in order to make this product acceptable to the cats. Having said this, the cats which we have unofficially tested the product on in Cape Town and Graaff-Reinet have absolutely loved the product, and in fact looked for and eaten the whole sample whenever possible.
- In terms of the dog polony, initially the dogs showed interest, with 3 dogs consuming 100% of the product, but by day 3, 1 dog refused and the other 5 did not consume the whole sample. After asking some questions, Mr Neves concluded that the ham flavour used for this polony was the reason for the dogs interest dwindling. The ham is a synthetic flavour and apparently dogs will eat it at first, but not enjoy the flavour long term. The suggestion has been made to produce more samples, utilising both the beef and chicken flavour options which are utilised in the pouched dog food, and repeat this trial. Mr Neves believes that this product will then be a success.
- The salami produced in December was better received by the dogs, and Mr Neves has thus given some advice in terms of reducing the seasoning in order to improve the acceptability. However, the major difference between samples produced in December and those produced in February is that the February samples were sprayed with a mould inhibitor as mould started developing on the December samples. The dog will generally first smell and lick the surface of the food before consuming it, and in this case will thus first taste the mould inhibitor and not the meat. Mr Neves suggested that the mould inhibitor be mixed into the raw meat, as is apparently standard practice in the pet food industry. He believes that this product will then be a success.
- The 2 different pouches which were produced for dogs (beef and chicken flavour) both scored very highly, with 70% and 65% acceptability respectively. According to Mr Neves, this is a very high score and he has requested that we not make any further changes to the recipe. One comment which he did however make is that the dogs should have been offered smaller quantities as beagles are utilised for the trials and, due to the fact that they are also fed other food, will not consume the full 250g, which results in what is perceived to be a less than desirable result in terms of the percentage acceptability. Samples will now be made in the 100g pouches.

In addition to the above, the intention was to also subject the 85 – 100g pouched cat food products to the step 1 palatability. However, having retorted the product 3 times, and each time something went wrong in the process (eg. water mains were switched off at CPUT), a decision was made to exclude this product as there were already 5 products to test and we had run out of raw material. When the new product samples are manufactured in March, we hope to make some pouches for cats, filled with fish shapes in a salmon flavoured sauce and possibly also a roast chicken option, which is delicious – even to us humans. If there is sufficient product available, we would also like to test the chicken flavour on cats. Mr Neves has advised that this market is growing rapidly and is definitely worth considering now.



11. FINANCIAL ANALYSIS

The market potential of the pet food vs the pet treat market has been analysed in order to evaluate which is the most attractive option, given current pet food production projections, as well as to evaluate the potential market share of this new product/s at full production. Whilst these calculations show a choice of one option or the other, a mix of the 2 would also be possible. From the table below, it is clear that the market size for wet food is far greater than that of treats. Given the fact that Montego currently hold just over 30% of the dry pet food market, it is probably realistic to assume that, if they have a range of good wet food products, they will be able to capture a similar size of this market too.

Table 18 : *Market potential for pet food products (as per 2014 volumes)*

	WET FOOD (pouches & polony)	TREATS (salami)
Annual pet food production	5,292 tons	1,512 tons
Annual pet food turnover	R 756 m	R 216 m
Annual growth in pet food market	6,7 %	17%
BKT production per aquaculture system	2,5 % of market	2,6 %
BKT production from commercial phase 1	37 % of market	39 %

Table 19 below summarises the financials for the pet food options, inclusive of the current range and average market price against which the BKT product will compete.

At this stage, the BKT pouches seem to be leading the pack in terms of market acceptance and, as can be seen in the table below, the product pricing is competitive, per kg. The BKT and Montego teams will meet again in April, once the Step 2 palatability test has been conducted for the dog pouches, and Step 1 repeated for the remaining products. At this point, Montego have requested that we calculate the cost of the manufactured product excluding the suggested packaging option as they would like to consider various options and need the base price in order to do so. These are serious businessmen with a wealth of knowledge in the pet food industry – it has really been a real privilege to work with them so far.

Table 19: *Product pricing*

	POUCHES	DOG-A-LONY	PET SALAMI
Market range (ZAR)	29 – 58	29 – 58	40 – 280
Av. market price (ZAR)	46	46	Beeno Rollies 208
Proposed BKT price to Montego - kg	31	34	65
- unit	7.75	5.01	3.21
Unit size	250g	150g	50g
Suggested bulk packaging (incl in above price)	12 in a box	10 in a box (indiv./string?)	3 per sealed packet

In summary, the financial analysis currently indicates that the manufacture of pet food is potentially a commercially viable and sustainable by-product. Once the results from the second palatability trial are received, it is believed that BKT will be in a position to rigorously pursue off-takes.



12. SECURE OFFTAKE AGREEMENT

Montego Pet Nutrition have given BKT a Letter of Intent (Annexure A) to purchase the BKT product/s, stating that they are keen to enter into an offtake agreement once the environmental authorisation for the processing facility is granted and firm timelines are established. The environmental authorisation is expected to be issued by July 2016.

13. OUTCOME OF FURTHER INTERACTION WITH POTENTIAL CUSTOMER (MONTEGO)

It should be noted that the activities outlined in point 8 – 11 above focussed on Montego Pet Nutrition. It was initially our intention to pursue a second market. However, due to the fact that Montego then produced the Letter of Intent and indicated that they would not want the end products supplied to any other organisation should an offtake be signed, a decision was made to invest more time in Montego Pet Nutrition rather than pursue a second customer. Additional efforts have thus been made to product fit specifically as per Montego requirements, and are included under points 13 – 17 below.

13a. Product Selection

A decision was made to pursue the dog food pouches, in smaller 85 – 100g pouches, as the first product which Montego could enter into an offtake for given that this product was found to be highly acceptable to dogs. The recipe was also improved slightly.

13b. Suggested survey method and instrument

Just to recap, palatability refers to the ability of a product to be consumed rapidly and heartily by the dog or the cat, and determines the level of spontaneous consumption by the animal.

- Step 1 is 'perceived palatability' which is subjectively appreciated by observing the animal's behaviour when faced with a single pet food option. *This exercise was repeated given the slight improvement to the recipe formulation.*
- 'Real palatability', which is the second test, is measured by comparing the animal's response to 2 different pet food products. *The BKT product was then tested against Pedigree, which is the best product on the market in this range.*

Results of the 2 palatability steps are included under point 15 below.

14. PRODUCT REFINEMENT BASED ON INPUT FROM PROSPECTIVE CUSTOMER (MONTEGO)

14a. Product adjustments / improvements

Very minor adjustments were made to the pouched dog food recipe formulation.

14b. Manufacture of required samples

Samples were produced for each of the 2 step palatability tests.

14c. Nutritional value analysis

The tables below provide a comparison of the following variables :

- Raw 1 : Raw material, including gut and gall bladder – tested early in 2014
- Raw 2 : Raw material, excluding gut and gall bladder – tested in February 2015
- BKT 1 : samples produced prior to the meeting with Montego
- BKT 2 & 3 : samples produced for palatability testing – the pouch sauce : meat ratio is 60:40 and the product has only stood for a week prior to testing
- **BKT 4 : Final sample submitted for palatability testing**
- Pedigree market sample : used as a guide



Table 20 : Pouches (for dogs)

Note that the BKT 4 results are extracted from Annexure D.

		no gut			beef	chicken	beef	market
		Raw 1	Raw 2	BKT 1	BKT 2	BKT 3	BKT 4	Pedigree
Moisture	g / 100g	63.19	59.8	80.2	88.2	88	79.3	82
Ash	g / 100g	12.53	14.1	5.8	3.23	3.64	6.14	3.5
Fat	g / 100g	4.16	6.41	3.3	2.16	2.36	3.27	4
Protein	%	15.95	14.80	7.8	3.7	3.76	7.59	7

15. OUTCOME OF PALATEBILITY TRIALS (Market acceptance testing)

Step 1 : Perceived palatability

ie. only one product is offered to the dogs

The pouched dog food achieved 100% acceptance during this trial, which is an excellent result. The palatability tests report is attached as Annexure B.



Step 2 : Real palatability

ie. the acceptance of 2 different pet food products is compared

The BKT product achieved 93% against Pedigree's 99% acceptance when offered to the dogs together. This is an excellent result, and the nutritionist has advised that no further refinement is required.

The product is now ready for sale. The palatability test report is included as Annexure C.



16. FINANCIAL ANALYSIS

As mentioned above, the BKT have now focussed all efforts on the pouched dog food which has achieved 100% acceptance during the palatability testing.

The table below includes an updated snapshot of the financials for this product, inclusive of the current range and average market price against which the BKT product will need to be compared. Montego have indicated that this pricing would be acceptable in that it would allow them to be competitive in the market.

Table 21: Product pricing

	POUCHED DOG FOOD	
	PER 100g UNIT	PER KG
Market range (ZAR / kg)	3,99 – 5,30	29 – 58
Av. market price (ZAR / kg)	4,99	46
Proposed BKT price to Montego	3,06	30,60

In summary, the financial analysis continues to indicate that the manufacture of pet food is potentially a commercially viable and sustainable by-product.



17. SECURE OFFTAKE AGREEMENT

As mentioned under point 12 above, Montego Pet Nutrition produced a Letter of Intent (Annexure A) to purchase the BKT product/s, stating that they are keen to enter into an offtake agreement once the environmental authorisation for the processing facility is granted and firm timelines are established. The environmental authorisation is expected to be issued by July 2016.

D. CONCLUSION

We have thoroughly enjoyed implementing this project which focusses on the post-harvest value addition for catfish (*clarias gariepinus*), in terms of the development of the 15 - 25% 'waste' into a marketable by-product. Lessons have been learnt throughout the exercise and thus incorporated into the subsequent activities / steps as the project has progressed. Who would have thought that pets are such fussy eaters ?

Our overall objective has been met in terms of producing a pet food by-product which is acceptable to the market. This is evidenced by the palatability results and letter of intent received from Montego.

The dog food recipe will now be registered with DAFF, following which sale of the product can commence. In addition, the product development team will continue to pursue other pet food options, such as the pouched cat food, in order to increase the range and variety of products which could potentially be offered to Montego Pet Nutrition.

We would like to take this opportunity to thank the IDC Agro Processing Competitiveness Fund for the financial support provided. This support has contributed significantly to ensuring that the initiative as a whole is commercially viable and sustainable, thus facilitating access to finance in order to commercialise and thus access to currently unavailable local skills development and employment opportunities.

It is requested that the IDC team travel to the farm site for the final presentation in order to gain a better understanding of the initiative as well as the challenges and opportunities faced on a daily basis in this dusty, isolated, small Karoo town, where local economic development is so desperately needed.

