Final Report

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Cost/benefit analysis for Scott's OP Rib attachment

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Executive Summary

There are significant yield and operator safety issues associated with current processing methods for deboning beef OP ribs. The angle of cut is critical to achieving optimal yields. Whilst companies have experienced improved yields using trial make-shift saws they have involved operators working in close proximity to bandsaw blades. No commercial solution exists that removes direct interaction of operator with the saw while maintaining improved yields because the large variance in beef bone to meat ratio results in unacceptably large yield variations.

Scott Technologies in conjunction with JBS, MLA and AMPC have developed a prototype OP rib attachment (attaches to the existing bandsaw) that is intended to improve operator safety while maintaining improved yields. This manual assist system requires the operator to place the meat primal into a cradle that guides the ribs through a bandsaw using the best cut profile selected by the operator.

This cost-benefit study reviewed the performance of the prototype Scott's rib de-boning system against the conventional bandsaw which was used as the baseline for comparison within this study.

Table 1: Performance of the Scott's OP Rib attachment when compared to the manual baseline

SUMMARY PERFORMANCE MEASURES		
	Ex-Post	
Hd / annum	260,300	
Production increase with equipment	0.00%	
	From	To
Capital cost (pmt option, upfront)	$10,000	
Gross return Per head	$0.07	$0.07
Total costs Per head	$0.01	
Net Benefit Per head	$0.06	$0.06
Annual Net Benefit for the plant	$ 15,992	$ 15,992
Annual Net Benefit for the ex cap	$ 14,484	$ 14,484
Pay back (years)	0.69	0.69
Net Present Value of investment	$109,345	$109,345

Trials conducted during the study demonstrated savings summarised in Figure 1. Removal of vertebra using the Scott bandsaw attachment could provide yield improvements over the conventional bandsaw, however the system was not completely commercialised due to mechanical issues. There was a significant increase in operational safety by removing the operator's hands from the bandsaw cutting area but the actual dollar savings is minimal.

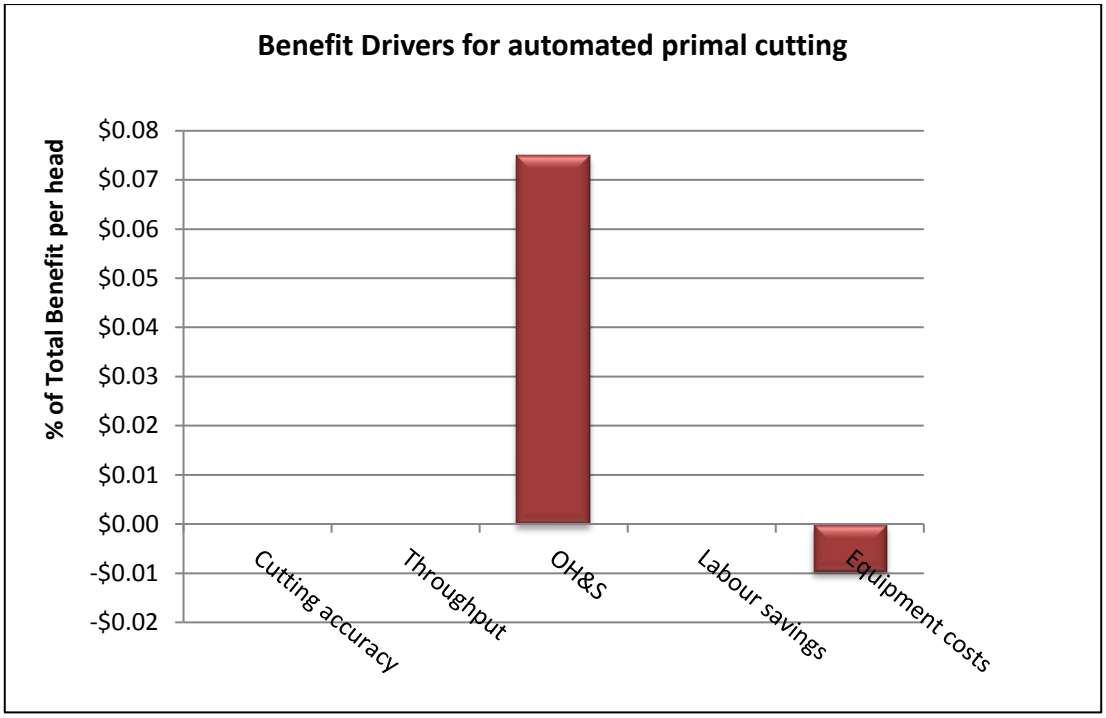

Figure 1: Breakdown of benefits between the de-boning methods

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1 Introduction

Within the developing beef market (especially domestic) JBS is receiving more and more enquiries for O.P. Ribs from grass and grain fed yearlings and MSA. Traditionally the specification requires the chime bone to be removed in a manner that enables butchers and chefs to easily carve the bone-in product into steaks (on the bone) without needing to use a bandsaw or meat cleaver. This specification detail requires the chime bone to be accurately removed in order to effectively implement this ‘steaking’ method. Typically a common (off the shelf) bandsaw is used to remove the chime bone. This presents 2 major issues: 1. Due to the curvature of the rib bones, saw operators hands are in close proximity to the saw blade. 2. Because the correct cutting line is hard to align yield loss results. JBS in conjunction with Scott RTL propose to review the outcomes from MLA P.PIP.0271, "Beef loin saw" and then apply relevant concepts to design and develop a prototype machine specifically for OPR processing. This project will utilise a standard bandsaw, design and develop a prototype machine with the correct and appropriate angled table top to maximise yield. A specially dedicated holding carriage will also be developed and integrated into the design to remove the operators interaction with the saw blade. As part of the above project, Greenleaf will carry out an ‘ex post’ CBA assessment of the costs and benefits of this unit. It is expected that the model and data collected will be as generic as possible, so it can be used for all JBS bandsaw related projects underway.

2 Objectives

The overarching objective of the developemnt project was for Scott technology to develop through a series of design interations and prototype tests a working prototype system that:

1. Improved on the existing yield benefits demonstrated by JBS’s existing in-house saw solution; while
2. Eliminating the operational saftey risks of the current test system.

Greenleafs objectives as part of this operational review were to establish a base line manual perfomance and determine the degree to which the newly designed Scott’s OP Rib saw attachment for an opperating bansaw achieved the following outcomes:

1. To improve accuracy of the chine bone removal and improve cube roll yield
2. Remove operator interaction with the saw blade, hence removing the risk of cuts, soft tissue and nerve damage, and ultimately the risk of amputation.

To measure the difference in yield between side chain boning of the loin against table boning and a bandsaw using the OP Rib attachment where side chain boning is used as the baseline on which to calculate benefit of the other methods.

3 Technical Description

The OP Rib cutter attachment for a bandsaw has been developed to decrease the OH & S risk and improve yield of OP Ribs sold. The attachment has been developed to rapidly attached and removed from the bandsaw table to ensure cleaning and general maintenance can be conducted efficiently.

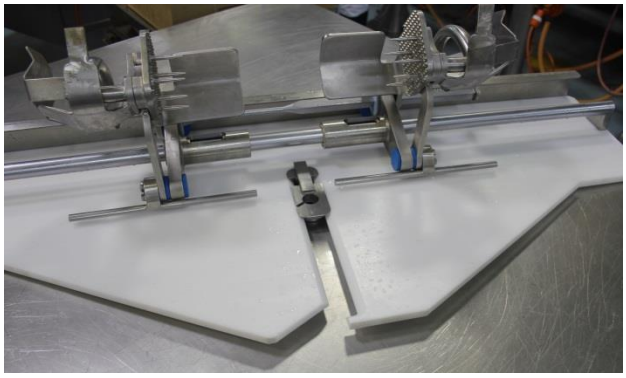

Figure 2: OP Rib attachment aligned with the bandsaw blade

4 Methodology

This section provides an outline of the details of the research conducted in the Beef City boning room.

4.1 Operating and OH & S Costs

The operational and OH & S data collected was as follows:

- Staffing levels per shift;
- Cost per hour for staff;
- OH & S claim costs over the last 10 years;
- Maintenance costs of hock cutter equipment;

These costs have been used to calculate an average operating cost variation if any for the areas that the OB Rib attachment has been installed.

4.2 Yield Benefit

The yield benefit associated with the installation of the OB Rib cutter is a reduction in meat left on the chine bone and an increase in saleable yield of rib bones. The following section identifies how the measurements were recorded to calculate the value achieved through the adoption of the OP Rib cutter attachment

4.2.1 Reduced Meat on Chine Bone

Figure 3: Bone-in loin after removing backbone with saw

Figure 4: button bones are removed from striploin with a wizard knife after saw cut

Figure 5: Ribs and vertebrae need to be separated for boning otherwise a second saw cut is required to enable boning

Figure 6: Measurement process to capture weight of bones relative to primal, wiz trim and fat weights

4.2.2 Increase Saleable Weight of Rib Bone

The yield measurement conducted to identify the variation in saleable meat yields between the bandsaw and the OP Rib attachment is shown in Figure 7. The variation in these ribs identified the value lost from the ribs to render from cutting the bones too short.

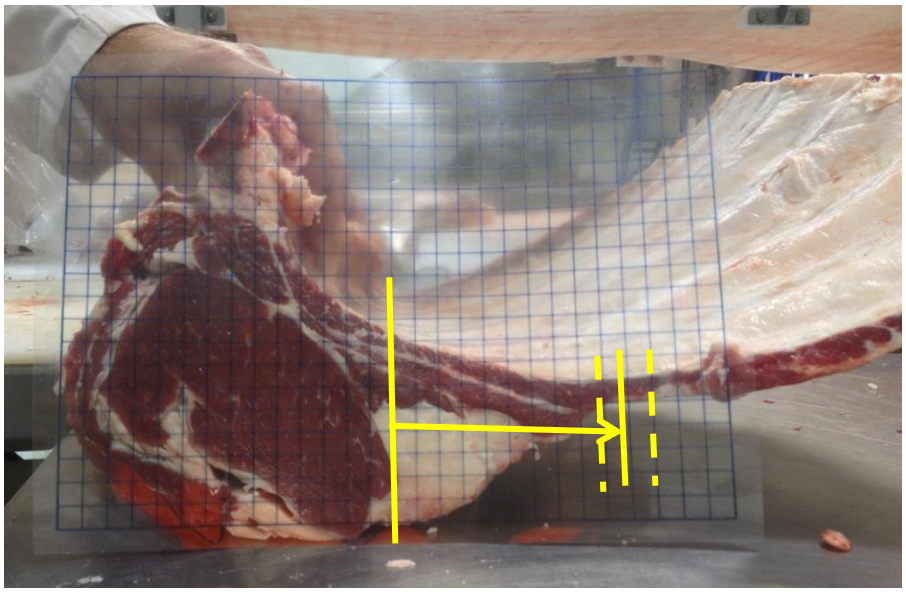

Figure 7: Measuring the variation in yield of rib bones sold on the OP Ribs

4.3 Fixed Model drivers

To estimate the dollar value per head of each of the costs and benefits, the production numbers used are shown in Table 2. The table summarises the estimated performance of the manual operation as a base line and Ex-post with the OP Rib attachment being utilised on the bandsaw.

Table 2: Calculation used for determining production volume base line

Processing room operation speeds		
	Manual	Ex-Post
Carcases / min	2.28	2.28
Carcases / Statn./hr	137	137
Carcases / day	2082	2082
Annual days	250	250
Annual # of hd	520,600	520,600

5 Results & Discussion

The main values attributed to the installation of the OP Rib cutter attachment are attributed to the following areas:

- Increase saleable red meat yield
- Reduction in work cover premiums

The cost savings are discussed in detail in the following section.

5.1 OH&S Savings

Two main areas are identified where the saw will provide OH&S benefits. These are reduced sprain and strain injuries through eliminating the need for any operator interaction with a saw blade for the cutting of the vertebra. Data from the past 10 years of history was reviewed to calculate the costs of OH&S injuries as a result of bandsaws on the rack trimming tasks.

Based on these assumptions the following frame work is presented to show OH&S Benefits (Table 3).

Table 3: OH&S Benefits of equipment

OH&S				
	Band Saw cutting	Sprain and Strain from lifting		
Job Role Affected	Band Saw operator	3		
Claims per 10 years	1.0	40.0	Manual	Ex-Post
Annual Premium	$120,000	$5,000		
Job Annual Hours			5,700	5,700
Limb Losses per year			0.10	0.00
Sprains and Strains per year			4.00	2.50
Annual Cost			$ 32,000	$ 12,500
Annual Cost / Head			$ 0.12	$ 0.05
Annual saving per head			$ -	$ 0.07

5.2 Yield benefits

The yield benefits for this system would maximise the weight of saleable OP Ribs. As the system has not been commercialised Greenleaf hasn't had the opportunity to complete the yield trials. However, as long as the system is able to maintain the current yield it could be beneficial to the plant. The following section is an excerpt from a previous project (P.PIP.0271).

5.2.1 Decreased Meat on the Chine Bone

The key financial driver of profit for this rib de-boning system is the weight of OP ribs sold relative to the starting carcase weight. Weight of saleable Ribs is directly impacted by the weight of chine and ribs removed from the OP ribs during the boning process. Comparative weights of these three products (finished ribs, chine, and bone) are the factors used in the primary method for comparing yield between the different systems. A secondary method (comparing weight of finished ribs against hot carcase weight) was also used. Both methods demonstrated an improvement in yield using the OP rib attachment. However, when using this second method create more variation in yield than that observed between the four boning methods measured during the trials. The time it takes to track carcases through the whole boning process and conduct full yields required for this analysis limits the sample size for each treatment which was the reason for using both calculation methods.

Table 4 and Table 5 summarise the yields results of all four boning methods using both yield calculations mentioned above. Weight is expressed as a combination of total carcase weights sampled during the trial. Note the "Loin Wgt" column and associated "Yield %" compares weight of finished loin back to hot carcase weight and demonstrate an improvement in yield of 0.13% of total carcase weight for JBS generic loin saw method as compared to side chain boning.

Table 4: Dinmore trials – Comparison of bandsaw and bandsaw with the OP rib saw attachment methods against carcase weight and loin weight

SUMMARY from "YIELD 16 8 12" Tab	*Side wgt*	*Loin wgt*	*Yield %*	*Wiz wgt*	*Yield %*	Wiz trim as % of Loin weight
Side Chain	2151	87	*4.05%*	4.9	*0.23%*	5.6%
Loin Saw	2188	92	*4.18%*	2.0	*0.09%*	2.2%

Wiz trim savings were observed in further trials as shown in Table 5 where table boning showed a reduction in wiz trim over chain boning of 2.2% of finished loin weight, loin saw showed an additional improvement of 1.5% over table boning and the Scott's loin saw showed a further reduction over the generic loin saw of 0.3% of total finished loin weight. Note the expression of loin yield as a percentage of total carcase weight followed similar trends but given the wide range of variables contained in this data is not considered a reliable and repeatable method for the limited size of the data set.

Table 5: Dinmore and Beef City trials 1 thru 4 comparing all four boning methods against carcase weight and loin weight

	Side wgt	Loin wgt	Yield %	Wiz wgt	Yield %	Bone wgt	Yield %	Wiz trim as % of Loin weight	Number of sides	Wiz Wgt/side
Side Chain	3088	118	3.81%	6.4	0.21%	47.5	1.54%	5.4%	20	0.32
Table Bone	3242	130	4.02%	4.2	0.13%	48.0	1.48%	3.2%	20	0.21
Generic Loin Saw	3363	133	3.95%	2.3	0.07%	48.3	1.44%	1.7%	20	0.11
Scott's Saw	2833	112	3.96%	1.6	0.06%	45.4	1.60%	1.4%	16	0.10

In summary, wizard trim very clearly shows the differences in the boning methods. Side boning produced in excess of 300grams of wizard trim while saw boning produced 100grams per side on average. This represents an increase of 200 gram saving in loin meat per side or 400grams per carcase.

The information above demonstrates that there would be differences in yield for a bandsaw with and without the attachment. Therefore if the attachment was to be used commercially then yield trials would be required to validate the payback period.

5.3 Labour Savings

There has been no labour savings recorded for the installation of the OP Rib cutter. However it has reduced the amount of time required by the bandsaw operator to conduct the cut. This is attributed to the operator only needing to conduct one swipe across the chine bone.

5.4 Equipment Costs

Table 6 shows the total cost of the equipment including both capital and operational costs. Real costs will be site specific to every application. Some adjustment to boning configuration may be required depending on the type of bandsaw in operation.

Table 6: Estimated capital, and operational costs of cutting equipment

Capital Cost	Manual		Ex-Post	
	Cost	Life span	Cost	Life span
Capital Cost of the equipment			$10,000	10
Essential and insurance spares				10
Other Capital install				10
Total			**$10,000**	

Service maintenance	Manual		Ex-Post	
	Units	Cost	Units	Cost
Estimated - COSTS				
Electricity	6.00 KW	$0.22 /KWH	6.00 KW	$0.22 /KWH
Maintenance labour (Daily)		0.00 /Yr		0.00 /Yr
Maintenance labour (Preventative)		0.00 /Yr		0.00 /Yr
Maintenance labour (Breakdown)		0.00 /Yr		0.00 /Yr
Maintenance labour (Training)		0.00 /Yr		0.00 /Yr
Operational		**$2,508**		**$2,508**
Maintenance		**$0**		**$0**
Annual Sub Total (excluding major overhaul costs)		**$2,508**		**$2,508**

Major maintenance	Manual		Ex-Post	
	Total	Life span	Total	Life span
Other				
Sub Total: Operating Expense				
Combined Total: (cap ex + operating)				
Total Annual Estimated Expenses	Years	Cost	Years	Cost
Expected downtime hours per year	0	0.00 /Yr	0	0.00 /Yr

5.4.1 Capital costs

Equipment purchase price is based on prices supplied by the manufacturer.

5.4.2 Maintenance & Service Costs

Maintenance and Service costs are also supplied by the equipment manufacturer. Maintenance costs are additional running costs that the plants will incur with the installation of the equipment and include components such as parts and labour. A very small difference in operating cost was observed between the bandsaw and the bandsaw with the OP attachment as the same bandsaw has been utilised for both applications.

6 Cost Benefit Results

The source of benefits all came from decreased yield loss and OH & S costs. The summary results in Table 7 demonstrate the performance of the ex-post machine when compared to the manual operation.

The ex-post net benefit was $0.06/hd. This delivers an estimated return on investment of 0.69years depending the number of carcases processed per hour.

Table 7: Summary of Benefits for the ex-post review relative to the manual cutting performance

SUMMARY PERFORMANCE MEASURES		
	Ex-Post	
Hd / annum	260,300	
Production increase with equipment	0.00%	
	From	To
Capital cost (pmt option, upfront)	$10,000	
Gross return Per head	$0.07	$0.07
Total costs Per head	$0.01	
Net Benefit Per head	$0.06	$0.06
Annual Net Benefit for the plant	$ 15,992	$ 15,992
Annual Net Benefit for the ex cap	$ 14,484	$ 14,484
Pay back (years)	0.69	0.69
Net Present Value of investment	$109,345	$109,345

The benefits identified can be broadly summarised as either product value or processing efficiency benefits with the larger portion of benefits being related to processing efficiencies in Figure 8. Product value benefits are a result of reduced yield loss.

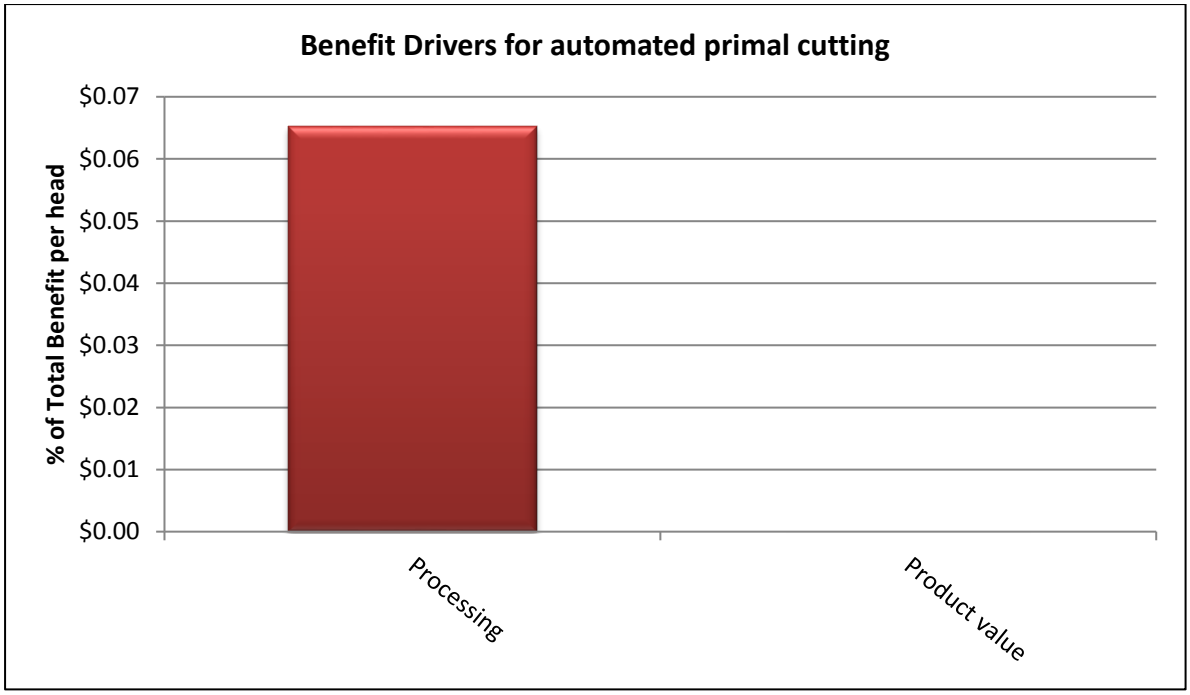

Figure 8: Broad grouping of benefits by automated primal cutting solutions for the ex-post review

The automated equipment will not be required to improve accuracy of cutting lines as compared with manual methods. The main benefits of the automated cutting technology are the decreased yield loss and OH & S savings. There was no reduction in bandsaw dust as the cutting methods are the same between the automated and manual systems. The contribution of each individual benefit is summarised in Figure 9.

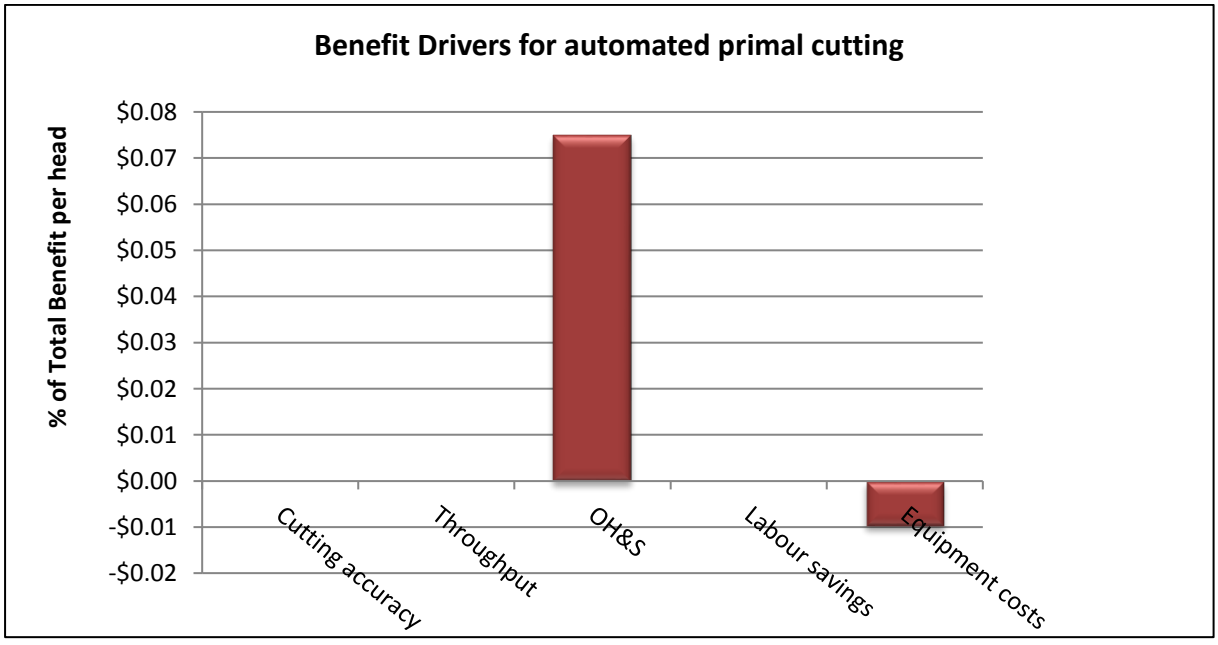

Figure 9: Summary of benefits from the OP Rib cutter attachment

6.1 Summary of Costs and Benefits

Table 8 shows the range in value associated with each cost of processing. The cost is calculated as any loss from the maximum benefit possible. Presenting the figures this way in the detailed section of the model demonstrates the total costs involved and highlights areas that future savings could be generated.

Table 8: Summary costs and benefits associated with each de-boning method compared with chain bone baseline

COST DUE TO INACCURACIES AND MANUAL INTERVENTION						
			Manual		Ex-Post	
Cost summary		% of annual production	$/hd From	$/hd To	$/hd From	$/hd To
1.1 Accuracy	Rib Removal	100%	$0.00	$0.00	$0.00	$0.00
	Chine removal	100%	$2.95	$2.95	$2.95	$2.95
2. Throughput cost			$1.12	$1.12	$1.12	$1.12
3. OH&S cost			$0.12	$0.12	$0.05	$0.05
4. Labour cost			$0.00	$0.00	$0.00	$0.00
Equipment costs	Maintenance		$0.00	$0.00	$0.00	$0.00
	Operation		$0.00	$0.00	$0.01	$0.01
	Risk of failure		$0.00	$0.00	$0.00	$0.00
$ Costs per head			$4.19	$4.19	$4.13	$4.13
$ Benefit per head			$0.00	$0.00	$0.07	$0.07
$ Benefit overall plant			$0	$0	$16,992	$16,992
$ Annual Costs overall plant			$1,091,500	$1,091,500	$1,074,508	$1,074,508

Figure 10 shows the difference in cost between the systems. Thickness of the box in the graph represents the upper and lower variation in value based on performance variation captured in the data.

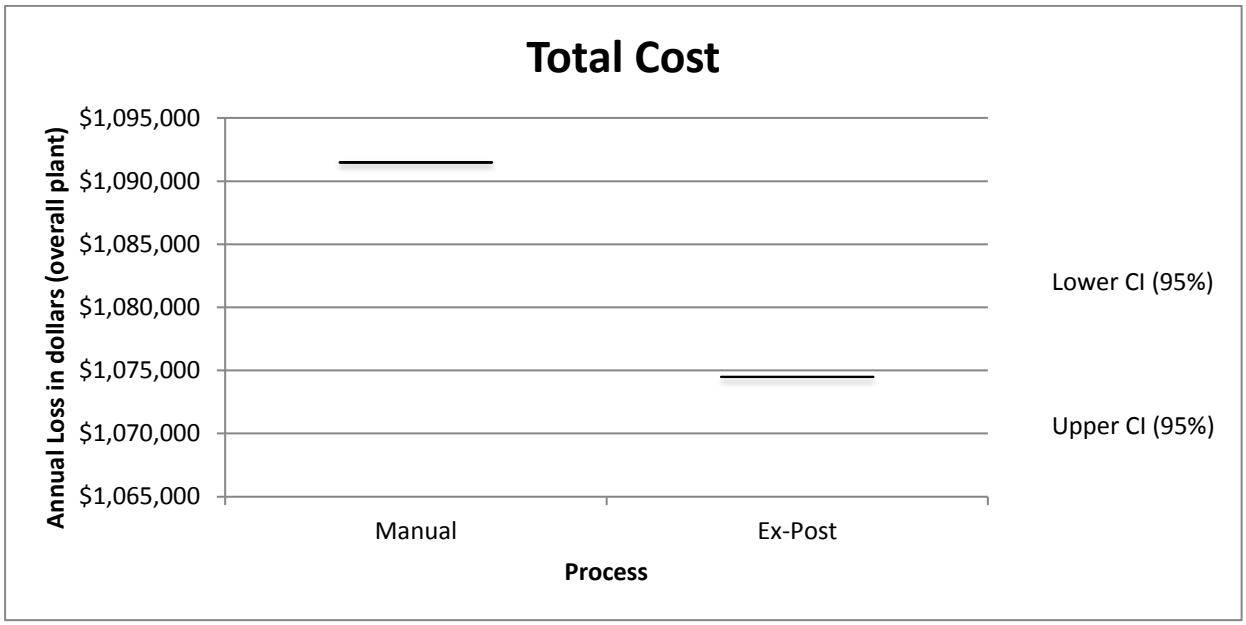

Figure 10: Summary financial results comparing 3 de-boning methods against a chain boning baseline

7 Summary

The development of the OP Rib cutter has provided substantial improvements to OH & S of bandsaw operators to reduce the chance of amputations. Coupled with the yield benefits achieved would provide benefits to the beef boning rooms in Australia. However the attachment has not been commercialised due to development issues. The estimated return on investment of 0.69 years but will need validation if the system is commercialised.

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