final report

Project code: P.MDC.0002

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Date submitted: October 2008

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Review of boa technology commercial application in the Australian red meat industry

This is an MLA Donor Company funded project.

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government and contributions from the Australian Meat Processor Corporation to support the research and development detailed in this publication.

Executive summary

1. Boa technology has been co-developed by MLA and Meat and Wool New Zealand as a pre-rigor stretching technique for improving value and eating quality of boneless red meat products.
2. The primary benefits of Boa are:
    a. Stretching to tenderize pre-rigor meat; and
    b. Shaping irregular muscles to increase value by changing muscles consumer usage

    Both benefits have commercial application with potential for reasonable return on investment.

    These benefits are not considered to be available with competing technologies.
3. Some secondary benefits deliver additional commercial return over primary benefits. Depending on plant circumstances these benefits by themselves would not be significant enough to justify Boa without the associated primary benefits.
4. A commercial system with equivalent volume capacity to the existing prototype does represent a viable commercial product for most applications. Volume is obviously a limitation but multiple units could be installed within reason.
5. This technology is a significant enabling technology if future international pressures on energy, environment and labour made hot boning a more important option for processing companies.
6. There are real commercial opportunities for existing cold boners to harvest hot boned cuts with the existing technology.
7. All of the technical assumptions made in this document have been received from the developers and are assumed to be correct and are the basis for much of the commercial benefits calculated. At the time of writing, some additional consumer tenderness trials were being conducted to confirm the tenderness benefits.
8. Financial figures are estimated to be close to industry costs based on previous industry information and phone conversations. Results of plant visits have been averaged to give an approximate benefit to the Australian red meat industry.
9. Although there has been a lot of technical development of this product, the largest unknowns are acceptance by the consumer and impact on existing marketing strategies. Although processors have given some opinions on market acceptance during site visits further consumer testing is strongly recommended in a pilot plant type environment.
10. The following tables summarise the commercial options for the technology and what benefits are relevant for each sector. Further costing data is included throughout the document.

	Existing System						Future Large Volume Machine	
	Option 1 - Hot Boning		Option 1 - Cold Boning - Harvest Hot		Option 1 - Cold Boned Product		Option 2 - Large Scale Hot Boning	
	Primary Benefit	Secondary Benefit	Primary Benefit	Secondary Benefit	Primary Benefit	Secondary Benefit	Primary Benefit	Secondary Benefit
Hot Bone Filling	✔		✔				✔	
Shaping	✔		✔		✔		✔	
Packaging Filling		✔		✔		✔		✔
Portion Control		✔		✔		✔		✔
Tenderising	✔		✔				✔	
Competing Technol	x	✔	x	✔	x	✔	x	✔

Benefits	Application of Boa Technology in its existing form	$ /kg - treated cuts
Existing Hot Boning Plants		**$ 1.80**
Pre-rigor stretch		
	Increasing eating quality within existing cut usage	$ 1.80
Pre-rigor shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Reduce Bon-bon wrapping cost (currently -$0.17/kg)	
Cold Boning Plants - HARVESTING selected hot boned muscles		**$ 2.05**
Pre-rigor stretch		
	Increasing eating quality within existing cut usage	$ 1.80
Pre-rigor shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Reduce cold storage time (finance cost) (- $0.09 if only benefit)	$ 0.09
	Reduce cold storage operating costs	$ 0.03
	Reduce shrink loss	$ 0.14
Cold Boned - Post rigor processing		**$ 1.13**
Post-rigor Shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Packaging filling - currently a disadvantage due to labour requirement	
	Tail to tail bonding of Tenderloins to improve yield - this must be tested!	
Secondary Weaknesses**		
	Squeezing stretching action of Boa will reduce brine uptake and yeild on moisture infused product by ~14% of inhjected weight	
	Value-added product opens up to many competing technologies (pressing etc)	
Cold Boning Plants - CONVERTING to Hot Boning		**$ 2.16**
Pre-rigor stretch		
	Increasing eating quality within existing cut usage	$ 1.80
Pre-rigor shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Reduce cold storage time (finance cost) (- $0.09 if no primary benefit)	$ 0.09
	Reduce cold storage operating costs	$ 0.03
	Reduce shrink loss	$ 0.14
	Reduce Bon-bon wrapping cost (currently -$0.17/kg)	
	Reduction in boning labour - 20% of current	0.11
	Reduction in Energy Costs - 25% of current (TBC)	

*Secondary Benefits are costed assuming Primary benefits have already been implemented. It costs $0.18/kg more to pack Boa product than normal vacuum packing. The benefit of reduced storage time is $0.09/kg but costs $0.18 to pack. If no other benefit

**Almost NO testing of Boa has been done on cold boned product. Cold product has two distinct markets (higher value uninjected and lower value moisture enhanced). It is questionable without further trials whether BOA will compete well against other tech

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1 Introduction / Background Information

The design of the commercial Boa prototype is based on air being forced into an outer sleeve of stretching cylinders with the meat cut encased in flexible food-grade based silicon. As air is forced in, the inner sleeve decreases in diameter and increases in length, thereby stretching the meat within. Once the dimensions of the meat have reached the desired level, the active sleeve is squeezed together at one end, expelling the meat cut upwards into a metal tube. The meat is then expelled from the tube into the appropriate size tube of packaging (Simmons 2007).

The potential opportunities for adding value to Boa treated red meat products include

- Muscle stretching (improved eating quality)
- Shaping of muscles
- Packaging filling
- Hot Bone Binding

Image a: Current version of Boa equipment for use in both hot and cold boned read meat products.

Image b: Specialized inner developed through joint program with MLA and Meat and Wool New Zealand.

Image c: Inserting cold Boned topside into plastic casing

Image d: Treated Cold Boned Boa top side as compared to untreated.

Figure 1-1: Current version of Boa now available for use in the Australian Red Meat industry.

2 Review Objectives

- To identify the commercial readiness of the existing system
- Identify any further development required to make commercial ready
- Quantify the dollar benefit for each attribute listed in background information of the existing Boa system and the dollar benefit of a large scale commercial system if it were to be developed
- Quantify the competitiveness of any competing technology

3 Research methodology

3.1 Research approach

It is understood that the early drivers in the development of the Boa technology were to capture the benefits known to exist in stretching of muscle prior to rigor. While this still remains the focus for the application of Boa technology in the red meat industry several other secondary benefits such as shaping and packaging have also been identified as having specialized application opportunities in hot and cold boning processes. The following results and discussion section assess the potential value of each benefit of the Boa technology applied under several different commercial processing scenarios.

The first review is of the existing R&D machines ability to deliver commercial benefits under the following conditions:

i.) Existing hot boning plants;
ii.) Harvesting selected hot boned products in existing cold boning plants;
iii.) Processing cold post-rigor product in a cold boned plant or value-adding plant

The second review considers further development of the prototype system to full scale commercial throughput as an in-line packaging system in large processing plants.

3.2 Data Collection

This review of the Boa technology involved a number of in-person and telephone discussions with Dean Gutzke, Ian Richards and David Carew, revision of many documents on the technology, inspection of the system in operation at an abattoir and at a value-added processing plant and telephone discussions with the Australian agent for the Hammax machine which has been considered a potential competing technology to Boa.

3.3 Benefit calculations

A detailed cost benefit exercise has been conducted for each of Boa's technology benefits. Mechanical benefits such as improvement in shrink or reduced yield loss are quite accurate. Marketing benefits such as increases in price paid for product because it is easier to cook are harder to quantify and require further input from the marketing teams in processing plants during the plant review stage following this desk report.

NOTE: *some costings and recommendations could change dependant on individual plants operational and marketing circumstances.*

Previous reports identify a wide range of benefits from Boa but none seem to quantify a realistic commercial dollar gain for each benefit.

We have attempted to quantify each of Boa's technology benefits separately in dollars/kilogram processed. To do this we have applied the technology to commercial value assumptions in that sector of the supply chain where value could be extracted. This places a market focus on the benefit analysis. Return on investment for individual plants (potential customers) can then be done. Conducting this type of analysis will also identify the most beneficial attributes to further develop, likely customers and sales volumes and any market research that still may be required to quantify the real market value of the technology.

4 Results and discussion

The following results and discussion identifies the potential benefits of Boa technology in relation to other processing equipment which have been identified as competing technologies. Detailed consideration is then given to each benefit in commercial scenarios as previously outlined in the methodology section.

4.1 Boa technology benefits verse competing technology

Each technology benefit has been summarized in the table below beside competing technologies. In order to determine what is competing or novel technology, some effort was given to separating each specific capability of Boa. The comments column helps to appreciate each specific and differentiating capability.

TECHNOLOGY CAPABILITY	Hot/ Cold	BOA	Hammax	PiVac	Marel	Manual	Comments	$ Benefit / Kg
HOT BONE FILLING: Placing hot meat in bag to maintain pre-rigor shape and minimise shortening and toughening of muscle during rigor and chilling.	Hot	✔	✔	✔		50%	Hammax bag sizes have to be fitted to muscle to prevent small muscles folding over in larger bag. Manual Bon-Bon method current practice but labour intensive. PiVac as effective as BOA but bag size not consistent enough to allow exact portioning (see below)	consistent pdct Q. no value assumed
HOT BONE BINDING: An extension of Hot Bone Filling - Placing multiple hot meat in single bag to use hot meat binding to "glue" together.	Hot	✔	✔	✔		✔	Example - binding tenderloins head to tail to provide consistent portion sizes for the entire length. Most other technologies could do this with varying levels of portion control so is considered a secondary benefit.	N/A
TENDERISING: Stretching muscles to increase tenderness where sarcomere length is the major contributor to tenderness	Hot	✔		?			PiVac is used for hot boned product but cannot stretch a muscle more than 20% of its resting state (the minimum required to improve tenderness, compared with maintaining tenderness under FILLING attribute)	$ 0.51
SHAPING: forming irregular shaped muscles such as topside for precise filling into bag so shape can be maintained for portioning.	Hot & Cold	✔					Hammax does not fill irregular shapes without significant yield loss. PiVac stretch bags don't have enough force to significantly change the shape of the subprimal. Unless BOA product is heavily marinated or massaged it will return to original form after portioning.	$1.92*
PACKAGING FILLING: Stuffing product into bags for freezing in shape, cooking, portioning. Similar to PORTION CONTROL below without consistent fill, nore exact portion weights.	Hot & Cold	✔	✔	✔		✔		Value not calculated
PORTION CONTROL: Similar to SHAPING but also applied to cylindrical muscles to fill all parts of the bag to give consistent diameters and precise portion weights	Hot & Cold	Prep. Ready for portioning	Only prep. Some cuts for portioning		✔		PiVac bags are not consistent diameter. Hammax could stuff to a consistent diameter but bag size must be fit to muscle size for cylindrical muscles only.	Value not calculated
Primary Benefit	Benefits that create the greatest value and ROI with limited or not competition from other technology							
Secondary Benefit	Smaller benefits or possible with other technologies. Would not justify the equipment but would achieve benefit if Boa was installed because of a primary benefit							
Has not been tested	Hard to see this being a pririty focus of further R&D							
* Value only achieved if used in conjunction with tenderising (stretch must be greater than 20%)								

4.2 Review 1: Commercial value of Boa in its existing hardware configuration

In considering the potential value of Boa technology in its existing form the following questions were posed

- Is the current system just a prototype that needs significant redesign to automate and increase capacity before a plant would consider installing it? OR
- Does the current system, with some re-design or enhancements have commercial potential for at least some of its technology benefits considering production capacity, labour and packaging costs?

Using this frame work the three scenarios listed in section 4.1 regarding use of the equipment in its current form are considered in detail.

4.2.1 Scenario A: Application of existing Boa equipment in hot boning plant.

An existing hot boning company currently selling all cuts as grinding meat or low value primals could increase product value by Boa processing. If the plant is already selling the higher value cuts at a higher price due to bon-bon wrapping those cuts can be tenderized to further increase their value either within their existing use or by changing their shape to be converted from a roast to a grilling option.

Boa Benefits

Primary Benefits

- Tenderizing of muscles
  - Elevate tenderness beyond that of cold boned product through stretching. This assumes the primals are still sold for their existing use (steak, grilling, thin sliced, roast etc) but as a higher and more consistent quality.
  -

4 Beef Plants	Cut	% of cuts V.A.	Kg/year / cut	Current Sales $	New Sales Dollars	Gross Benefit / Kg	COLD Pack & Labour Cost	BOA Pack & Labour Costs	Net Benefit /kg	Net Benefit
Changing target market of lower grade cuts of meat to mid-range cuts	4 Cuts V.A.	9%	3,227,641	$ 7.83	$ 8.84	$1.01	$ 0.21	$ 0.45	$ 0.77	$ 2,497,367
	Cube Roll	25%	878,684	$10.80	$ 12.30	$1.50	$ 0.21	$ 0.45	$ 1.26	$ 1,110,041
	Tenderloin S/off	25%	343,232	$13.20	$ 14.70	$1.50	$ 0.21	$ 0.45	$ 1.26	$ 433,604
	Striploin	25%	750,146	$ 7.65	$ 8.55	$0.90	$ 0.21	$ 0.45	$ 0.66	$ 497,571
	D-Rump	25%	1,255,579	$ 4.38	$ 4.98	$0.60	$ 0.21	$ 0.45	$ 0.36	$ 456,151
	Inside	0%	0	$ 2.94	$ 3.06	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Eye Round	0%	0	$ 2.94	$ 2.94	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Chuck Roll 5Rib	0%	0	$ 3.72	$ 3.72	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Chuck Tender	0%	0	$ 2.40	$ 2.40	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Oyster Blade	0%	0	$ 2.40	$ 2.52	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Outside Flat	0%	0	$ 2.94	$ 2.94	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Outside	0%	0	$ 2.94	$ 2.94	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -
	Knuckle	0%	0	$ 2.82	$ 2.94	$ -	$ 0.21	$ 0.45	$ (0.24)	$ -

  - The scenario in the table above assumes 4 cuts are Boa processed compared with bon bon wrapped low value frozen.
  - The volumes in the table relate to 4 hot boning plants. It is assumed 25% of the total plant volume of each cut was value added with boa for the following reasons:
    - Greater volumes require more multiples of the existing Boa equipment which becomes inefficient and not a large scale long term strategy
    - The market is not likely in the short term to absorb even this much volume of hot boned product at an increased price

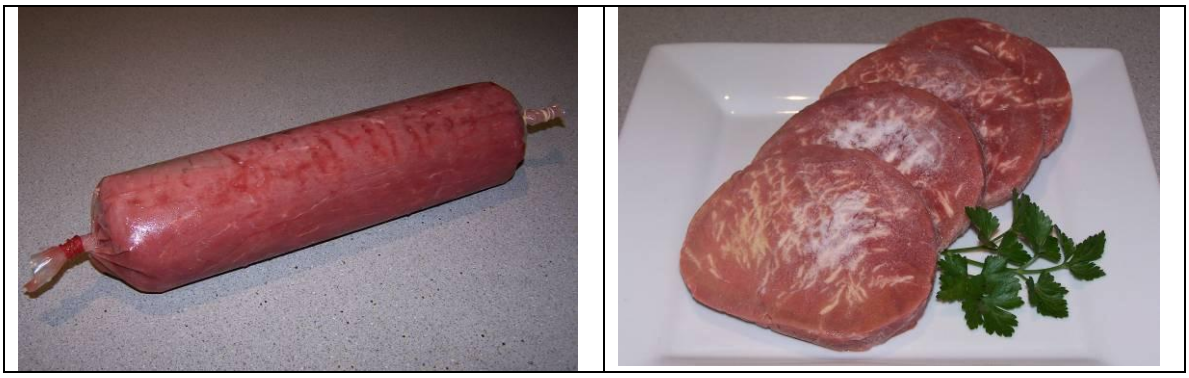
- This pricing assumption is based on existing price premiums of between $1.00 and $2.50/kg for MSA sweet cuts and $0.20/kg for MSA secondary cuts compared with non-graded. Although MSA relates to cold boned product, this is the only factual evidence available of market premiums paid for “higher quality” product. These MSA premiums have been devalued by 40% to more closely match hot boned product prices. The resultant quality premium after devaluing for hot boned markets is assumed at $0.68/kg on average across the 5 primals.
- Existing markets for bon-bon wrapped hot boned cow beef may not pay a premium for increased quality. A premium may only be realistic if it enables plants to sell some product to different markets.
- The price increases calculated in the above tables were not supported by Tabro meats. We have kept these price calculations in the report however for the following reasons:
  - All plants were extremely impressed with the presentation of the Boa processed hot boned product.
  - Eating quality sensory evaluation may still be done that indicates tenderness is improved with Boa over that of bon bon wrapping.
  - Commercial trials of boa processed hot boned product should be undertaken to confirm what market premium could be achieved for hot boned product presented in this way.
- Using the current packaging costs in the table above made it prohibitive to process insides. The table below indicates the additional benefits that could be achieved if more automated packaging was built into the Boa technology. The average price/kg reduces but the percentage of the total carcase processed could be increased.

4 Beef Plants	Cut	% of cuts V.A.	Kg/year / cut	Current Sales $	New Sales Dollars	Gross Benefit / Kg	COLD Pack & Labour Cost	BOA Pack & Labour Costs	Net Benefit /kg	Net Benefit
Changing target market of lower grade cuts of meat to mid-range cuts	5 Cuts V.A.	13%	5,097,155	$ 6.03	$ 6.72	$0.68	$ 0.21	$ 0.21	$ 0.68	$ 3,485,694
	Cube Roll	25%	878,684	$10.80	$ 12.30	$1.50	$ 0.21	$ 0.21	$ 1.50	$ 1,318,026
	Tenderloin S/off	25%	343,232	$13.20	$ 14.70	$1.50	$ 0.21	$ 0.21	$ 1.50	$ 514,848
	Striploin	25%	750,146	$ 7.65	$ 8.55	$0.90	$ 0.21	$ 0.21	$ 0.90	$ 675,132
	D-Rump	25%	1,255,579	$ 4.38	$ 4.98	$0.60	$ 0.21	$ 0.21	$ 0.60	$ 753,347
	Inside	25%	1,869,514	$ 2.94	$ 3.06	$0.12	$ 0.21	$ 0.21	$ 0.12	$ 224,342

- Shaping irregular primals into consistent shape
  - The Boa’s ability to shape irregular primals like the topside and fill into a tube not only tenderizes beyond that achieved through cold boning process as in the benefit above, but allows the product to be portioned as a steak.
  - This allows cuts to be sold for another use than originally suited to. The assumed target market is lower value pub and club market where a reshaped steak would be acceptable as a replacement for cow cube roll or tenderloin.
  - It has been assumed that topsides have been elevated in value to that of cow cube roll in the table below.

1 Beef Plant	Cut	Cut % of Carc	% of cuts V.A.	Kg/year / cut	Current Sales $	New Sales $	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Net Benefit /kg	Net Benefit
Changing target market of lower grade cuts of meat to mid-	1 Cuts V.A.	5.77%	100%	2,437,292	$ 5.64	$ 7.00	$ 1.37	$ 0.21	$ 0.45	$ 1.13	$ 2,749,994

- If irregular shaped roasts are presented as consistent grilling steaks, as in the photo below, realistic prices for portioned 150-200gm steaks is approximately $10-14/kg.



- Other quality attributes from secondary cow primals like taste and juiciness are assumed to be similar to that from current cow cube rolls and not a barrier to entry if tenderness can be achieved.
- The impact of this type of new product on existing markets for cow cube roll and similar low value steak items needs to be considered.

<u>Secondary Benefits</u>

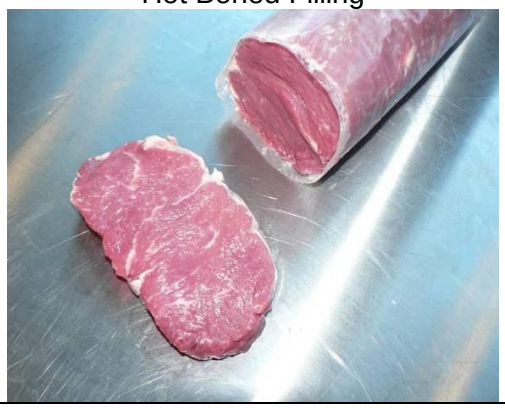
These are benefits that by themselves would not justify the use of Boa (Competitor products can do this) but are still realizable if primary benefits justify the investment:

- Hot Boned Filling – (automated version of bon-bon wrapping)
  - Maintaining eating quality of meat at similar levels as cold boned product by preventing muscle contraction during chilling
  - It was identified in the benefits table that bon-bon wrapping will only be half as effective in preventing cold shortening as boa. However, bon-bon wrapping is considered the industry standard method of maintaining hot boned meat quality. Developing new market premiums for slight enhancements over bon bon wrapping would be difficult. Boa's real opportunities are in tenderizing and shaping where significant changes in eating quality are achieved.
  - Commercial benefit here is only in the packaging costs saved between Bon Bon and Boa (includes labour and materials costs).
  - These costs were confirmed at Tabro Meats.
  - Flethcers method of wrapping boneless leg and shoulder primals uses a high speed over-wrapping machine with packaging cost being less than 10 cents per kilogram. However, the finished product is not as high a quality and should not be compared.
  - Unless packaging cost estimates are revised during plant visits or unless a large scale machine were developed, low production efficiency in Boa wrapping hot boned product is not economically viable as per the following costs.

		FTE's	$/kg
Boa Packaging - Total Cost		**2**	**$ 0.45**
Bon Bon Wrapping - Total Cost		**1.5**	**$ 0.28**

- Packaging filling capability – No dollar benefit assumed
    - Plants that have processed Bon-Bon product (Hand wrapping before chilling to prevent cold shortening) but reverted to low value frozen product due to high labour costs provide a direct comparison with Boa as a competing technology. Labour savings between the two technologies become the more precise comparison, not the increase in product value. This assumes Boa packaging costs become more competitive against bon-bon wrapping. (See Appendix 5 – Site Visit Report – for comments on value-added processing considerations)
- Portion control – No dollar benefit assumed
    - Existing technologies such as Marel slicers are able to portion steak cuts to a similar level of precision already. Although crust freezing of the product (particularly from hot boned carcases) would make it cost prohibitive, the benefits of portion control have not been included. Boa does not have the capability to portion product but the tight packaging method guarantees a $\pm$ 3 gram tolerance when portioning on a slicers with set thickness (See Appendix 5 – Site Visit Report – for comments on value-added processing considerations).

Hot Boned Filling



Associated Benefits:
None for this plant application – cost savings in hot boning efficiency already being realized.

Return on Investment:
- Estimated return on investment is less than 12 months.
- Calculations are based on installing one or more of the existing sized Boa's in a hot boning plant to tenderize (stretch) muscles to increase eating quality. This also assumes some additional re-engineering activities are required to make the existing system commercial ready. Re-engineering costs have been estimated at approximately 30-40,000 to develop. Once developed it has been assumed that commercial costs would be approximately $18,000 per machine in the table below.
    - (NOTE – these costs are rough guesses only based on conversations with MLA R&D team for the purpose of calculating estimated ROI's, not for approving engineering development budgets).

- Net benefit counted is $0.77/kg and assumes muscles are sold for their existing cut purpose and does not include shaping benefits to change the end use of the cut.

Head / week	Kg/year	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of small BOA Systems	Automatted Boa System / Bags/hour
13500	129,600,000		360		217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	8 Hrs/day
2500	24,000,000	2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	104
2500	24,000,000	2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	104
5000	48,000,000	4,981	13.84	5	401,942	$ 100,000	$ 36,000	$ 175,000	$ 311,000	2	208
3500	33,600,000	3,487	9.69	6	401,942	$ 100,000	$ 36,000	$ 175,000	$ 311,000	2	145

- Processing capacity (2- 3 metric ton / day / Boa Prototype)
    - The existing system is limited by volume and would only be appropriate if one to two cuts of meat were to be processed or where multiples of the existing machine were installed as an interim step prior to development of a larger scale system
- Additional infrastructure –
    - A separate processing room would be required for Boa processing. An additional cost of $100,000 for plant investment in infrastructure has been assumed when calculating ROI. Each additional Boa system installed in parallel has assumed an additional 75% of the initial infrastructure cost to house the Boa equipment.

4.2.2 Scenario B: Application of existing Boa equipment to harvest selected hot boned cuts in existing cold boned plant:

This scenario assumes a cold boning plant harvests hot primals on the slaughter floor in order to extract value with the Boa that is not currently available to them.

The combination of applications is estimated to provide a benefit of approximately $1.52/kg based on assumed meat prices. The details of each benefit are explained in the next section.

		Total Cuts Value Added	Kg/year	Current Sales $	New Sales	Gross Benefit	Net Benefit/kg	Net Benefit
Total Combined Value of benefits below	1 Beef Plants	3	4,560,804	$ 11.35	$ 13.03	$ 8,021,241	$ 1.52	$ 6,941,694

    - Benefits in faster chilling of deep butt cuts after removal of topside not counted as financial benefit

Boa Benefits:

Primary Benefits

- Shaping (and tenderizing) of muscles
    - Elevate tenderness beyond that of cold boned product through stretching
    - The process here is exactly the same as that explained in Scenario A above for hot boning plants. There would be a difference in the cost of the raw material being value-added. But there would also be an increase in finished steak value. Market assessments indicate a portioned 150gm steak would equate to approximately $12-14/kg.

1 Beef Plant	Cut	Cut % of Carc	% of cuts V.A.	Kg/year / cut	Current Sales $	New Sales $	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Net Benefit /kg	Net Benefit
Changing target market of lower grade cuts of meat to mid-	1 Cuts V.A.	5.77%	100%	2,437,292	$ 5.64	$ 7.00	$ 1.37	$ 0.21	$ 0.45	$ 1.13	$ 2,749,994

- *Depending on the time of year and demand for cow cube rolls, processing of topsides or other similar muscles into competing products may not be feasible. A lower price for cow cube rolls has been used to accommodate this fluctuation.*

- Hot Boned Filling
  - Reduced aging time = reduction in cold storage inventory cost – Boa treatment has proven to speed up the ageing process for some existing cold boned cuts of meat that are currently aged for >20 days to achieve a higher MSA grade or aged eating quality – (Cost of inventory is a very important issue for some plants)
  - The scenario in the table below assumes striploins and cube roles are harvested hot from a cold boning plant. Stretching and forming has not been counted as an increase in value, only achievement of aged tenderness level without cold storage inventory days
  - The assumptions include a reduction in cold storage refrigeration costs (costed at commercial rates for cold storage), finance costs on value of inventory. Additional benefit in freeing up pallet spaces in cold store will have varying impact from plant to plant and have not been counted.
  - NOTE – Applying Boa only to reduce inventory costs does not break even as outlined in the net benefit column below. As this benefit is considered secondary, the cost of boa processing would only be paid for once by the primary benefit. Therefore the additional benefits outlined below are calculated at

		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit before Interest saving	Saved Ageing Days	Interest Rate p.a.	Net Benefit/ kg	Interest & Value Benefit	**Benefit w/o Boa cost**
Achieve 20 day aging tenderness in 20 hours - **reduce cold storage financing cost**	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 17.92	$ 17.92	$ (502,637)	18	10%	$ (0.15)	$ (314,983)	$ 0.09
		Total Cuts Value Added	Kg/year	Pallet storage /wk	Kg / Pallet	Cost / Kg / Wk	Saved Ageing Days	Refrig cost / kg	Net Benefit/ kg	Interest & Value Benefit	**Benefit w/o Boa cost**
Achieve 20 day aging tenderness in 20 hours - **reduce refrigeration & pallet cost** - cold storage	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 8.28	792	$ 0.010	18	$ 0.03	$ 0.03	$ 57,071	$ 0.03
TOTAL of ABOVE BENEFITS		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit before Interest saving	Refrig cost / kg	Interest Benefit/kg	Net Benefit/ kg	Interest & Value Benefit	**Benefit w/o Boa cost**
Achieve 20 day aging tenderness in 20 hours - **reduce finance, refrigeration & pallet**	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 17.92	$ 17.92	$ (502,637)	$ 0.03	$ 0.09	$ (0.12)	$ (257,911)	$ 0.12

Secondary Benefits

- Hot Boned tenderizing

  - Additional cuts could be tenderized by stretching to increase their eating quality above existing cold boned rating and therefore their value.
  - Applying Boa stretching (particularly where the cuts tenderness is impacted heavily by sarcomere length – see APPENDIX 3 - Hot Boned Cuts capable of Boa Value-Adding could elevate the cuts to an acceptable quality.
  - This could be feasible in plants doing MSA or other eating quality grading that have a percentage of cuts fail a minimum eating quality grade.
  - Any benefits from this have not been included in this scenario although quite feasible.
- Packaging capability
- Portion control

Associated Benefits:

- Reduction in Shrink from cold to hot boning
  - Improvement in shrink from +2% to <0.8% by processing hot has been accounted for in the following table

	Total Cuts Value Added	Kg/year	Standard Shrink	BOA Shrink	Average $ Value	Shrink Benefit /kg	Shrink $ Benefit p.a.
Reduce shrink loss from cold boned to hot boned	3	4,560,804	2.0%	0.8%	$ 11.35	$ 0.14	$ 621,436

- Increased chilling rate - Removing butt cuts from the carcase prior to chilling will speed up deep butt chilling and improve the quality of the remaining leg cuts. This has not been costed in the ROI calculations.

Return on Investment:

  - An additional cost of $100,000 for plant investment in infrastructure has been assumed when calculating ROI.

BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost
	360		217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000
2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000

4.2.3 Scenario C: Application of existing Boa equipment to cold boned:

Value-added processors can apply Boa shaping technology to irregular shaped cold primals to increase product value for markets that require consistent portion size and easy preparation.

Boa Benefits:

<u>Primary Benefits</u>

- Shaping of muscles
  - The main benefit of Boa technology in its existing form for post rigor meat will be the packaging and shaping capability which provides the portion control of irregular shaped muscles.

- There is some interest within the industry for value adding lower grade cold boned muscles. This would be to compete with new products such Woolworths recently released product marketed as sizzle steak which is made by 'Beak and Johnson' using a press mould to shape and form topsides (Figure 4-1).

Figure 4-1: Woolworths shaped and sliced topside

  - The same costing examples as those used in the previous Scenario B above can be used. However, there are a number of limitations to using Boa for shaping cold post-rigor muscles as compared with warm pre-rigor:
    - Post rigor muscles treated with Boa are more likely to return to their original shape once the packaging has been removed unless cooking is done in the bag. Cooking in the bag would then indicate a roast application as compared to a higher value grilling portion.
    - If the product is marinated and tumbled to break down the fiber structure before Boa processing it will remain in close to the same shape after debagging. It could be portioned in the bag, then grilled but would have a marinade or flavourless moisture enhancement.
    - These limitations narrow the market for cold Boa processing to the lower end pub and club markets.
    - Although Boa's ability to shape irregular muscles is quite unique, it is arguable that highly marinated and tumbled primal's could be filled with some existing filling/stuffing machine

Changing target market of lower grade cuts of meat to mid-range cuts	Existing Market Size including white meat (Kgs p.a.)	Existing Red Meat Market Share	BOA Market Share	Red Meat Kg's to V.A.	Cut	Kg/year / cut	Current Sales $	New Sales Dollars	New Value	Net Benefit/ kg	Net Benefit
Total Market	**955200**	**63%**	**63%**	**604800**		**604,800**	**$ 5.64**	**$ 7.00**	**$ 4,233,600**	**$ 1.13**	**$ 682,395**
Supermarkets	350400	0%	0%	-	0 Cuts V.A.	-	$ -	$ -	$ -	$ -	$ -
Institutions -	0	0%	0%	-	0 Cuts V.A.	-	$ -	$ -	$ -	$ -	$ -
Domestic	0	100%	100%	-	0 Cuts V.A.	-	$ -	$ -	$ -	$ -	$ -
Pub/Club Steak	604800	100%	100%	604,800	1 Cuts V.A.	604,800	$ 5.64	$ 7.00	$ 4,233,600	$ 1.13	$ 682,395
Export Product	0	0%	0%	-	0 Cuts V.A.	-	$ -	$ -	$ -	$ -	$ -

Secondary Benefits

- Packaging capability
- Portion control
    - Boa's ability to prepare product ready for portion control has been mentioned in previous reports. This would require an additional piece of equipment to do the portioning. However, it has been difficult to justify any financial gain that would improve the equipments ROI:
        - Delivering consistent roasting portion size for foodservice would allow consistent cooking times but probably not at a premium
        - Consistent shaped product that increases a caterer's yield of plated roast from 75% to close to 100% would definitely return a premium. However, the fat and waste they cut off now at store would have to be removed during Boa processing and is expected to be of similar cost to the premium received.
        - Dicing and slicing of formed logs could also improve yield loss through reduction in fines and off-cuts. However, other technologies can achieve similar results so doesn't appear to be a core benefit on which to justify further Boa development.

Associated Benefits:
None

Return on Investment:

- Plant infrastructure will most likely already be in place in value-adding plants. However, infrastructure establishment costs have been assumed the same as those in hot boning plants for calculating ROI's below.
- Increases in product value of $1.13/kg have been assumed as per the costing table above.

BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of BOA Systems
2520	360	4.0	148,897	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1

Marketing considerations:
The limitations mentioned in the benefits section above indicate more consumer acceptance testing is required to confirm the real premiums that could be achieved with these new potential products.

4.3 Review 2: Up-scaling Boa technology to accommodate in-line commercial production volumes

Discussions with Boa development team identified the option of developing a large production scale system able to pack volumes per hour similar to that of a rotary vacuum packing machine. This type of machine would only be beneficial for large scale production plants and return on development cost would most likely require a large number of plants to install such a system.

Although this review does not provide a detailed analysis of the different strengths and weaknesses between hot and cold boning the following key points highlight the relevant issues:

1. There are only a limited number of hot boning plants in Australia
2. Savings in boning labour, chiller shrink and power costs up to 25% have been quoted for hot boning compared to cold boning
3. These savings are generally known to industry, however, the cost of converting a plant to hot boning and the perception and reality that hot boned product is significantly lower quality are disincentive enough for industry.
4. Industry currently does not have any economic motivation or thinking towards converting cold boning operations to hot boning operations.

Consequently, any benefits Boa can provide to maintain cold boned eating quality in hot boning plants on a national scale should be considered future enabling technology if and when environmental or economic pressures on industry make large scale hot boning a viable option.

To consider how realistic this type of large scale system could be some economic analysis have been included below:

A number of things should be considered carefully before progressing such an option:

- Current hot boning plants focus on lower value markets such as grinding meat. Although there is an option to upgrade cuts of meat with Boa, not all cuts make economic sense to upgrade. Therefore the real capacity required on a full scale commercial system is only a portion of total plant production and would need to be carefully assessed.
    - Assuming a hot boning plant were to process 8 primal cuts through the system the following table indicates the volume that would need to be produced per hour for the varying sizes of plants (on the left of the table) and the potential savings in packaging and pack labour costs on the right side if an up-scaled system were to operate and similar speeds to existing high speed systems.

8 cuts V.A.	Head killed per year	Boa Processed	BOA Kg / Day	Kg/hour & Hours Pdn. / day	Prototype Total Cost	# BOA Prototype Systems	Automatted System / Bags/hour	Packaging savings Auto vs Prototype
Head/wk	720000	43,421,919		360	$ 168,000	1	16 Hrs/day	$ 0.24
5000	240000	15,407,778	52,092	144.70	$ 3,103,000	21	1,085	$ 3,647,036
4000	192000	11,205,657	37,885	105.24	$ 2,388,000	16	789	$ 2,652,390
3000	144000	8,404,242	28,414	78.93	$ 1,816,000	12	592	$ 1,989,292
2000	96000	5,602,828	18,943	52.62	$ 1,244,000	8	395	$ 1,326,195
1000	48000	2,801,414	9,471	26.31	$ 672,000	4	197	$ 663,097

- Other constraining factors that limit the number of cuts upgraded include sales and marketing limitations and price and volume impacts on a plants existing markets

- The ability to automate Boa and reduce labour cost is not a simple challenge while still maintaining the core benefits of Boa which are to stretch (>20% of total length) and to shape irregular primal cuts.

Boa Benefits

- Overall increase in eating quality (increase in tenderness) (or reduced ageing time to get the same quality product from a cold boned plant, which would also lead to reduced infrastructure required as wouldn't need to hold the meat for long time period
- As lower grade muscles that would normal be used grinding
- An enabling technology in the future to maintain existing eating quality if other factors such as energy restrictions pressure conversion of cold boned plants to hot boning.

Primary Benefits

- Hot Boned Filling
    - Holding primal in elongated shape to maintain eating quality through chilling to match previous cold boned quality
- Tenderizing of muscles
    - Elevate tenderness beyond that of cold boned product through stretching
    - This would be an advantage for cold boners who convert to hot
- Shaping of muscles
    - Provided customer markets are willing to accept some cuts in a more portionable format this could be an extra advantage for existing cold boners to convert

Secondary Benefits

These are benefits that by themselves would not justify the use of Boa (Competitor products can do this) but are still realizable if primary benefits justify the investment:

- Packaging filling capability
- Portion control

Associated Benefits:

- Hot boning conversion
- Power, labour and shrink savings
- Different way of marketing some cuts (this could be as much a constraint depending on customer acceptance of some new product shapes and cut applications)

Constraints:

- Muscle shape would change dramatically for some cuts
- Additional infrastructure - Separate processing room required for Boa processing

4.4 General Considerations impacting on Boa's commercial application

A number of general considerations that impact on Boa's technical limitations and commercial constraints are applicable to most potential commercial scenario's considered in this review. These considerations have been identified below.

4.4.1 Raw Material Constraints

Muscle Fiber Alignment –

Boa capabilities that enhance the eating quality require placement of the muscles in the machine with muscle fibres aligned parallel with the direction of stretch. Muscle groups with multidirectional muscle bundles such as chuck and silverside will not benefit from stretching as the minimum 20% stretch will not be guaranteed on all muscle groups. Furthermore, overlying muscle bundles will pull apart from their formed shape during cooking. A more detailed list of these cuts is under development in Appendix 3

Additional Muscles to tenderize -
Meat tenderness is made up of a combination of factors including proteolysis, sarcomere length and connective tissue. Boa technology works on extending sarcomere length. Muscles like topsides that have a larger percentage of their overall tenderness impacted by sarcomere length will be tenderized more than muscles that are impacted more by the other 2 factors.
Although the contribution these three factors make to overall eating quality has not been quantified exactly, existing meat science research can provide a sound estimation of each of these factors on each primal.
The topside has been the primary muscle tested in the Boa to date but others are expected to deliver similar results in tenderness.
The type and volume of cuts that could or should be value-added in hot boning to prevent quality devaluation is being populated and awaiting technical information from the MSA researchers. A draft is included in APPENDIX 3.

4.4.2 Labour Cost on Slaughter lines:

- Labour shortages are a major issue in all Australian meat processing plants. People are often pulled from offal collection and other non-critical value adding excercises to man critical areas of the slaughter chain. Sourcing extra labour for Boa processing would have to provide at least as high a return as offal collection to justify allocation of FTE's to the process.
- Processing plants have indicated that in order to add more labour to operational equipment, there must be a significant return over their existing offal collection in order to justify it.
- Other value added processes such as offal capture are competing with Boa for FTE's. Plant visits indicate that 1 beef plant FTE represents $0.012/CCW Kg or $2.65/hd. 1 sheep plant FTE represents $0.01/CCW Kg or $0.21/hd. Depending on the particular plant constraints, other non-critical labour opportunities can be as high as $0.97/CCW Kg or $9.71/hd in the case of seasonal lamb processing.
- Costings in Appendix 7 demonstrate the type of returns existing non-critical activities return on labour cost.

4.4.3 Cost of packaging and consumables:

- Current Boa packaging cost is calculated at $0.45/kg including labour costs. A range of vacuum packaging costs have been retrieved varying from automated to manual systems. These current vacuum packaging costs have been confirmed with plants and are significantly lower than Boa packaging and processing cost. Bon bon wrapping efficiency make it difficult for the existing Boa configuration to replace bon bon wrapping on throughput alone.

		FTE's	$/kg
Conventional Vaccum Pack - Total Cost		**2**	**$ 0.21**
Conventional Frozen - Total Cost		**2**	**$ 0.11**
Boa Packaging - Total Cost		**2**	**$ 0.45**
Bon Bon Wrapping - Total Cost		**1.5**	**$ 0.28**

- Inefficiencies in existing boa packaging processes mean the added value boa has to achieve has to be larger to be viable.
    - As an example, one beef processing plant that places a lot of importance on cold storage inventory said reducing their ageing inventory would be viable even at a cost neutral position. Current benefit in reducing inventory by 20 days is estimated at a cost of $0.09/kg after Boa processing costs.
    - Reduction in boa packaging cost by up to $0.24/kg with an automated system would change this plants cost to a benefit of $0.12/kg (capital cost of large system not included in this calculation).

4.4.4 Commercial Readiness:

- The existing Boa prototype has enough capacity for some commercial applications. However, making the system robust for daily commercial performance is still required.
    - The premise for processing hot meat is to stretch and tenderize. Wide variation in muscle size results in stretch variation. A plant would not be able to control the variation in size of muscles to guarantee the minimum of 20% stretch required to protect tenderness.
    - An automatic variable stretch control could be integrated into the Boa allowing plants to process a larger weight range of cuts. Dean Gutzke estimated the cost of this development to be $20-30,000. We have assumed $18,000 of extra investment in Boa when calculating ROI's.
- Assuming capabilities are added to the system to control muscle stretch, we would like to discuss this prototype as a commercial piece of equipment during the plant reviews with a focus on confirming the operating requirements and marketing assumptions used to justify the ROI.

- Cut diameter impacts so significantly on amount of stretch. If installation of a variable "squeeze" compensated for muscle size to give the same stretch does the bag size also need to adjust? Assuming a 10cm diameter piece of meat and a 7 cm diameter piece of meat are both stretched 25% you would assume the bag diameter to contain them would need to different.
- Clipping bags after filling is required as a separate activity for the existing prototype Boa. These costs have been included in the assumptions.
    - **Development staff identified further testing to confirm if clipped chilled product will have the same shelf life as vacuum packaging.** This question was raised during the plant visit with Cargill and must not be overlooked as a critical factor in commercialization of this technology.
- Refining process for loading plastic (packaging holder may need to be adjustable in size to allow for different muscles to be processed)

4.4.5 Parts Maintenance and Engineering limitations

The primary purpose of this report has been economic analysis of the technologies benefits. Independent engineering advice should be obtained to quantifying the commercial readiness of the existing equipment. However, when observing the Boa in action the oil leaks and troubleshooting observed during the trials would indicate some re-engineering is required to prepare the existing system for reliable commercial operation.
Failure of the inner needs to be considered for full production. Inners currently cost around $300 but price is expected to reduce if the system is made available on a commercial scale). As the system has not been run in continuous production an accurate estimate of parts replacement costs is difficult.

5 References

Partners, F. I. (2008). Boa Technology Business Opportunity Review. Brisbane, Meat & Wool New Zealand, MIRINA Inc, Meat and Livestock Australia**:** 50.

Simmons, N. (2007). Mechanical stretching of pre-rigor meat for enhanced quality, Carne Tech**:** 12.

6 APPENDICES

6.1 APPENDIX 1 – Summary of 3 Scenarios

	Existing System						Future Large Volume Machine	
	Option 1 - Hot Boning		Option 1 - Cold Boning - Harvest Hot		Option 1 - Cold Boned Product		Option 2 - Large Scale Hot Boning	
	Primary Benefit	Secondary Benefit	Primary Benefit	Secondary Benefit	Primary Benefit	Secondary Benefit	Primary Benefit	Secondary Benefit
Hot Bone Filling	✓		✓				✓	
Shaping	✓		✓		✓		✓	
Packaging Filling		✓		✓		✓		✓
Portion Control		✓		✓		✓		✓
Tenderising	✓		✓				✓	
Competing Technolo	x	✓	x	✓	x	✓	x	✓

6.2 APPENDIX 2 – Summary of Economic Benefits by Scenario

Benefits	Application of Boa Technology in its existing form	$ /kg - treated cuts
Existing Hot Boning Plants		**$ 1.80**
Pre-rigor stretch		
	Increasing eating quality within existing cut usage	$ 1.80
Pre-rigor shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Reduce Bon-bon wrapping cost (currently -$0.17/kg)	
Cold Boning Plants - HARVESTING selected hot boned muscles		**$ 2.05**
Pre-rigor stretch		
	Increasing eating quality within existing cut usage	$ 1.80
Pre-rigor shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Reduce cold storage time (finance cost) (- $0.09 if only benefit)	$ 0.09
	Reduce cold storage operating costs	$ 0.03
	Reduce shrink loss	$ 0.14
Cold Boned - Post rigor processing		**$ 1.13**
Post-rigor Shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Packaging filling - currently a disadvantage due to labour requirement	
	Tail to tail bonding of Tenderloins to improve yield - this must be tested!	
Secondary Weaknesses**		
	Squeezing stretching action of Boa will reduce brine uptake and yeild on moisture infused product by ~14% of inhjected weight	
	Value-added product opens up to many competing technologies (pressing etc)	
Cold Boning Plants - CONVERTING to Hot Boning		**$ 2.16**
Pre-rigor stretch		
	Increasing eating quality within existing cut usage	$ 1.80
Pre-rigor shaping		
	Elevating cuts into a new use (Topside into Steak)	$ 1.13
Secondary Benefits*		
	Reduce cold storage time (finance cost) (- $0.09 if no primary benefit)	$ 0.09
	Reduce cold storage operating costs	$ 0.03
	Reduce shrink loss	$ 0.14
	Reduce Bon-bon wrapping cost (currently -$0.17/kg)	
	Reduction in boning labour - 20% of current	0.11
	Reduction in Energy Costs - 25% of current (TBC)	

*Secondary Benefits are costed assuming Primary benefits have already been implemented. It costs $0.18/kg more to pack Boa product than normal vacuum packing. The benefit of reduced storage time is $0.09/kg but costs $0.18 to pack. If no other benefit

**Almost NO testing of Boa has been done on cold boned product. Cold product has two distinct markets (higher value uninjected and lower value moisture enhanced). It is questionable without further trials whether BOA will compete well against other tech

6.3 APPENDIX 3 - Hot Boned Cuts capable of Boa Value-Adding

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
4																	EQ Contribution		
5	Hot cuts for cold bone plants	Cuts for Hot Bone Plants	Cold V.A. cuts	CUT	YEILD %	Hot Boned Bulk	Hot Bone V.A. (YP, PR eqiv)	Cow Prices	Grass fed	Shortfed (not MSA graded) 2008 approx.	Short fed 2-star	Short fed MSA 3-Star	MSA preimu over ungraded	BOA HOT V.A.	BOA COLD V.A.	Product Comments	Sarcomere Length	Proteolysis	Connective Tissue
6						60%	60%			115%	2007	2007							
7	2	1		**Cube Roll**	2.71%	$ 10.80	$ 12.30	$ 7.00		$ 20.70	$ 18.00	$ 19.50	$ 2.50			premuim product shape		50%	
8	2	1		**Tenderloin S/off**	1.06%	$ 13.20	$ 14.70	$ 7.00		$ 25.30	$ 22.00	$ 23.25	$ 2.50						
9	2	1		**Striploin**	2.32%	$ 7.65	$ 8.55	$ 7.00		$ 14.66	$ 12.75	$ 13.25	$ 1.50			tipping into grilled grade		60%	
10	1	1	1	**Inside**	5.77%	$ 2.94	$ 3.06			$ 5.64	$ 4.90	$ 4.90	$ 0.20						
11		3		**Eye Round**	0.63%	$ 2.94	$ 2.94			$ 5.64	$ 4.90	$ 4.90							
12		3		**Chuck Roll 5Rib**	3.77%	$ 3.72	$ 3.72			$ 7.13	$ 6.20	$ 6.20							
13				**Chuck Whole**		$ -	$ -			$ -									
14		4		**Chuck Tender**	0.04%	$ 2.40	$ 2.40			$ 4.60	$ 4.00	$ 4.00					60%	20%	20%
15		4		**Oyster Blade**	1.26%	$ 2.40	$ 2.52			$ 4.60	$ 4.00	$ 4.00	$ 0.20			don't age well like BI	40%		60%
16		4		**D-Rump**	3.88%	$ 4.38	$ 4.98			$ 8.40	$ 7.30	$ 8.30	$ 1.00			Negative is rump with different shape			
17				**Whole Rump**		$ -	$ -			$ -									
18		5		**Outside Flat**	1.58%	$ 2.94	$ 2.94			$ 5.64	$ 4.90	$ 4.90							50%
19		5		**Outside**	2.62%	$ 2.94	$ 2.94			$ 5.64	$ 4.90	$ 4.90							
20		5		**Knuckle**	3.54%	$ 2.82	$ 2.94			$ 5.41	$ 4.70	$ 4.70	$ 0.20						
21				**PE Brisket D/ON**	3.30%	$ 2.52	$ 2.52			$ 4.83	$ 4.20	$ 4.20							
22				**NE Brisket**	2.75%	$ 2.61	$ 2.61			$ 5.00	$ 4.35	$ 4.35							
23				**1 Rib NE Brisket**		$ 2.88	$ 2.88			$ 5.52	$ 4.80	$ 4.80				Primal and subprimal matrix of benefits			
24				**Brisket Skirt (ISK)**	0.44%	$ 3.24	$ 3.24			$ 6.21	$ 5.40	$ -				Break rump into 3 bits			
25				**Thin Flank Meat**	1.86%	$ 1.95	$ 1.95			$ 3.74	$ 3.25	$ -				Knuckle broken into 3 muscels.			
26				**Conical Muscle**		$ -	$ -			$ -									
27				**O.P.Ribs**	0.14%	$ -	$ -			$ -									
28						$ -	$ -			$ -									
29				**Rib End**	1.51%	$ 2.04	$ 2.04			$ 3.91	$ 3.40	$ -							
30				**Short Rib 3 Rib**	0.54%	$ 6.60	$ 6.60			$ 12.65	$ 11.00	$ -							
31				**Bone in Shin Shank**	4.70%	$ 2.07	$ 2.07			$ 3.97	$ 3.45	$ 3.45							
32				**Boneless Shin Shank**		$ -	$ -			$ -									
33				**Intercostals**	0.48%	$ 7.08	$ 7.08			$ 13.57	$ 11.80	$ 11.80							
34				**Butt Tenderloin**	0.18%	$ 13.20	$ 14.70			$ 25.30	$ 22.00	$ 23.25	$ 2.50						
35				**Shortloin**	1.51%	$ 6.90	$ 6.90			$ 13.23	$ 11.50	$ 11.50							
36				**Flank Steak**	0.51%	$ 4.26	$ 4.26			$ 8.17	$ 7.10	$ 7.10							
37				**Flank Plate**	0.85%	$ 3.78	$ 3.78			$ 7.25	$ 6.30	$ 6.30							
38				**Tri Tip**		$ -	$ -			$ -									
39				Clod						8.55									
40				**TOTAL PRIMALS**	47.94%														
41																			
42				**TRIM**															
43				**95 cl Trim**	1.49%	$ 1.20	$ -				$ 2.00								
44				**Chuck & Blade**	8.26%	$ 2.38	$ -				$ 3.96								
45				**65cl Trim**	6.22%	$ 1.14	$ -				$ 1.90								
46				**85 cl Trim**	######	$ 1.95	$ -				$ 3.25								
47				**90 cl Trim**	0.02%	$ 2.10	$ -				$ 3.50								
48				**Beef Body Fat**		$ 0.03	$ -				$ 0.05								
49				**Coli Muscle**		$ 2.10	$ -				$ 3.50								
50				**TOTAL TRIM**	26.97%														
51																			
52				**TOTAL SCRAP**	8.51%														
53																			
54				**SUB TOTAL**	83.4%														

6.4 APPENDIX 4 – Labour Opportunity Costs

Labour Opportunity Cost (these figures are a template only and <u>COULD NOT</u> be confirmed with plants during visits due to confidentiality issues)

Other value added processes such as offal capture are competing with Boa for FTE's. However, it was confirmed that 1 FTE represents between $0.011/CCW Kg and $0.97/CCW Kg depending on the activity and pant scenario.

OFFAL RECOVERY - LABOUR OPPORTUNITY COSTS

Number Killed	592		Average Weight	265	
Total HSCW	156,880		Total Offal FTE's	12	
			Labour FTE's Short	3	

FTE's Short to loose offal	CUT	Yield Expected %	Yield Achieved %	Target Recovery %	Actual Recovery %	$ Per KG	KG Expected	KG Achieved	KG Lost w/o Labour	Product Value Expected	Product Value Achieved	Product Value Diffrence
8	Grain Tongue	0.40%	0.38%	95%	95%	$ 15.30	596	596	0	$ 9,121	$ 9,121	$0
8	Grain Tails	0.36%	0.34%	95%	95%	$ 6.20	537	537	0	$ 3,326	$ 3,326	$0
8	Grain Thick Skirt	0.33%	0.31%	95%	95%	$ 5.25	492	492	0	$ 2,582	$ 2,582	$0
8	Grain Thin Skirt	0.49%	0.47%	95%	95%	$ 5.70	730	730	0	$ 4,163	$ 4,163	$0
7	Livers	1.77%	1.35%	76%	76%	$ 1.75	2110	2110	0	$ 3,693	$ 3,693	$0
8	Head Meat	0.65%	0.59%	90%	90%	$ 2.80	918	918	0	$ 2,570	$ 2,570	$0
9	Membrane	0.15%	0.14%	90%	90%	$ 1.00	212	212	0	$ 212	$ 212	$0
5	Tendon FQ	0.23%	0.16%	70%	70%	$ 9.00	253	253	0	$ 2,273	$ 2,273	$0
5	Tendons HQ	0.19%	0.10%	50%	50%	$ 8.70	149	149	0	$ 1,297	$ 1,297	$0
5	Kidneys	0.35%	0.18%	50%	50%	$ 0.87	275	275	0	$ 239	$ 239	$0
9	Lungs	0.71%	0.36%	50%	50%	$ 1.80	557	557	0	$ 1,002	$ 1,002	$0
6	Hearts	0.62%	0.43%	70%	70%	$ 2.10	681	681	0	$ 1,430	$ 1,430	$0
4	Cheek Meat	0.28%	0.25%	90%	90%	$ 4.00	395	395	0	$ 1,581	$ 1,581	$0
4	Lips	0.18%	0.17%	95%	95%	$ 2.10	268	268	0	$ 563	$ 563	$0
3	Spleens	0.34%	0.00%	70%	0%	$ 0.65	373	0	-373	$ 243	$ -	-$243
3	Aorta	0.05%	0.00%	75%	0%		59	0	-59	$ -	$ -	$0
3	Paddy Wack	0.15%	0.00%	80%	0%	$ 1.50	188	0	-188	$ 282	$ -	-$282
10	Beef Body Fat	0.64%	0.58%	90%	90%	$ 0.72	904	904	0	$ 651	$ 651	$0
10	Beef Kidney Fat	0.60%	0.54%	90%	90%		847	847	0	$ -	$ -	$0
12	Neck Bones	2.10%	1.89%	90%	90%		2965	2965	0	$ -	$ -	$0
12	Coli Muscle	0.22%	0.20%	90%	90%		311	311	0	$ -	$ -	$0
12	Neck Trim		0.00%	90%	90%		0	0	0	$ -	$ -	$0
	Total Red Offal	10.59%	8.22%									
1	MC Tripe	0.12%	0.00%	92%	0%	$ 5.00	173	0	-173	$ 866	$ -	-$866
1	Scalded Tripe	1.28%	0.00%	90%	0%	$ 1.50	1807	0	-1807	$ 2,711	$ -	-$2,711
2	Honeycomb	0.20%	0.00%	90%	0%	$ 3.00	282	0	-282	$ 847	$ -	-$847
2	Omasum	0.70%	0.00%	90%	0%	$ 2.00	988	0	-988	$ 1,977	$ -	-$1,977
3	Abomasum	0.15%	0.00%	90%	0%	$ 5.60	212	0	-212	$ 1,186	$ -	-$1,186
	Total Green Offal	2.45%	0.00%							TARGET	ACTUAL	Profit / Loss
	TOTAL OFFAL %	13.04%	8.22%						TOTAL $ Value	$ 42,814.74	$ 34,702.95	-$8,111.79
	Average $ Return per Body & Lost offal/hd	$ 58.62	-$ 13.70						Average Price per KG	$ 0.27	$ 0.22	-$0.05

6.5 APPENDIX 5 - Plant Visit Report

BOA SITE VISIT NOTES
Site visits were conducted to confirm assumptions in the models previously generated by Greenleaf Enterprises regarding the potential benefit of Boa to Australian Red Meat Industry. Some plants have requested to remain anonyms in the finale reporting process, and these originations are referred in the report according to the nature of the operation

The following tables summarises the plants visited.

Table 6-1

Company	Plant	Application	Page #
Australian Country Choice	Brisbane	Cold Boning of Beef, Hot Boning of selected cuts of beef in existing cold boning plant	29
Cold Boned Beef Food Processor: Cold Boned value add	QLD	Food Processing Industry	30
Beef Cold Boning	NSW	Cold Boning Beef	32
Fletchers	Dubbo	Hot and Cold boning of sheep and lamb	33
Beef Hot Boning	VIC	Hot Boning of beef	37
Summary Table			39

6.5.1 Australian Country Choice (ACC)

Dates:
1. **10/9/2008 (**View Boa treatment of Strip loins at ACC**)**
2. **25/9/2008 (**Catch up regarding application of Boa to ACC operation)

Application:
1. Hot bone harvesting of selected muscles in an existing cold boning plant
2. Value adding to cold boned muscles

Background: ACC's beef slaughter and cold boning processing facility is located in Brisbane. The larger portion of ACC's beef is sold direct to Coles. ACC in collaboration with UNE (University of New England) and MLA have conducted the first trial for Boa treatment of hot boned beef strip loins (*Longissimus Dorsi* or LD) in Australia. Objective and sensory results for the trial work are not currently available. Our costings have assumed increases in muscle tenderness as outlined by the MLA development team.

ACC comments in relation to the operation of BOA:

- Eating quality improvement - ACC, due to their relationship with their customer, would not increase the sell price of the finished product if Boa treatment increased eating quality. They still believe increased eating quality does add value and would provide a competitive advantage against competitor's products. For this reason they think it is worthwhile continuing investigation on Boa's ability to increase eating quality.
- Cold Storage – Minimising inventory of finished product is a serious KPI for ACC's supply chain. They believe a reduction in storage time required to achieve a level of eating quality would still be a benefit to their business if it was cost neutral or even slightly less than cost breakeven.

- Cold storage savings used in the modelling work have accounted for reduced meat inventory, reduced storage costs (at commercial cold storage rates) but have not accounted for reductions in chiller infrastructure although ACC mentioned the benefits of reduced floor space per volume of output.
- Their view on additional labour is much the same as tenderstretching. If it reduces storage time for similar eating quality then add the extra FTE.
- Cold storage benefits are not applicable for all meat processors.

Capital Investment required

- Unsure about the capital costs required for infrastructure development if selected primals were to be hot bone harvested within the existing cold boning plant, however capital cots required to do this would be significant.
- ACC's preferred option for moving forward is to setup a pilot plant possibly in a chiller where selected muscles could be hot boned and treated using the existing BOA equipment as carcasses pass through to final chiller destination. This option would avoid significant capital outlay and provide opportunity to further assess the benefits of Boa treated muscles.
- If pilot studies showed positive results for Boa treated muscles, the equipment would then require further development to increase processing volume and reduce the required labour.
- ACC will consider commercially viable processes or interventions that would provide opportunities to increase eating quality and reduce the cost of storage through a reduction in the amount of time required for ageing

6.5.2 Company: Cold Boned Beef Food Processor

Contact Point: Plant Manager, Plant Engineer
Dates:

1. **6/9/2008** Meet with plant staff in Brisbane to observe operation of Boa for treatment of brine injected beef topsides supplied by the plant.
2. **13/10/2008** (Meeting with plant staff regarding results from topside trial and discuss opportunities for Boa within the organizations processing operation)
    a. Product from these trials was tested at Fine Food Melbourne for consumer feedback but results were not yet available when we met.

Background:
The organization is a fresh meat portion control and value-adding company. They have been investigating different processing equipment and methods for value-adding cold cuts of meat. They have a particular interest towards equipment that could provide muscle shaping opportunities.

Application:

1. Food Processing – value-added cold boned cuts
2. Bonding and forming steak cuts

Comments on existing system:

1. They were quite impressed with the presentation of Boa treated cold boned beef topside.
2. Labour cost is too large for their business. The driver of this is such a low throughput per hour. The assumptions used 2 cuts per minute but the company questions whether the existing system could process this much volume in the current configuration.

3. Brine yield loss occurs prior to packaging because of the Boa's squeezing action on the injected muscle. During the trials Topsides were injected with brine to 30% but had almost a 14% reduction in injected weight after packaging through the Boa process. Losing half the brine is a disadvantage of Boa and affects product quality and profitability.
    a. It was noted during the meetings with the company that their trial was the first testing of Boa on injected, value-added meat cuts. In value-added processing there are many competing technologies that fit specific purposes within a broad and widely varied set of value-adding capabilities?
    b. Keep in mind that Boa's novel technology is to stretch and tenderise 100% meat cuts and form into a cylindrical shape (or oval using a mould to squash the bag). Adapting Boa to value-add processed meat product is a step away from this novel technology and should be considered carefully.
    c. If Boa is reengineered for high speed fresh meat packaging it may become less adaptable to processed meat products.

Considerations for Boa Cold Processing:

4. Irregular shaped muscles can be formed to maintain thier shape with Boa but they have to be injected and tumbled first to break down some of the muscle structure. This limits the market for the finished product to that of value-added processed meats.
5. The company mentioned that they are looking at a number of technologies provide value adding opportunities. They noted that Boa is not yet well developed but were keen to see the development continue. The presentation of the finished product was the key thing that impressed them because of the perceived potential to create a new product line.
6. There are a number of other equipment suppliers and techniques for filling and forming lower quality value added products (pressing, filling etc)
    a. Ross
    b. Trief
    c. Handtmann
    d. Marel vacuum moulding

Greenleaf's previous prduction experience with the machine pictured above showed some significant limitations in shaping fresh meat too far beyond its natural shape. The product was portioned very precisely and presented impressively straight after vacuum portioning. Although it is difficult to tell in the photo below, portions that were varied too much from their regular shape during portioning would return to thier original shape after resting and resulted in uneven cooking.

The same limitations will occur with Boa where fresh, unprocesses meat is changed in shape and portioned.

6.5.3 Company: Beef Cold Boning

Contact: Plant Manager, Slaughter Floor Manager, Boning room and further processing manager
Date: 24/10/2008
Application: Cold Boning Beef.

Background: This Company is one of the top five processors in Australia with two beef slaughter and cold boning processing facilities in Australia. One of the facilities is considering beginning a second shift doing hot boning early next year. The operations manager has requested more information in relation to the potential opportunities of Boa a hot boning application.

Meeting Outcomes:

1. The company had no prior exposure to Boa technology so part of the visit involved outlining and explaining the history and objectives behind the development of the Boa equipment. We explained potential benefits and showed slides and video of and previous Boa trial's that were conducted.
2. We inspected the slaughter floor and observed potential opportunities for hot boning selected muscle cuts on floor. We reviewed the boning room flow and packaging machines to confirm the costs of packaging traditionally compared with Boa.
3. Looked at spreadsheet developed by boning room manager for quantifying value and cost of offal cuts
4. Focused on identifying potential opportunities where Boa would have application in the plant
    a. Value adding to knuckle, the target market would be interested in opportunities for value adding knuckle as it is currently difficult to move.
    b. Plant staff also saw opportunities for improving the eye round. However, harvesting of silverside and eye of round as hot product in a cold boning plant is not possible.

c. The recent sizzle steak and its market success were discussed. The plant would be interested in developing similar value add cuts. Although they would not receive any increase in value any benefit for their client would be viewed favourably.

5. Two key points were raised by plant staff that should be considered before commercializing.
   a. Shelf Life – Because the Boa bags are clipped and not vacuum sealed they believe the maximum shelf life will be about 2 weeks. Shelf life does need to be tested as a priority if not already done.
   b. Labour shortages are a significant issue for the plant with a lot of focus on installing equipment that reduces labour costs and on the removal of non-value-adding labour positions. Due to labour shortage people can be transferred from offal collection to fill critical slaughter positions. Senior management like the idea of Boa but indicated the return on investment would have to be significantly higher than the current opportunity cost of labour. The opportunity cost of labour from offal and other non-critical jobs has been estimated at a minimum of $210/FTE/Shift.

Product	Xtra Labour FTE's	Labour Cost	Volume /Hd	Value /Shift	Net Profit /FTE /Shift	Net Profit /FTE /Kg
Offal's	6	$ 1,400	1000	$ 2,655.40	$ 209.23	**$ 3.36**

6. Any capital investment required to set up a facility for Boa or to harvest hot cuts of the slaughter floor would need to deliver around 25% internal rate of return to be considered favourably.

6.5.4 Company: Fletchers (Dubbo)

Contact point: export manager, Export marketing representative, Export marketing executive, and Middle East Marketing
Date: 22/10/2008
Application: Hot boning of mutton for export market and cold boning of lamb for domestic and export markets

Background: The most extensive trial work regarding the use of Boa Technology in Australia has been conducted at Fletchers (Dubbo) by NSW DPI and MLA. Fletcher's sales staff was familiar with the operation of the Boa equipment, and products produced by Boa. The site visit consisted of a discussion with the sales staff regarding market opportunities and limitations that exist for Boa treated lamb and mutton products. We inspected both the slaughter and hot and cold boning operations to assist in identifying some possible opportunities for Boa to add value to their business.

Product: Hot Boned leg
Market:

- United Kingdom – used for Indian curries. Product is diced and slow cooked. Any issues with eating quality through hot boning process are overcome through preparation and end usage.
- Middle Eastern countries – slow cooked for use in catering. Preparation technique overcomes any hot boning issues with eating quality.

- Japan – sliced marinated Jungas Kan style product. This product is very thinly sliced and cooked in shabu shabu style. The product is very price sensitive with customers changing between leg, shoulder and backstrap product dependant on price.

Packaging: IW frozen. Packaging process is fully automated with film cost approximately 30% of cost of vacuum bags or 4 cents/kg (23c/vac bag x 2 kg boneless leg)

Market dynamics impacting on relevance of BOA to hot boned sheep:

- Current markets are large enough to take total Australian Hot boned volume and cost structures provide sound margins that limit processors incentive to develop new products and invest in new markets.
- Current hot boned product is price sensitive due to end use and does not allow increased sell price (for increased eating quality or added packaging and portioning convenience) beyond basic supply and demand constraints
- Hot boned backstrap denuded is currently priced 20-30% higher than beef TDR. Mutton Eye of loin is 100% more than beef at $23/kg.
    - Increasing eating quality of these cuts through Boa processing does not mean a higher selling price as product is already expensive compared with other meats.
- Lamb loins wholesale for $7.00/kg. Lamb legs wholesale for $6.00/kg. Any opportunity to increase value of legs has downward pressure on price from existing higher quality loins.
- Fletchers tried making a value added blackstrap item for the airline catering. Raw material value was $12.00/kg but added $5.00/kg of labour and processing costs to make the finished product. This included 10% brine injection and had to be $\pm$ 4 grams portion weight. Final price was too high. Standard airline meat price (beside fish is $6-7/kg).
    - (Could boa processed chuck roll achieve a similar finished product but at the right price point?).
    - Boa will help with portion weight but will potentially reduce brine uptake.

- Cold boned lamb legs and shoulders are being processed as slow cooked cuts and roasts for the Middle Eastern and USA markets. Because the product already has 40days ageing during shipping any enhancement in tenderness is not going to be an advantage for their existing markets.

- Mutton shoulder rolls are being produced for Taiwan. Shoulder blade is filled into 3kg, 120mm diameter rolls and clipped using a very simple semi-automated stuffing machine. The product is frozen and sliced 1-2mm thick in Taiwan. Eating quality is not an issue.

- Mutton is all being used for manufacturing.

- There is no opportunity for value-adding of mutton in the domestic market due to potential damage it could have in devaluing the existing lamb market and prices.

Technical limitations to Boa Benefits:

- Sheep cuts are very small in comparison with beef. The primary benefit of BOA to stretch and tenderise muscles requires their muscle fibres to be aligned length ways in the Boa to obtain that benefit. Separating lamb primal to achieve this results in very small cuts and is prohibitive. Subsequently leg primal separation is not done. Connective tissue in the leg is therefore not removed. Boa does not assist in tenderisation of cuts with high amounts of connective tissue so enhancement of leg primals to higher value markets without large amounts of labour is limited.

- Sheep subprimal cuts are not large enough for the current Boa system unless bonding multiple backstraps together for example.
- Issue of Electrical stimulation on sheep processing. A lot of money has been invested in improving the electrical stimulation of sheep to improve eating quality. However, hot boned E.S. product does not have the same functional binding capabilities as non-E.S. If any products were to be developed that use the binding capabilities of hot boned meat, this will be in direct opposition to the E.S. policies and procedures being developed at plants in conjunction with MLA. What the net financial and eating quality implications are for Boa versus E.S. do need to be quantified as they appear to be in opposition.

Labour shortages impact on Boa:
Labour shortages across the processing industry are not uncommon to Fletchers who have placed a large focus on finding ways to limit absentees.

Fletcher's staff identified a number of areas within their existing business where staff shortages are costing them money. We have used these examples to estimate the opportunity cost of labour to Fletchers. Given the labour requirements of the current Boa format, any benefits will have to be significantly above the existing opportunity cost per FTE to make boa processing worth considering.

Lost Offal opportunity:
Brains, Hearts, livers, tongues, tripe and runners are collected.
No offal's are being collected on second shift due to labour shortages.

Brains sell for $0.7/piece and require two labour units to pack off and $0.15/kg estimated cost. So 4000 head for second shift = $2,800/day at cost of $470 = $1730/day profit or $865 profit /shift/FTE or $200,000 annually.

Fletchers mentioned other projects they are currently putting on hold to increase product value with existing customers and existing product specifications which they cannot fill because of labour shortages.

- Frenching racks for European customers is a seasonal opportunity that is never realized due to labour shortages.

Product	CCW	Carcase Yield	SMY Kg's	$/kg Sell	$/Hd Sell	Xtra Labour FTE's	Labour Cost	Volume /Hd
Standard Rack	20	10.0%	2	$ 6.00	$ 12.00			
Frenched Rack	20	5.5%	1.1	$ 20.00	$ 22.00	5	$ 1,167	4000
GM $/kg	GM $/Hd	GM $/Shift	Net Profit /Shift	Net/ Profit /Hd	Net Profit /FTE /Shift	Net Profit /FTE /Kg	Sales - % of Annual	Net Profit p.a.

$ 14.00	$ 10.00	$ 40,000	$ 38,833	$ 9.71	$ 7,767	**$ 0.97**	20%	**$1,864,000**

New Potential Opportunity for plants boning both hot and cold product:
Potential to hot bone lower value existing cold boned lambs –

- Small low muscular lamb carcases that will not produce a good lamb rack and are often cut as full bone-in loins. Carcase sales value is not great and demand is low. If these carcases could be identified on the slaughter floor there might be a benefit in boning them hot to produce the following items:
    - Boneless leg cuts - Boa processed for higher quality leg roast market or processed using existing hot boned Boa roasting cut
    - Boneless Boa processed backstrap where 3-4 back straps are filled hot with Boa to produce a premium backstrap – assumes this primal is the one that increases significantly in value compared with selling whole bone in loins
    - Shoulder as hot boned and sold into existing hot boned shoulder markets or new Boa lamb roast shoulder.

Benefit:

- Reduction in boning labour cost
- Reduction in energy costs
- Reduction in chiller shrink
- Potential to value-add lower value lamb carcases

Limitations / Barriers:

- Scheduling and capacity availability with existing operations

Detailed Opportunity and Technical Questions that would need to be addressed

- Does bone-in cold bone leg prevent muscles in leg from shortening? If so, does hot boning and processing through Boa without fibre alignment deliver similar, better or worse eating quality than cold boning? If worse than potentially not worth doing, but if as good as cold than hot boned benefits in some lamb carcases could be worthwhile. For example:

KEY ASSUMPTIONS to confirm before assuming this could be viable

- Do leg and shoulder cuts boned hot with Boa have similar value as previous cold boned cuts?
- Will bonded backstraps have greater value than previous cold boned commodity loin (remember these are smaller muscled lower value lambs before value-adding)?
- Savings between hot and cold boning of 20% energy cost and 25% labour cost
- Savings in shrink of 2% (2.8% down to 0.8%) because of hot boning and boa processing

Other Potential Value-adding opportunities:

- Current Jungas Kan item requested by Japanese to have chuck roll removed. Then Japanese wanted to pay less for the 85 CL shoulder bulk pack, and then did not want to buy the chuck roll at all.
- There is currently some yield loss on the chuck roll. Is there any opportunity to hot bone the shoulder to reduce labour cost, then remove the chuck roll and fill and bind the product to form a new value added item?
- Consideration - This area of hot boned filling and bonding hasn't been tested. But if successful, the ability to bond small back straps and chuck rolls to increase finished product value could provide some solutions to the sheep processors.

Additional comments:

- Alignment of the product in the Boa should be loaded in a horizontal orientation rather than vertical for ease of operation.

6.5.5 Company: Hot Beef Boning

Contact point: Plant staff via phone conversation and plant inspection

Application: Hot Beef boning

Background: The plant is a hot boning beef plant that process predominately cow beef plus a small percentage of yearling beef. This plant has established markets where they value-add some of their sweet cuts by bon bon wrapping.

A major limitation with the current equipment is the labour required to operate the machine.

Current production performance for BON-BON wrapping

- Hot 540 animals per day.
- 100kg per side
- Currently at 1 labour unit is bonbon wrapping all Cube roll, Tender Loin and 20% of strip loins

The value of Boa wrapping to the plant is not in the increased value the company will get from the product because they are already wrapping product. The benefit would be in any cost savings in packaging labour.

There may be some opportunity to increase product value but current indications cannot confirm this will occur.

The plants current packaging costs are estimated at $0.28/kg compared with $0.45/kg for Boa. Note in the table below that cost of labour for Boa in its current form is no more than manual boa wrapping. The current cost difference is in packaging. For Boa to be more beneficial, increased through-put per FTE will be required to offset the increase in packaging costs.

BOA PACKAGING			Kg/pc	Pcs/min	Kg/hr	FTE's	Labour /hr	$/kg
Boa Packaging - Total Cost						**2**		**$ 0.45**
Labour Cost	Filling &Bagging	$ 53,200	3	2	360	1	$ 29.17	$ 0.08
	Clipping & Cartoning & materials handling	$ 53,200	3	2	360	1	$ 29.17	$ 0.08
			Kg/pc				Cost/meter	**$/kg**
Packaging cost	Plastic Tubing		3				$ 0.67	$ 0.22
	12-14 kg Carton		13				$ 0.66	$ 0.05
	Clips ($/each)	$0.02						$ 0.01
BON BON WRAPPING		Labour Cost	Kg/pc	Pcs/min	**Kg/hr**	**FTE's**	**Labour /hr**	**$/kg**
Bon Bon Wrapping - Total Cost						**1.5**		**$ 0.28**
Labour Cost	Wrapping	$ 53,200	1.92	2.25	259.8	1	$ 29.17	$ 0.11
	Cartoning & materials handling	$ 53,200	1.92	2.25	259.8	0.5	$ 14.58	$ 0.06
			Kg/pc				Cost/pce	**$/kg**
Packaging cost	Wrap plastic		1.92				$ 0.05	$ 0.03
	Lid and Base		18				$ 1.34	$ 0.07
	Dry Ice, Blast Freeze							$ -
	Carton Liner		15				$ 0.20	$ 0.01

Key comments

- Plant staff were impressed with presentation of Boa treated product
- Current configuration
  - Not fast enough
  - To high labour requirement for operation.
- It was suggested the system be installed horizontally as opposed to vertical orientation with product filled in one end and exiting from the other end in a continuous flow.

Table 6-2 Key opportunities and limitations of current Boa technology in

PLANT	Priority/ Ranking*	APPLICATION	OPPORTUNITIES	LIMITATIONS
ACC (Australian Country Choice)	1	1. Cold Boning Beef 2. Harvesting selected hot bone cuts for treatment with Boa	Value adding hot boned cuts Reduction in the amount time required to age Strip Loin	Cost of capital required to make infrastructure changes to make hot boning of selected cuts possible within the existing plant. Cost of labour required to operate the equipment
			Competitive advantage achieved through pre-rigor stretch resulting in improved eating quality	Increase in eating quality expected from Boa treatment is still needs further testing for Beef.
			AAC preference is to setup a Boa pilot plant to allow for more trial work to be conducted to quantify the added eating quality benefits that can be expected from Boa treated products, and test markets for newly develop Boa treated products.	
Cold and Hot Boning beef	2	Cold Boning Beef	Interest in the potential of Boa for improving value of lower quality cuts for Woolworth's market. Potential cuts for Boa treatment included Knuckle, (silver side for if possible)	As Cargill had not had any previous experience with the equipment, practical operation of the existing equipment was communicated to Cargill staff based on results from trials conducted at ACC, Earle products and Tabro meats
		Hot boning	The Wagga plant is planning o start a second shift using hot boning. Senior management has expressed interest in the application of Boa technology on this product. Needs follow up as there may be more opportunity for application of Boa in the Wagga Wagga plant	
Beef Food Processing	4	Food Processing for Beef	Value adding topsides,	The amount of product that the current system can process is a limitation largely because of the resulting high cost of labour. (After observing boa treatment of brine injected topsides at Earle product AACo represent ivies were unsure of Boa capability to processes two cuts per minute
			Potential for higher speed binding of TDR's (tail-tail) will also result in a reduction in waste during portioning	Brine yield loss for injected product (up to half injected weight lost due to Boa squeezing action)

PLANT	Priority/ Ranking*	APPLICATION	OPPORTUNITIES	LIMITATIONS
			Creating new value-added beef products – interest from AACo to explore Boa's wider Value-adding capabilities.	Suitability of Boa to none core capabilities may distract from development of the machines core commercial application.
Hot Boning beef	5	Hot Boning Beef	Impressed the presentation of Boa treated muscles.	The amount of product that the current system can process is a limitation largely because of the resulting high cost of labour, Existing manual bonbon wrapping of muscles much more efficient use of labour
Fletchers (Dubbo Plant)	6	Hot Boning Lamb	Potential option to hot bone some existing cold boned lambs. Primary benefit in hot bone cost savings with possible secondary benefits in increased product value (requires investigation)	With Boa in its existing form there are several other opportunities within the plant that would give a better return with the extra labour needed to operate the Boa equipment. (e.g., water frenched racks, offal collection)
				Sheep cuts are very small in comparison with beef, resulting in reduced number of suitable cuts for Boa processing as compared to Beef.
				Current markets are large enough to take total Australian Hot boned volume. Product is price sensitive due to end use and does not allow increased sell price (for increased eating quality or added packaging and portioning convenience) beyond basic supply and demand constraints
				Advise against value adding mutton for the existing domestic market due to damaging effect that it may have on existing lamb prices.

*priority considers plant interest, potential benefit to the plant and ability to use an upgraded version of the existing system now as compared with a fully re-designed high speed system

6.6 APPENDIX 6: Boa Technology & Competitor Products

Previous reports submitted to MLA have identified, and outlined several technologies that provide similar value added benefits for boned red meat products with descriptions of hand wrapping, a whole muscle stuffer produced by Schroder, and Pi-Vac system are provided on pages 34-36 (Partners 2008).

TECHNOLOGY CAPABILITY	Hot/ Cold	BOA	Hammax	PiVac	Marel	Manual	Comments	$ Benefit / Kg
HOT BONE FILLING: Placing hot meat in bag to maintain pre-rigor shape and minimise shortening and toughening of muscle during rigor and chilling.	Hot	✔	✔	✔		50%	Hammax bag sizes have to be fitted to muscle to prevent small muscles folding over in larger bag. Manual Bon-Bon method current practice but labour intensive. PiVac as effective as BOA but bag size not consistent enough to allow exact portioning (see below)	consistent pdct Q. no value assumed
HOT BONE BINDING: An extension of Hot Bone Filling - Placing multiple hot meat in single bag to use hot meat binding to "glue" together.	Hot	✔	✔	✔		✔	Example - binding tenderloins head to tail to provide consistent portion sizes for the entire length. Most other technologies could do this with varying levels of portion control so is considered a secondary benefit.	N/A
TENDERISING: Stretching muscles to increase tenderness where sarcomere length is the major contributor to tenderness	Hot	✔		?			PiVac is used for hot boned product but cannot stretch a muscle more than 20% of its resting state (the minimum required to improve tenderness, compared with maintaining tenderness under FILLING attribute)	$ 0.51
SHAPING: forming irregular shaped muscles such as topside for precise filling into bag so shape can be maintained for portioning.	Hot & Cold	✔					Hammax does not fill irregular shapes without significant yield loss. PiVac stretch bags don't have enough force to significantly change the shape of the subprimal. Unless BOA product is heavily marinated or massaged it will return to original form after portioning.	$1.92*
PACKAGING FILLING: Stuffing product into bags for freezing in shape, cooking, portioning. Similar to PORTION CONTROL below without consistent fill, nore exact portion weights.	Hot & Cold	✔	✔	✔		✔		Value not calculated
PORTION CONTROL: Similar to SHAPING but also applied to cylindrical muscles to fill all parts of the bag to give consistent diameters and precise portion weights	Hot & Cold	Prep. Ready for portioning	Only prep. Some cuts for portioning		✔		PiVac bags are not consistent diameter. Hammax could stuff to a consistent diameter but bag size must be fit to muscle size for cylindrical muscles only.	Value not calculated
Primary Benefit	Benefits that create the greatest value and ROI with limited or not competition from other technology							
Secondary Benefit	Smaller benefits or possible with other technologies. Would not justify the equipment but would achieve benefit if Boa was installed because of a primary benefit							
Has not been tested	Hard to see this being a pririty focus of further R&D							
* Value only achieved if used in conjunction with tenderising (stretch must be greater than 20%)								

 Hammax 800	 Tubes stuffed with meat: • no stretching capability to enhance eating quality • no ability to conform irregular shaped muscles such as topside into tubes without significant cutting of the subprimal
Pivac	

The table below lists the benefits that Boa treated product provides as compared to meat processed using competing technologies. Vacuum packing has not been mentioned in the current analysis because it is not considered a muscle shaping and or stretching technology. Marel is also considered in the analysis as it an example of equipment used for portion control.

As stated in the background information the main driver for the development of the Boa technology was to capitalize on the increased eating benefit that can be achieved through pre-rigor stretching. This is largely achieved through increasing the tenderness of the muscle by increasing the distance between Z-bands in the sarcomeres prior to rigor. During the process of treating muscle with Boa, muscles are stretched between 5 and 35% of its original length, and then forced into bags to hold the stretch during the rigor process.

6.6.1 Comparing technologies for hot boning

Of all the four technologies described below the most competitive technology for pre-rigor stretching as compared to Boa would likely be the bon-bon or the hand filled bazooka type methods. The main purpose of design for the Hamax equipment has been stuffing of whole cold boned muscles into artificial casings. As this action is achieved through a compression type mechanism it is assumed that there will be little or no stretch advantage with use of Hammax equipment on hot boned muscle, and therefore no improvement in the eating quality of the

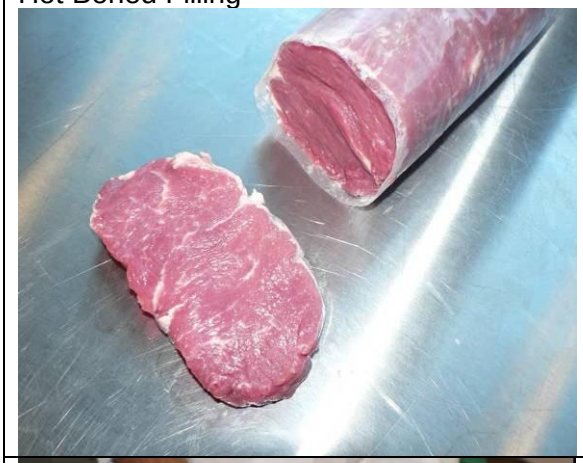
muscle. While the Pi-Vac system has been specifically developed for processing of hot boned muscle, and the restraining force of the elasticized film is designed to hinder contraction and thereby reduce toughening, no specific action is applied to stretching the muscle prior to rigor to improve the tenderness.

Boa treated hot boned muscles will have superior pre-rigor stretching capabilities and it is assumed therefore, superior eating quality.

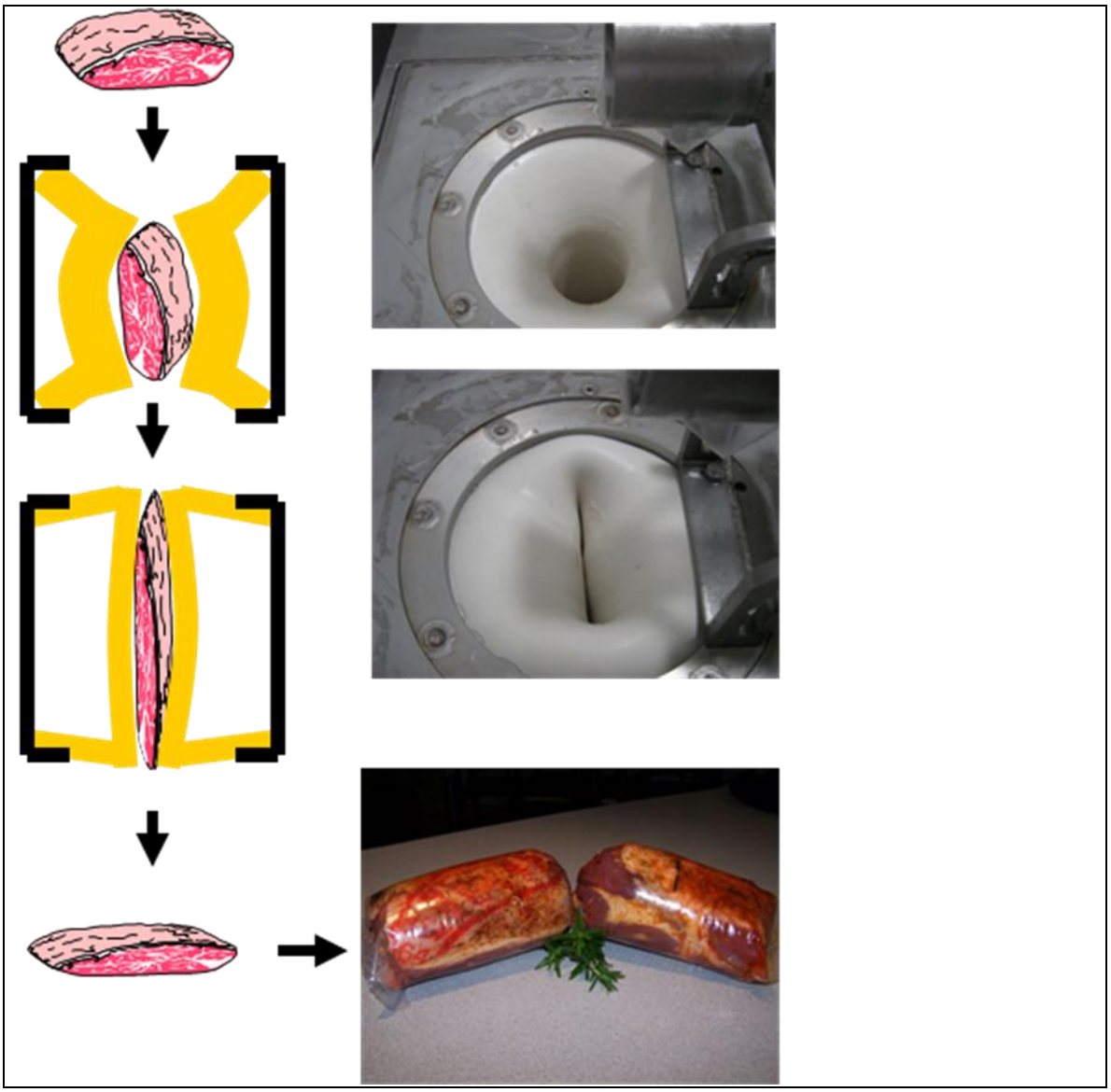
6.6.2 Comparing technologies for cold boning

Whilst the main driver for developing Boa was to stretch hot boned muscle prior to rigor, the filling, packaging, and shaping mechanisms used during this process also offer some potential value for the processing of cold boned muscles. 30% of all domestic red meat in Australia is consumed via the food service industry where consistency, uniformity, and presentation are highly valuable. Packaging of cold boned muscles that have been previously injected with a marinade and tumbled can be used to manipulate the shape of irregular shaped muscles such as top sides. Figure 6-1 shows a comparison between untreated and top-side muscles treated with Boa. The Boa treated muscles are desirable for the food service industry because the cooking will be more consistent, and also potentially the finale presentation of the product will be more consistent. The Hamax which has been specially designed for this type of operation will have a higher volumetric processing capacity, and a lower labour requirement, however it also has a higher capital cost, and also based on communication with the Australian distributors (Andrew Schurker CBS Foodtech) would not have the flexibility to process large muscles such as beef top-side. Pi-Vac technology could also be used for processing such cold boned muscles; however the ends of muscles would not have good consistent flat ends such as the muscle shown in Figure 6-1. Hand filling, or bon-bon techniques can also be used to achieve a similar result with no capital requirement, however ease and efficiency would be greater with the Boa technology.

Examples of Boa technology benefits are displayed in the following table:

Hot Boned Filling 	
	Figure 6-1: Comparison of Boa treated and untreated cold boned marinated beef top side
	



6.7 APPENDIX 7: Boa Technology Benefits and Competitor Products

Excerpt from excel costing sheets containing detailed assumptions. These costing assumptions will be reviewed with plants.

Strategic Benifits

COLD CUTTING BENEFITS													
BEEF		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit							
Changing target market of lower grade cuts of meat to mid- range cuts	Existing Market Size including white meat (Kgs p.a.)	Existing Red Meat Market Share	BOA Market Share	Red Meat Kg's to V.A.	Cut	Kg/year / cut	Current Sales $	New Sales Dollars	New Value	Net Benefit/kg	Net Benefit	Red Meat Market Growth (Kgs)	Red Meat Market Growth ($)
Pub/Club Steak	604800	100%	100%	604,800	1 Cuts V.A.	604,800	$ 5.64	$ 7.00	$ 4,233,600	$ 1.13	$ 682,395	-	$ -
EXISTING HOT BONING PLANTS													
		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit	COLD Pack & Labour	BOA Pack & Labour Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit		
Current Hot boners can increase value of existing cuts	4 Beef Plants	4	3,227,641	$ 7.83	$ 8.84	$ 3,261,353	$ 0.21	$ 0.45	$ -	$ 0.77	$ 2,497,367		
		Volume / Year	Labour saved / Kg	Packaging Saved /kg	FTE's saved	FTE Cost	COLD Pack & Labour	BOA Pack & Labour Costs		Net Benefit/kg	Net Benefit		
Reduce cost of Bon-Bon wrapping with Boa	Labour and Packaging differences		$ 0.01	-$ 0.17	$ -	$ 45,000	$ 0.28	$ 0.45		$ (0.17)	$ -		
FUTURE HOT BONING PROCESSES - ENABLING TECHNOLOGY FOR OTHER BENEFITS													
		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit	COLD Pack &	BOA Pack & Labour	Hot Boning Premium	Net Benefit/kg	Net Benefit		
Harvesting hot boned leg cuts from current cold boned plants. Increase value from roast to catering steak.	1 Beef Plants	1	2,437,292	$ 5.64	$ 7.00	$ 3,326,904	$ 0.21	$ 0.45	$ -	$ 1.13	$ 2,749,994	Although value added cuts can be made from the enhanced raw material the increase in value is only up to that of outsourced raw material of the new standard of quality.	
		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit	COLD Pack &	BOA Pack & Labour	Hot Boning Premium	Net Benefit/kg	Net Benefit		
Increasing quality grade of cuts for existing market	1 Beef Plants	2	2,123,512	$ 17.92	$ 19.96	$ 4,330,812	$ 0.21	$ 0.45	$ -	$ 1.80	$ 3,828,175		
		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit before Interest saving	Gross Benefit /Kg	Saved Ageing Days	Interest Rate p.a.	Net Benefit/kg	Interest & Value Benefit	**Benefit w/o Boa cost**	
Achieve 20 day aging tenderness in 20 hours - reduce finance, refrigeration & pallet cost	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 17.92	$ 17.92	$ (502,637)	$ (0.24)	$ 0.03	$ 0.09	$ (0.12)	$ (257,911)	$ 0.12	0
		Total Cuts Value Added	Kg/year	Standard Shrink	BOA Shrink	Average $ Value			Hot Boning Premium	Shrink Benefit /kg	Shrink $ Benefit p.a.		
Reduce shrink loss from cold boned to hot boned		3	4,560,804	2.0%	0.8%	$ 11.35			$ -	$ 0.14	$ 621,436		

Detailed Assumptions

COLD CUTTING BENEFITS

BEEF		Total Cuts Value	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit										
Changing target market of lower grade cuts of meat to mid- range cuts with higher returns	Existing Market Size (Kgs p.a.)	Red Meat Market Share	BOA Market Share	Red Meat Kg's to V.A.	Cut	Cut % of BOA Share	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Net Benefit/kg
Supermarkets	350400	0%	0%	-	0 Cuts V.A.	0.00%	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Rotisserie Product - Elevate beef quality and allow competing against chicken in deli? Benefit is increased sales against chicken.					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45	
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
Institutions - V.Added	0	0%	0%	-	0 Cuts V.A.	0.00%	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Uniform shape for easy cooking and portioning - convenience and slight quality benefit	Volume based on throughput of one machine is more specific ROI. It is questionable the value caterers would be prepared to pay for this convenience.				0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45	
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
Domestic Foodservice	0	100%	100%	-	0 Cuts V.A.	0.00%	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Explaination and assumptions TBC					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45	
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
Pub/Club Steak	604,800	100%	100%	604,800	1 Cuts V.A.	100.00%	604,800	$ 5.64	$ 3,408,048	$ 7.00	$4,233,600	$ 825,552	$ 1.37	$ 0.21	$ 0.45	$ 1.13
Shaped Inside steak improves quality beyond that of cow cube roll, strip or tenderloin	Volume based on throughput of one machine is more specific ROI than extrapolating total market impact at this stage.				Inside	100.00%	604,800	$ 5.64	$ 3,408,048	$ 7.00	$4,233,600	$ 825,552	$ 1.37	$ 0.21	$ 0.45	
					0	0.00%	0		$ -		$ -	$ -	$ -			
					0	0.00%	0		$ -		$ -	$ -	$ -			
					0	0.00%	0		$ -		$ -	$ -	$ -			
					0	0.00%	0		$ -		$ -	$ -	$ -			
					0	0.00%	0		$ -		$ -	$ -	$ -			
						BOA Kg / Day	Kg/hour	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	BOA Systems		
						2520	360	3.0	148,897	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1		
Export Product	0	0%	0%	-	0 Cuts V.A.	0.00%	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Explaination and assumptions TBC					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45	
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			
					0	0.00%	0	$ -	$ -	$ -	$ -	$ -	$ -			

Detailed Assumptions

PACKAGING COSTS

CONVENTIONAL VACCUM PACKAGING		Labour Cost	Kg/pc	Pcs/min	Kg/hr	FTE's	Labour /hr	$/kg
Conventional Vaccum Pack - Total Cost						**2**		**$ 0.21**
Labour Cost	Filling &Bagging	$ 53,200	3	27	4860	1	$ 29.17	$ 0.01
	Cartoning & materials handling	$ 53,200	3	27	4860	1	$ 29.17	$ 0.01
			Kg/pc				Cost/bag	**$/kg**
Packaging cost	Vaccum bags		3				$ 0.40	$ 0.13
	12-14 kg Carton		13				$ 0.66	$ 0.05
	Drip Keeper		3				$ 0.05	$ 0.02

CONVENTIONAL FROZEN CARTON		Labour Cost	Kg/Ctn	Pcs/min	Kg/hr	FTE's	Labour /hr	$/kg
Conventional Frozen - Total Cost						**2**		**$ 0.11**
Labour Cost	Filling &Bagging	$ 53,200	27.2	10	16320	1	$ 29.17	$ 0.00
	Materials handling	$ 53,200	27.2	10	16320	1	$ 29.17	$ 0.00
			Kg/pc				Cost/meter	**$/kg**
Packaging cost	Liner		27.2				$ 0.12	$ 0.00
	Lid and Base		27.2				$ 1.34	$ 0.05
	Dry Ice, Blast Freeze							$ 0.05

BOA PACKAGING			Kg/pc	Pcs/min	Kg/hr	FTE's	Labour /hr	$/kg
Boa Packaging - Total Cost						**2**		**$ 0.45**
Labour Cost	Filling &Bagging	$ 53,200	3	2	360	1	$ 29.17	$ 0.08
	Clipping & Cartoning & materials handling	$ 53,200	3	2	360	1	$ 29.17	$ 0.08
			Kg/pc				Cost/meter	**$/kg**
Packaging cost	Plastic Tubing		3				$ 0.67	$ 0.22
	12-14 kg Carton		13				$ 0.66	$ 0.05
	Clips	2 cents each						$ 0.01

BON BON WRAPPING		Labour Cost	Kg/pc	Pcs/min	Kg/hr	FTE's	Labour /hr	$/kg
Bon Bon Wrapping - Total Cost						**1.5**		**$ 0.28**
Labour Cost	Wrapping	$ 53,200	1.92	2.25	259.8	1	$ 29.17	$ 0.11
	Cartoning & materials handling	$ 53,200	1.92	2.25	259.8	0.5	$ 14.58	$ 0.06
			Kg/pc				Cost/pce	**$/kg**
Packaging cost	Wrap plastic		1.92				$ 0.05	$ 0.03
	Lid and Base		18				$ 1.34	$ 0.07
	Dry Ice, Blast Freeze							$ -
	Carton Liner		15				$ 0.20	$ 0.01

Bulk Pack				
$ 0.66	Lid			
$ 0.68	Base			
$ 0.20	Liner			
$ 0.05	Strap/label			
$ 0.06	27.2	kgs		

Retail Small Vac product				
0.66	12-14 kg carton			
5.04	Vac Bags small x		12	
0.05	Soaker Pads			
$ 0.20	Liner			
$ 0.05	Strap/label			
$ 0.46	13	kgs		

Retail Large Vac product				
0.66	12-14 kg carton			
3.48	Vac Bags Large x		6	
0.05	Soaker Pads			
	Liner			
$ 0.05	Strap/label			
$ 0.33	13	kgs		

Plain bulk Vac product				
0.66	12-14 kg carton			
0.3	Vac Bags Large x			
0.05	Soaker Pads			
	Liner			
$ 0.05	Strap/label			
$ 0.08	13	kgs		

0.42	Vac Bags small			
0.58	Vac Bags Large			
0.35	Netting/meter			
0.05	Soaker Pads			
0.2	Packaging Labour			
0.07	Distribution Fee			

EXISTING HOT BONING PLANTS

Hot Bone Beef Plants	Head / week	Head killed per year	Carcase weight	Kg/year	Value adding - Bon Bon etc	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of small BOA Systems	Automatted Boa System / Bags/hour		Capex
4 Beef Plants	13500	648000	200	129,600,000			360		217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	8 Hrs/day		
Tabro	2500	120000	200	24,000,000	Yes	2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	104		
Greenham	2500	120000	200	24,000,000		2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	104		
Midfield	5000	240000	200	48,000,000		4,981	13.84	5	401,942	$ 100,000	$ 36,000	$ 175,000	$ 311,000	2	208		
Teys	3500	168000	200	33,600,000		3,487	9.69	6	401,942	$ 100,000	$ 36,000	$ 175,000	$ 311,000	2	145		
Other	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-		

4 Beef Plants	Cut	Cut % of Carc	% of cuts V.A.	Kg's to V.A.	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Pack & Labour Cost	BOA Pack & Labour Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit
Changing target market of lower grade cuts of meat to mid- range cuts	4 Cuts V.A.	9.96%	9%	37,819,091	3,227,641	$ 7.83	$ 25,258,502	$ 8.84	$ 28,519,855	$ 3,261,353	$ 1.01	$ 0.21	$ 0.45	$ -	$ 0.77	$ 2,497,367
	Cube Roll	2.71%	25%	3,514,736	878,684	$ 10.80	$ 9,489,788	$ 12.30	$ 10,807,814	$ 1,318,026	$ 1.50	$ 0.21	$ 0.45		$ 1.26	$ 1,110,041
	Tenderloin S/off	1.06%	25%	1,372,927	343,232	$ 13.20	$ 4,530,659	$ 14.70	$ 5,045,507	$ 514,848	$ 1.50	$ 0.21	$ 0.45		$ 1.26	$ 433,604
	Striploin	2.32%	25%	3,000,585	750,146	$ 7.65	$ 5,738,619	$ 8.55	$ 6,413,751	$ 675,132	$ 0.90	$ 0.21	$ 0.45		$ 0.66	$ 497,571
	D-Rump	3.88%	25%	5,022,316	1,255,579	$ 4.38	$ 5,499,436	$ 4.98	$ 6,252,783	$ 753,347	$ 0.60	$ 0.21	$ 0.45		$ 0.36	$ 456,151
	Inside	5.77%	0%	7,478,056	0	$ 2.94	$ -	$ 3.06	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Eye Round	0.63%	0%	814,681	0	$ 2.94	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Chuck Roll 5Rib	3.77%	0%	4,891,843	0	$ 3.72	$ -	$ 3.72	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Chuck Tender	0.04%	0%	53,251	0	$ 2.40	$ -	$ 2.40	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Oyster Blade	1.26%	0%	1,631,462	0	$ 2.40	$ -	$ 2.52	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Outside Flat	1.58%	0%	2,047,869	0	$ 2.94	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Outside	2.62%	0%	3,399,655	0	$ 2.94	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Knuckle	3.54%	0%	4,591,711	0	$ 2.82	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -

Assumptions needing claification

Cuts that can be value added (Bon Bon wrapped) in hot boning plant? What is the value of these cuts if not wrapped? What cuts not currently wrapped? Does BOA give advantage over Bon Bon (labour, packaging cost etc)?

KEY ASSUMPTION - Existing Hot Boned plants could improve product quality with BOA. Increase in value is only packaging cost savings in packaging and labour compared with Bon Bon wrapping.

EXISTING HOT BONING PLANTS

Hot Bone Beef Plants	Head / week	Head killed per year	Carcase weight	Kg/year	Value adding - Bon Bon etc	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of BOA Systems	Automatted System / Bags/hour		Capex
4 Beef Plants	13500	648000	200	129,600,000	0	0	360	0	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	8 Hrs/day	0	
Tabro	2500	120000	200	24,000,000	Yes	2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	104	-	
Greenham	2500	120000	200	24,000,000	0	2,490	6.92	5	217,126	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	104	$ -	
Midfield	5000	240000	200	48,000,000	0	4,981	13.84	5	401,942	$ 100,000	$ 36,000	$ 175,000	$ 311,000	2	208	0.00	
Teys	3500	168000	200	33,600,000	0	3,487	9.69	6	401,942	$ 100,000	$ 36,000	$ 175,000	$ 311,000	2	145	0	
Other	0	0	200	0	0	-	-	0	-	$ -	$ -	$ -	$ -	0	-	0	

4 Beef Plants	Cut	Cut % of Carc	% of cuts V.A.	Kg's to V.A.	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Pack & Labour Cost	BOA Pack & Labour Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit
Changing target market of lower grade cuts of meat to mid- range cuts	5 Cuts V.A.	15.73%	13%	37,819,091	5,097,155	$ 6.03	$ 30,754,873	$ 6.72	$ 34,240,567	$ 3,485,694	$ 0.68	$ 0.21	$ 0.21	$ -	$ 0.68	$ 3,485,694
	Cube Roll	2.71%	25%	3,514,736	878,684	$ 10.80	$ 9,489,788	$ 12.30	$ 10,807,814	$ 1,318,026	$ 1.50	$ 0.21	$ 0.21	$ -	$ 1.50	$ 1,318,026
	Tenderloin S/off	1.06%	25%	1,372,927	343,232	$ 13.20	$ 4,530,659	$ 14.70	$ 5,045,507	$ 514,848	$ 1.50	$ 0.21	$ 0.21	$ -	$ 1.50	$ 514,848
	Striploin	2.32%	25%	3,000,585	750,146	$ 7.65	$ 5,738,619	$ 8.55	$ 6,413,751	$ 675,132	$ 0.90	$ 0.21	$ 0.21	$ -	$ 0.90	$ 675,132
	D-Rump	3.88%	25%	5,022,316	1,255,579	$ 4.38	$ 5,499,436	$ 4.98	$ 6,252,783	$ 753,347	$ 0.60	$ 0.21	$ 0.21	$ -	$ 0.60	$ 753,347
	Inside	5.77%	25%	7,478,056	1,869,514	$ 2.94	$ 5,496,371	$ 3.06	$ 5,720,713	$ 224,342	$ 0.12	$ 0.21	$ 0.21	$ -	$ 0.12	$ 224,342
	Eye Round	0.63%	0%	814,681	0	$ 2.94	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -
	Chuck Roll 5Rib	3.77%	0%	4,891,843	0	$ 3.72	$ -	$ 3.72	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -
	Chuck Tender	0.04%	0%	53,251	0	$ 2.40	$ -	$ 2.40	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -
	Oyster Blade	1.26%	0%	1,631,462	0	$ 2.40	$ -	$ 2.52	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -
	Outside Flat	1.58%	0%	2,047,869	0	$ 2.94	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -
	Outside	2.62%	0%	3,399,655	0	$ 2.94	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -
	Knuckle	3.54%	0%	4,591,711	0	$ 2.82	$ -	$ 2.94	$ -	$ -	$ -	$ 0.21	$ 0.21	$ -	$ -	$ -

Assumptions needing claification

Cuts that can be value added (Bon Bon wrapped) in hot boning plant? What is the value of these cuts if not wrapped? What cuts not currently wrapped? Does BOA give advantage over Bon Bon (labour, packaging cost etc)?

KEY ASSUMPTION - Existing Hot Boned plants could improve product quality with BOA. Increase in value is only packaging cost savings in packaging and labour compared with Bon Bon wrapping.

Detailed Assumptions

Reduced Portion Loss	0	100%	100%	-	1 Cuts V.A.	100.00%	-	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Forming chubs into square molds reduces fines and yield loss during portioning	Volume based on throughput of one machine is more specific ROI. Assumes value of diced fines reduced and elavated to premium price. **ASSUME this is a SECONDARY BENEFIT. Able to be done by competing machines.**				Inside	100.00%	0	$ 3.50	$ -	$ 3.80	$ -	$ -	$ -	$ 0.66	$ 3.48
					0	0.00%	0	$ 3.50	$ -	$ 3.80	$ -	$ -	$ -	$ 0.66	$ 3.48
					0	0.00%	0	$ 3.50	$ -	$ 3.80	$ -	$ -	$ -	$ 0.66	$ 3.48
					0	0.00%	0	$ 3.50	$ -	$ 3.80	$ -	$ -	$ -	$ 0.66	$ 3.48
					0	0.00%	0	$ 3.50	$ -	$ 3.80	$ -	$ -	$ -	$ 0.66	$ 3.48
					0	0.00%	0	$ 3.50	$ -	$ 3.80	$ -	$ -	$ -	$ 0.66	$ 3.48

FUTURE HOT BONING PROCESSES (COLD BONE - HARVESTING HOT) - ENABLING TECHNOLOGY FOR OTHER BENEFITS																
		Total Cuts Value	Kg/year / cut	Current Sales $	New Sales Dollars	Gross Benefit										
Changing target market of lower grade cuts of meat to mid- range cuts	Head / week	Head killed per year	Carcase weight	Kg/year	Value adding - Bon Bon etc	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of BOA Systems	Automatted System / Bags/hour	
1 Beef Plants		192000	220	42,240,000		2520	360	4.0	148,897	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	16 Hrs/day	
ACC	4000	192000	220	42,240,000		10,155	28.21	4	722,326	$ 250,000	$ 90,000	$ 475,000	$ 815,000	5	212	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
Other	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	Cut	Cut % of Carc	% of cuts V.A.	Kg's to V.A.	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit
Changing target market of lower grade cuts of meat to mid- range cuts	1 Cuts V.A.	5.77%	100%	2,437,292	2,437,292	$ 5.64	$ 13,734,141	$ 7.00	$ 17,061,045	$ 3,326,904	$ 1.37	$ 0.21	$ 0.45	$ -	$ 1.13	$ 2,749,994
Improve roast to steak	Inside	5.77%	100%	2,437,292	2,437,292	$ 5.64	$ 13,734,141	$ 7.00	$ 17,061,045	$ 3,326,904	$ 1.37	$ 0.21	$ 0.45		$ 1.13	$ 2,749,994
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -

Assumptions on increasing value:
Current cuts go into irregular shaped roasts. Price premium for consistent shape (Convenient portioning), plus added tenderisation, making the product equivalent or better eating quality than cow cube roll or strip loin.
Increasing the tenderness of the product will bring a premium because it enables the product to be sold into a different market for a higher value eating purpose.

Increasing quality grade of cuts for existing market	Head / week	Head killed per year	Carcase weight	Kg/year	Value adding - Bon Bon etc	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of BOA Systems	Automatted System / Bags/hour	
1 Beef Plants		192000	220	42,240,000			360		93,191	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	16 Hrs/day	
ACC	4000	192000	220	42,240,000		8,848	24.58	3	372,763	$ 200,000	$ 72,000	$ 400,000	$ 672,000	4	184	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
Other	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	Cut	Cut % of Carc	% of cuts V.A.	Kg's to V.A.	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit
Increasing quality grade of cuts for existing market	2 Cuts V.A.	5.03%	34%	6,197,707	2,123,512	$ 17.92	$ 38,052,218	$ 19.96	$ 42,383,030	$ 4,330,812	$ 2.04	$ 0.21	$ 0.45	$ -	$ 1.80	$ 3,828,175
	Cube Roll	2.71%	100%	1,145,544	1,145,544	$ 20.70	$ 23,712,754	$ 23.20	$ 26,576,614	$ 2,863,859	$ 2.50	$ 0.21	$ 0.45		$ 2.26	$ 2,592,708
	Striploin	2.32%	100%	977,969	977,969	$ 14.66	$ 14,339,464	$ 16.16	$ 15,806,417	$ 1,466,953	$ 1.50	$ 0.21	$ 0.45		$ 1.26	$ 1,235,467
	D-rump	3.88%	0%	1,636,903	0	$ 8.40	$ -	$ 9.40	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
	Inside	5.77%	0%	2,437,292	0	$ 5.64	$ -	$ 5.84	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -

Detailed Assumptions

Reduce Ageing Time	Head / week	Head killed per year	Carcase weight	Kg/year	Value adding - Bon Bon etc	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	Number of BOA Systems	Automatted System / Bags/hour	
1 Beef Plants		192000	220	42,240,000			360		(709,756)	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	16 Hrs/day	
ACC	4000	192000	220	42,240,000		8,848	24.58	-17	(2,839,025)	$ 200,000	$ 72,000	$ 400,000	$ 672,000	4	184	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
Other	0	0	200	0		-	-	0	-	$ -	$ -	$ -	$ -	0	-	
	Cut	Cut % of Carc	% of cuts V.A.	Kg's to V.A.	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit
Reduce Ageing Time	2 Cuts V.A.	5.03%	100%	2,123,512	2,123,512	$ 17.92	$ 38,052,218	$ 17.92	$ 38,052,218	$ -	$ -	$ 0.21	$ 0.45	$ -	-$ 0.24	$ (502,637)
	Striploin	2.32%	100%	977,969	977,969	$ 14.66	$ 14,339,464	$ 14.66	$ 14,339,464	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ (231,486)
	Cube Roll	2.71%	100%	1,145,544	1,145,544	$ 20.70	$ 23,712,754	$ 20.70	$ 23,712,754	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ (271,151)
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		0.00%	100%	-	0	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ -
		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit before Interest saving	Gross Benefit /Kg	Saved Ageing Days	Interest Rate p.a.	Net Benefit/kg	Interest & Value Benefit	**Benefit w/o Boa cost**				
Achieve 20 day aging tenderness in 20 hours - **reduce cold storage financing cost**	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 17.92	$ 17.92	$ (502,637)	$ (0.24)	18	10%	$ (0.15)	$ (314,983)	$ 0.09				
		Total Cuts Value Added	Kg/year	Pallet storage /wk	Kg / Pallet	Cost / Kg / Wk	Hot Boning Premium	Saved Ageing Days	Refrig cost / kg	Net Benefit/kg	Interest & Value Benefit	**Benefit w/o Boa cost**				
Achieve 20 day aging tenderness in 20 hours - **reduce refrigeration & pallet cost** - cold storage	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 8.28	792	$ 0.010	$ -	18	$ 0.03	$ 0.03	$ 57,071	$ 0.03				
TOTAL of ABOVE BENEFITS		Total Cuts Value Added	Kg/year	Current Sales $	New Sales Dollars	Gross Benefit before Interest saving	Gross Benefit /Kg	Refrig cost / kg	Interest Benefit/kg	Net Benefit/kg	Interest & Value Benefit	**Benefit w/o Boa cost**				
Achieve 20 day aging tenderness in 20 hours - **reduce finance, refrigeration & pallet**	1 Beef Plants	2 Cuts V.A.	2,123,512	$ 17.92	$ 17.92	$ (502,637)	$ (0.24)	$ 0.03	$ 0.09	$ (0.12)	$ (257,911)	$ 0.12				

Assumptions on increasing value:
Current cuts go into irregular shaped roasts. Price premium for consistent shape (Convenient portioning) is estimated at ????????????
Increasing the tenderness of the product will bring a premium. The real price difference realised in the market for MSA vs. Non-MSA product has been used as the premium able to be extracted for these types of cuts.

Detailed Assumptions

FUTURE CAPACITY CONSIDERATIONS

		Total Cuts Value	Kg/year / cut	Current Sales $	New Sales Dollars	Gross Benefit										
8 Cuts V.A.	Head killed per year	Carcase weight	Kg/year	8 Cuts V.A.	Boa Processed	BOA Kg / Day	Kg/hour & Hours Pdn. / day	ROI Months	ROI Kilo's	BOA Cost	BOA Upgrades	Infrastructure Cost	Total Cost	# BOA Prototype Systems	Automatted System / Bags/hour	Packaging savings Auto vs Prototype
Head/wk	720000	140	#########		43,421,919		360		(709,756)	$ 50,000	$ 18,000	$ 100,000	$ 168,000	1	16 Hrs/day	$ 0.24
5000	240000	220	52,800,000		15,407,778	52,092	144.70	-13	(13,109,368)	$ 1,050,000	$ 378,000	$ 1,675,000	$ 3,103,000	21	1,085	$ 3,647,036
4000	192000	200	38,400,000		11,205,657	37,885	105.24	-14	(10,088,679)	$ 800,000	$ 288,000	$ 1,300,000	$ 2,388,000	16	789	$ 2,652,390
3000	144000	200	28,800,000		8,404,242	28,414	78.93	-14	(7,672,128)	$ 600,000	$ 216,000	$ 1,000,000	$ 1,816,000	12	592	$ 1,989,292
2000	96000	200	19,200,000		5,602,828	18,943	52.62	-14	(5,255,576)	$ 400,000	$ 144,000	$ 700,000	$ 1,244,000	8	395	$ 1,326,195
1000	48000	200	9,600,000		2,801,414	9,471	26.31	-15	(2,839,025)	$ 200,000	$ 72,000	$ 400,000	$ 672,000	4	197	$ 663,097
	Cut	Cut % of Carc	% of cuts V.A.	Kg's to V.A.	Kg/year / cut	Current Sales $	Current Value	New Sales Dollars	New Value	Gross Benefit	Gross Benefit / Kg	COLD Packing Cost	BOA Packing Costs	Hot Boning Premium	Net Benefit/kg	Net Benefit
8	8 Cuts V.A.	29.18%	81%	43,421,919	35,233,055	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 0.45	$ -	-$ 0.24	$ (8,339,698)
Improve roast to steak	Cube Roll	2.71%	100%	4,035,438	4,035,438		$ -		$ -	$ -	$ -	$ 0.21	$ 0.45		$ (0.24)	$ (955,192)
	Tenderloin S/off	1.06%	100%	1,576,324	1,576,324		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (373,117)
	Striploin	2.32%	100%	3,445,116	3,445,116		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (815,462)
	Inside	5.77%	100%	8,585,916	8,585,916		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (2,032,294)
	Eye Round	0.63%	100%	935,374	935,374		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (221,404)
	Chuck Roll 5Rib	3.77%	100%	5,616,560	5,616,560		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (1,329,445)
	Chuck Tender	0.04%	0%	61,140	0		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ -
	Oyster Blade	1.26%	0%	1,873,160	0		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ -
	D-Rump	3.88%	100%	5,766,362	5,766,362		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (1,364,903)
	Outside Flat	1.58%	0%	2,351,257	0		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ -
	Outside	2.62%	0%	3,903,308	0		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ -
	Knuckle	3.54%	100%	5,271,965	5,271,965		$ -		$ -	$ -		$ 0.21	$ 0.45		$ (0.24)	$ (1,247,879)

Assumptions on increasing value:

Assums one cut of meat is being value added per plant.

Weekly volume on the left shows the number of existing systems required on the right, plus the volume (bags/primals) needing to be packed per hour (16 hours / day) for an automatted alternative.

Labour Opportunity Cost

Opportunity Cost of Frenching Racks

Product	CCW	Carcase Yield	SMY Kg's	$/kg Sell	$/Hd Sell	Xtra Labour FTE's	Labour Cost	Volume /Hd
Standrad Rack	20	10.0%	2	$ 6.00	$ 12.00			
	20	5.5%	1.1	$ 20.00	$ 22.00	5	$ 1,167	4000

GM $/kg	GM $/Hd	GM $/Shift	Net Profit /Shift	Net/ Profit /Hd	Net Profit /FTE /Shift	Net Profit /FTE /Kg	Sales - % of Annual	Net Profit p.a.
$ 14.00	$ 10.00	40000	$ 38,833	$ 9.71	$ 7,767	**$ 0.97**	20%	**$ 1,864,000**

Large Intestine collection requires 6 offal staff

Product	CCW	Offal Yield	Kg's/hd	$/kg Sell	Xtra Labour FTE's	Labour Cost	Volume-Hd / Shift	Value /shift	Net Profit /FTE /Shift	Net Profit /FTE /Kg
Large Intestine	220	0.17%	0.374	$ 7.10	6	$ 1,400	1000	$ 2,655.40	$ 209.23	**$ 3.36**

Hot cuts for cold bone plants	Cuts for Hot Bone Plants	Cold V.A. cuts	CUT	YEILD %	Hot Boned Bulk	Hot Bone V.A. (YP, PR eqiv)	Cow Prices	Grass fed	Shortfed (not MSA graded) 2008 approx.	Short fed 2-star	Short fed MSA 3-Star	MSA preimu over ungraded	BOA HOT V.A.	BOA COLD V.A.	Product Comments	EQ Contribution		
																Sarcomere Length	Proteolysis	Connective Tissue
					60%	60%			115%	2007	2007							
2	1		**Cube Roll**	2.71%	$ 10.80	$ 12.30	$ 7.00		$ 20.70	$ 18.00	$ 19.50	$ 2.50			premuim product shape		50%	
2	1		**Tenderloin S/off**	1.06%	$ 13.20	$ 14.70	$ 7.00		$ 25.30	$ 22.00	$ 23.25	$ 2.50						
2	1		**Striploin**	2.32%	$ 7.65	$ 8.55	$ 7.00		$ 14.66	$ 12.75	$ 13.25	$ 1.50			tipping into grilled grade		60%	
1	1	1	**Inside**	5.77%	$ 2.94	$ 3.06			$ 5.64	$ 4.90	$ 4.90	$ 0.20						
	3		**Eye Round**	0.63%	$ 2.94	$ 2.94			$ 5.64	$ 4.90	$ 4.90							
	3		**Chuck Roll 5Rib**	3.77%	$ 3.72	$ 3.72			$ 7.13	$ 6.20	$ 6.20							
			Chuck Whole		$ -	$ -			$ -									
	4		**Chuck Tender**	0.04%	$ 2.40	$ 2.40			$ 4.60	$ 4.00	$ 4.00					60%	20%	20%
	4		**Oyster Blade**	1.26%	$ 2.40	$ 2.52			$ 4.60	$ 4.00	$ 4.00	$ 0.20			don't age well like BI	40%		60%
	4		**D-Rump**	3.88%	$ 4.38	$ 4.98			$ 8.40	$ 7.30	$ 8.30	$ 1.00			Negative is rump with different shape			
			Whole Rump		$ -	$ -			$ -									
	5		**Outside Flat**	1.58%	$ 2.94	$ 2.94			$ 5.64	$ 4.90	$ 4.90							50%
	5		**Outside**	2.62%	$ 2.94	$ 2.94			$ 5.64	$ 4.90	$ 4.90							
	5		**Knuckle**	3.54%	$ 2.82	$ 2.94			$ 5.41	$ 4.70	$ 4.70	$ 0.20						
			PE Brisket D/ON	3.30%	$ 2.52	$ 2.52			$ 4.83	$ 4.20	$ 4.20							
			NE Brisket	2.75%	$ 2.61	$ 2.61			$ 5.00	$ 4.35	$ 4.35							
			1 Rib NE Brisket		$ 2.88	$ 2.88			$ 5.52	$ 4.80	$ 4.80				Primal and subprimal matrix of benefits			
			Brisket Skirt (ISK)	0.44%	$ 3.24	$ 3.24			$ 6.21	$ 5.40	$ -				Break rump into 3 bits			
			Thin Flank Meat	1.86%	$ 1.95	$ 1.95			$ 3.74	$ 3.25	$ -				Knuckle broken into 3 muscels.			
			Conical Muscle		$ -	$ -			$ -									
			O.P.Ribs	0.14%	$ -	$ -			$ -									
					$ -	$ -			$ -									
			Rib End	1.51%	$ 2.04	$ 2.04			$ 3.91	$ 3.40	$ -							
			Short Rib 3 Rib	0.54%	$ 6.60	$ 6.60			$ 12.65	$ 11.00	$ -							
			Bone in Shin Shank	4.70%	$ 2.07	$ 2.07			$ 3.97	$ 3.45	$ 3.45							
			Boneless Shin Shank		$ -	$ -			$ -									
			Intercostals	0.48%	$ 7.08	$ 7.08			$ 13.57	$ 11.80	$ 11.80							
			Butt Tenderloin	0.18%	$ 13.20	$ 14.70			$ 25.30	$ 22.00	$ 23.25	$ 2.50						
			Shortloin	1.51%	$ 6.90	$ 6.90			$ 13.23	$ 11.50	$ 11.50							
			Flank Steak	0.51%	$ 4.26	$ 4.26			$ 8.17	$ 7.10	$ 7.10							
			Flank Plate	0.85%	$ 3.78	$ 3.78			$ 7.25	$ 6.30	$ 6.30							
			Tri Tip		$ -	$ -			$ -									
			Clod						8.55									
			TOTAL PRIMALS	47.94%														
			TRIM															
			95 cl Trim	1.49%	$ 1.20	$ -				$ 2.00								
			Chuck & Blade	8.26%	$ 2.38	$ -				$ 3.96								
			65cl Trim	6.22%	$ 1.14	$ -				$ 1.90								
			85 cl Trim	#######	$ 1.95	$ -				$ 3.25								
			90 cl Trim	0.02%	$ 2.10	$ -				$ 3.50								
			Beef Body Fat		$ 0.03	$ -				$ 0.05								
			Coli Muscle		$ 2.10	$ -				$ 3.50								
			TOTAL TRIM	26.97%														
			TOTAL SCRAP	8.51%														
			SUB TOTAL	83.4%														