



final report

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Prepared by: Will Cowley, Guy Chojnacki
ATTEC Australia
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Adoption of ATTEC Lamb Rack Barrel Machine in a commercial setting

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Executive Summary

The ATTEC Lamb Rack Barrel Machine (LRBM) is a semi-modular rack cutting machine. It uses innovative cutting technologies and processes targeted at reducing OHS/WHS exposure, increased yield and specification compliance, and combined with dramatically improved product presentation.

Fletchers and MLA have interest in documented trials to quantify these attributes.

A series of trials have been conducted at Fletchers in Dubbo, using the ATTEC Lamb Rack Barrel Machine. These trials have been compared to existing processes, which use a combination of band-saw cutting and alternative chine cutting machines.

The trials have clearly demonstrated substantial improvements and positive financial aspects. These outcomes are obviously based on volumes processed, however, the ATTEC LRBM results –

- improve yield by 2%
- Increase product compliance and specification by up to 10%
- Improve product presentation, due to virtually zero bone dust
- reduce workers compensation costs
- Save up to one labour unit (Full time equivalent) per year

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1 Background

Fletchers have viewed the first R&D machine developed by ATTEC and BMC and there has been an interest for this machine to be tested in the Fletchers operations proving its use for the range of products and cut variations being performed on band-saws and other chine machines. Management of change and capability building with the focus on adoption will be reported, providing other processors a documented approach, as validated by a major processor, supporting their considerations of such equipment. The project will document the methodology followed and the results in detail in the final report. The original machine was adapted for GM Scott meeting the specific requirement to leave the featherbone on the rack and only performing chine bone and flap cuts. The GM Scott evaluation has resulted in the understanding that the loading accuracy will affect performance in respect of the chine bone removal accuracy as various pre-cutting and handling guides have to be removed for the featherbone to be left on the rack. To this end it is concluded that the controlled handling of the rack barrel is an important part of the chine bone removal with the featherbone being removed at the same time as the pre-cutting blades and guides clearly provide for stable holding of the rack saddle during the chine bone separation. Fletchers have indicated a willingness to trial the machine in their environment to gain further knowledge of machine capability, capacity and adaption against detailed customer specifications.

2 Projective Objectives

- To initiate a change management process for effective installation and testing of the ATTEC Lamb Rack Barrel Machine
- To document performance capability in respect of cut accuracy, speed, yield and consistency comparing band-saw and the Rack Barrel machine
- To quantify the benefits specifically for Fletchers.
- To provide a Factsheet for AMPC to disseminate to Industry
- To produce an open report, presenting the findings (without compromising confidentiality).

3 Methodology

3.1 Milestone 1

- 3.1.1 Preparation and change management meeting with Fletchers and ATTEC teams (BMC will lead this).
- 3.1.2 Room layout with the new machine in position and consideration of process for operating/using the machine.
- 3.1.3 Shipment of the machine to site and machine located in Fletchers Engineering workshop.
- 3.1.4 ATTEC Australia with input from ATTEC Denmark to update the machine to meet match latest specifications for the chine-featherbone and the flap cuts on the rack barrel of lamb.
- 3.1.5 Adaptability to the variability in the rib length specification
- 3.1.6 Testing of the machine to ensure it is set up correctly before positioning the machine at cutting room location.
- 3.1.7 Planning of tests for when the machine is in the boning room.
- 3.1.8 Benchmarking the current processes and the machines.

3.2 Milestone 2

- 3.2.1 Engineering process change and tuning the layout.
- 3.2.2 Physical positioning of the machine within the Fletchers cutting room and connection of services.
- 3.2.3 Structured testing to benchmark the machine for performance (speed, accuracy, quality, etc)

3.3 Milestone 3

- 3.3.1 Benchmarking details of each cutting process (band-saw, ATTEC LRBM)
- 3.3.2 Detail speed, accuracy, yield, revenue, OH&S benefits and potential labour saving.
- 3.3.3 Results of the trials and details of how they were carried out
- 3.3.4 Assessment of the status of the equipment
- 3.3.5 Guidelines for future adoption procedure of the machine and the change management process
- 3.3.6 Produce a Factsheet for AMPC to disseminate to Industry

4 Results

4.1 Milestone 1

4.1.1 Preparation and change management meeting with Fletchers and ATTEC teams.

At this meeting the senior team at Fletchers met with the ATTEC Australia team and BMC. Representatives from Sales and Marketing as well as Operations and General Management were keen to see the modifications to the machine completed as soon as the machine arrives so that trials can begin.

It was reported at this meeting that there is a desire to perform cuts on mutton rack barrels and also to perform special cuts that open up new markets for products currently not produced by Fletchers due to the complexities in handling and cutting on band-saws.

This latter approach provides a new opportunity for all concerned. In particular the cutting of the flap on a whole barrel leaving the flap attached and only separating the ribs followed by removal of the chine bone along the full length of the whole barrel is of interest

4.1.2 Room layout with the new machine in position and consideration of process for operating/using the machine.

The consideration of the layout suggested that the machine is best located on the opposite side of the room from the current BLM. The machine is to be located in a temporary position within the load out area and after first power up it is to be located within the room, but again as a temporary step. It was agreed that there is sufficient information available without a drawing for the services to be situated both in the load out area and at the location within the room or the machine to be powered up initially for a set up test and later in the trial position within the room. A layout drawing will be produced for a final position of the machine prior to the end of the project.

4.1.3 Shipment of the machine to site and machine located in Fletchers Engineering workshop.

The machine has been delivered to Fletchers and in a workshop environment it has been tested for functionality. A number of maintenance tasks have been required as the machine has been idle for several months.

4.1.4 ATTEC Australia with input from ATTEC Denmark to update the machine to match latest specifications for the chine-featherbone and the flap cuts on the rack barrel of lamb.

This task has been completed and the machine used for first set of cuts after locating the machine in the load out area.

4.1.5 Adaptability to the variability in the rib length specification

Tests have been conducted to show the capability of the machine for adaptability to meet user defined rib lengths. This has been done by programming new recipes and showing the management and supervisors responsible for the cutting room, that there is physical adjustment of the position of the flap blades in automatic mode, when selecting a new recipe with different setting rib length. Initial training of how to adjust this setting has been carried out.

4.1.6 Testing of the machine to ensure it is set up correctly before positioning the machine at cutting room location.

During the visit on 17th to 19th November 2014, the testing of the machine was done with a small number of whole and rack barrels.

It was agreed during this visit that the machine will be located within the room for the trials to begin before mid December 2014.



First testing at Fletchers

4.1.7 Planning of tests for when the machine is in the boning room.

Initial testing in the load out area has resulted in the discussions of the cuts to be performed during the testing (currently scheduled for late November 2014 start).

Other than the standard cuts, Fletchers require tests with Mutton Rack Barrels (MRBs) and Whole Barrels. The cut on the whole barrel is to be partial, only through the ribs on the flaps and the removal of the whole chine bone including the loin section. It is recorded that the scope of the tests in the project will be for Lamb Rack production only, however the scope of required changes for cutting mutton and whole barrels to the specification required by Fletchers will be evaluated. Changes to reach the capabilities against new cuts and products will, however, be the subject for future projects, once the scope of the tests under the current PIP project has been completed to expectation.

4.1.8 Benchmarking the current processes and the machines.

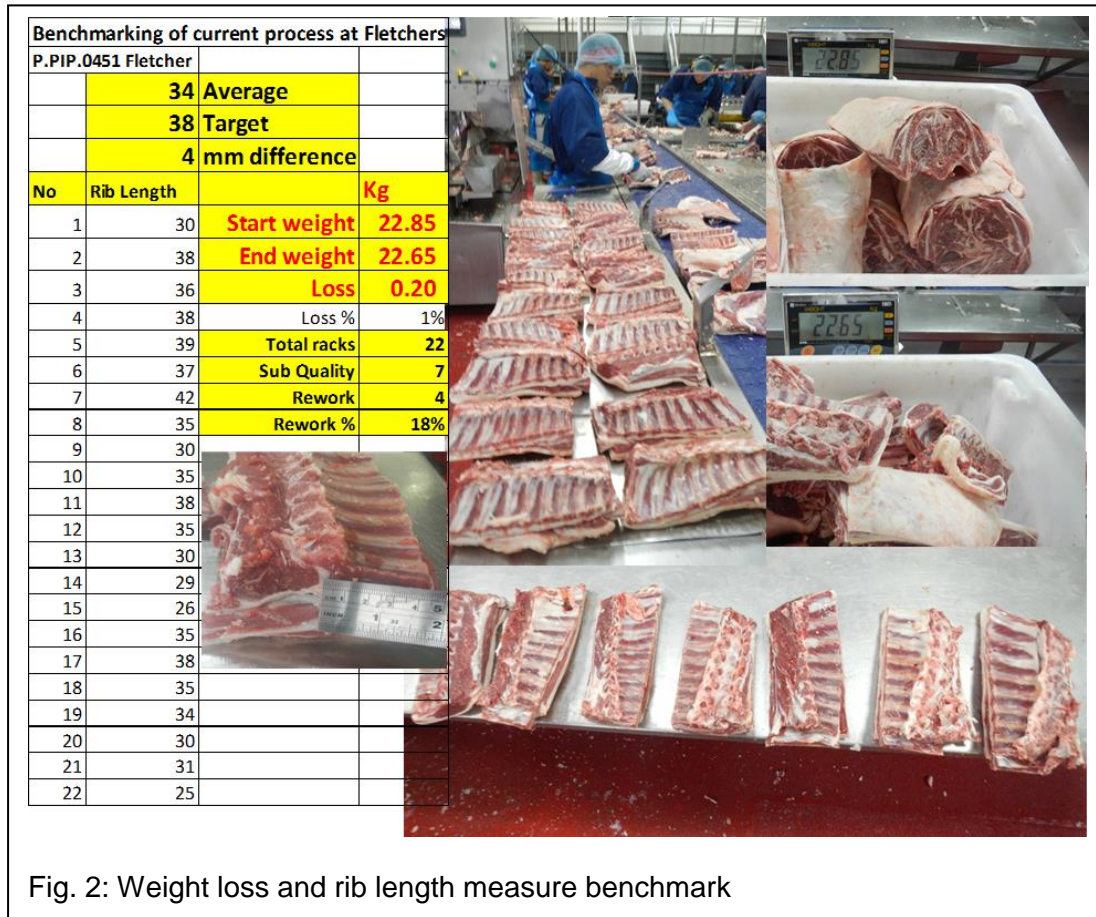


Fig. 2: Weight loss and rib length measure benchmark

4.1.9 Milestone 1 - Concluding statements

Milestone 1 had been completed and the current process has been benchmarked.

The summary benchmarking results of current process involving flap cutting on a band-saw and chine boning using an existing BLM machine are as follows:

Eye muscle damaged racks = 3
 Bone dust loss = 1%
 Rib length shortfall= 4 mm

The ATTEC trial Lamb Rack Barrel Machines was situated within the cutting room at Fletchers under Milestone 2, after its updating and initial testing for function under this milestone.

4.2 Milestone 2

4.2.1 Process change and locating the machine in the cutting room.

The current process at Fletchers uses a band-saw for the separation of the primal sections from a whole carcass, resulting in the whole barrel, which uses a second band-saw for separating the rack barrel and then cutting the flaps producing the rack saddle. The rack saddle then has the chine and featherbone removed in one piece on the BLM machine, giving the lamb rack.

The current process achieves the separation of the flap cut on the band-saw and the removal of the chine and featherbone as one piece on the BLM machine.

The schematics of the layout of the cutting area of the processing room at Fletchers have been developed. The position of the band-saw for primal cutting; the BLM machine and second band-saw for flap separation, and the BLM machine are identified. The flow starts where the primal break up occurs. The flaps are removed and at the BLM machine removes the chine and featherbone to produce racks. Note that the BLM is operated by one person loading and unloading the BLM machine.

The ATTEC Lamb Rack Barrel Machine (LRBM) has been located and connected to services, with upgrades that allow full operation of the machine. The process with the LRBM during testing is arranged for the rack barrels (with station 2 band-saw NOT performing the flap cuts) to travel to the ATTEC LRBM. The machine is loaded by an operator and it performs flap cuts (replacing the band-saw actions), and the task currently done on the BLM.

4.1.2 **Benchmarking the LRBM process**

Trials have been conducted on the machine and several engineering changes have been performed, during December 2014 and January 2015, to upgrade the machine for practical operation and testing, with improved chine and featherbone separation as well as programming for different rib length recipes against the flap cut position.

Fletchers have requirement (at present) for 38mm, 55mm, 75mm and 100mm, rib length racks, with the rib length measures at the loin face of the rack, from the trip of the rib cut to the edge of the eye muscle.

Fig. 4 shows the performance benchmark of the LRBM against trials performed for 100 mm rib racks. Figure 3, shows the benchmark and improvement possibility for the current process against flap cut position accuracy.

Lamb carcass range 24-27 Kg as available					06/01/2015	
Rack No.	Barrel Weight	Rack weight	Flap Weight	Chine Weight	Rib Length	Rib Length
1	5.22	2.58	2.30	0.38	105.00	90.00
2	4.26	2.24	1.69	0.33	80.00	85.00
3	5.59	3.02	2.17	0.42	100.00	97.00
4	4.78	2.54	1.88	0.36	100.00	95.00
5	4.36	2.47	1.52	0.36	100.00	100.00
6	4.61	2.38	1.87	0.36	105.00	105.00
7	4.76	2.51	1.88	0.37	110.00	105.00
8	5.21	2.86	1.97	0.36	90.00	95.00
9	4.71	2.48	1.88	0.37	95.00	95.00
10	5.36	2.88	2.07	0.41	100.00	100.00
11	4.69	2.38	1.88	0.43	90.00	95.00
12	4.30	2.26	1.67	0.36	95.00	95.00
13	4.34	2.07	1.91	0.37	95.00	100.00
14	5.32	2.74	2.18	0.39	105.00	105.00
15	5.45	2.95	2.11	0.39	85.00	80.00
16	5.86	3.18	2.24	0.43	105.00	105.00
17	4.48	2.36	1.76	0.36	100.00	100.00
18	5.13	2.78	1.95	0.39	95.00	100.00
19	4.93	2.55	1.96	0.41	90.00	105.00
20	5.15	2.65	2.11	0.39	105.00	103.00
21	5.84	2.87	2.57	0.40	102.00	107.00
22	4.71	2.47	1.85	0.39	93.00	105.00
23	5.07	2.73	1.91	0.40	100.00	100.00
24	4.49	2.39	1.75	0.34	105.00	100.00
25	4.58	2.41	1.77	0.41	105.00	105.00
26	4.55	2.40	1.61	0.36	100.00	100.00
27	5.34	2.94	2.06	0.34	98.00	102.00
28	5.02	2.68	1.94	0.39	93.00	110.00
29	5.31	2.75	2.08	0.47	120.00	105.00
30	5.03	2.58	2.09	0.35	100.00	100.00
31	4.65	2.39	1.82	0.44	105.00	90.00
32	4.77	2.42	1.94	0.40	100.00	106.00
33	4.89	2.43	2.03	0.41	100.00	90.00
34	5.65	2.96	2.27	0.37	110.00	100.00
35	4.02	2.12	1.49	0.40	100.00	100.00
36	4.56	2.45	1.72	0.38	95.00	100.00
37	4.59	2.36	1.90	0.33	95.00	100.00
38	5.33	2.95	2.00	0.37	110.00	105.00
39	4.36	2.37	1.60	0.37	80.00	95.00
Total	191.19	100.44	75.29	14.87	99.00	99.36
Av. Rack wgt		1.29	Av. rib length LRBM		99.18	

Figure 4. Benchmark trials for the LRBM

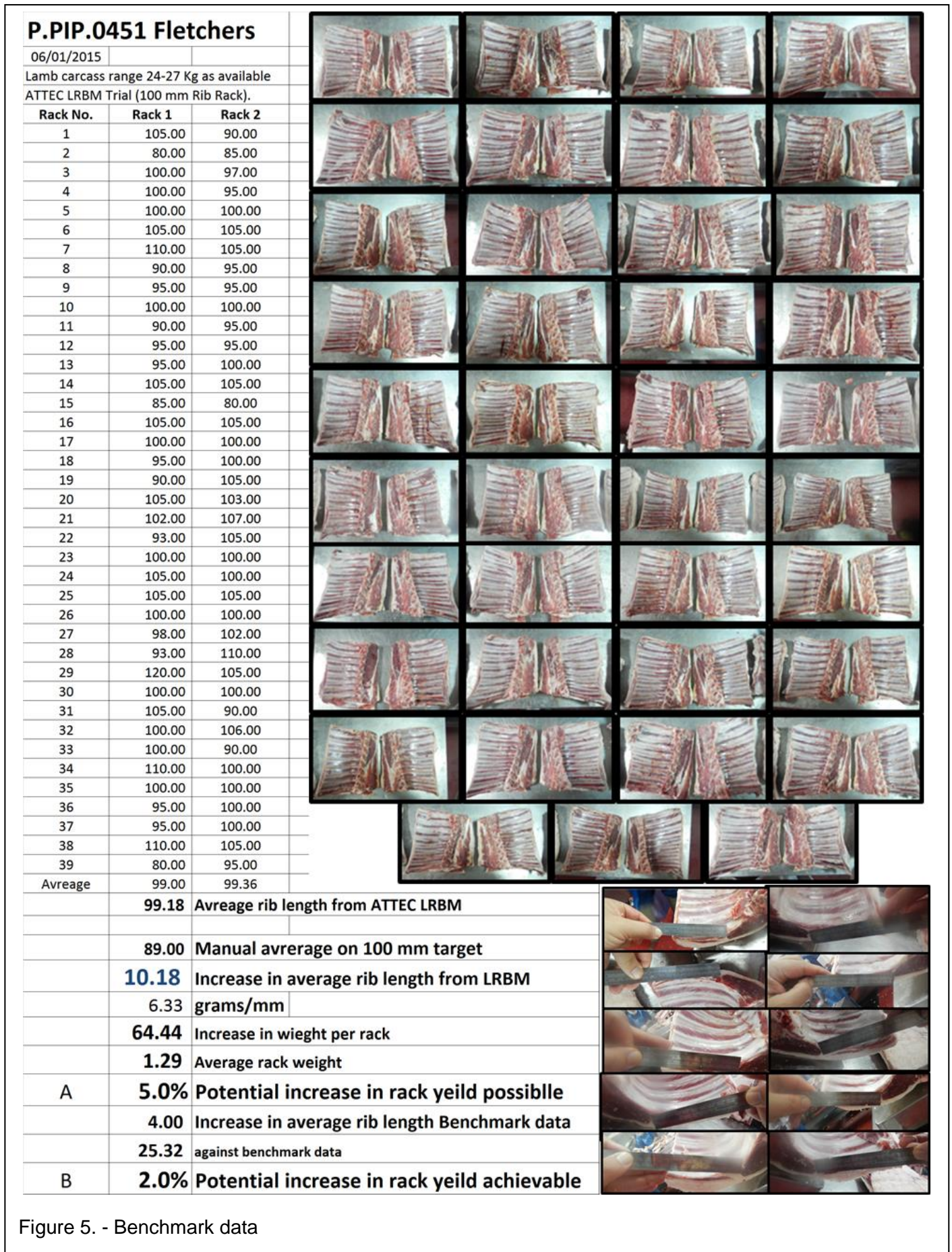


Figure 5. - Benchmark data

Fig. 5 shows images of the rack cuts from 39 rack barrels from available lambs in the total carcass weight range 24 to 27 Kg. The rib lengths for cuts from the LRBM average 99mm against, a target of 100mm. The checks on the flap cuts performed currently (band-saw cuts) give an average rib length of 89mm (see images from racks measures from current process in figure 3 bottom right). A difference of 11mm.

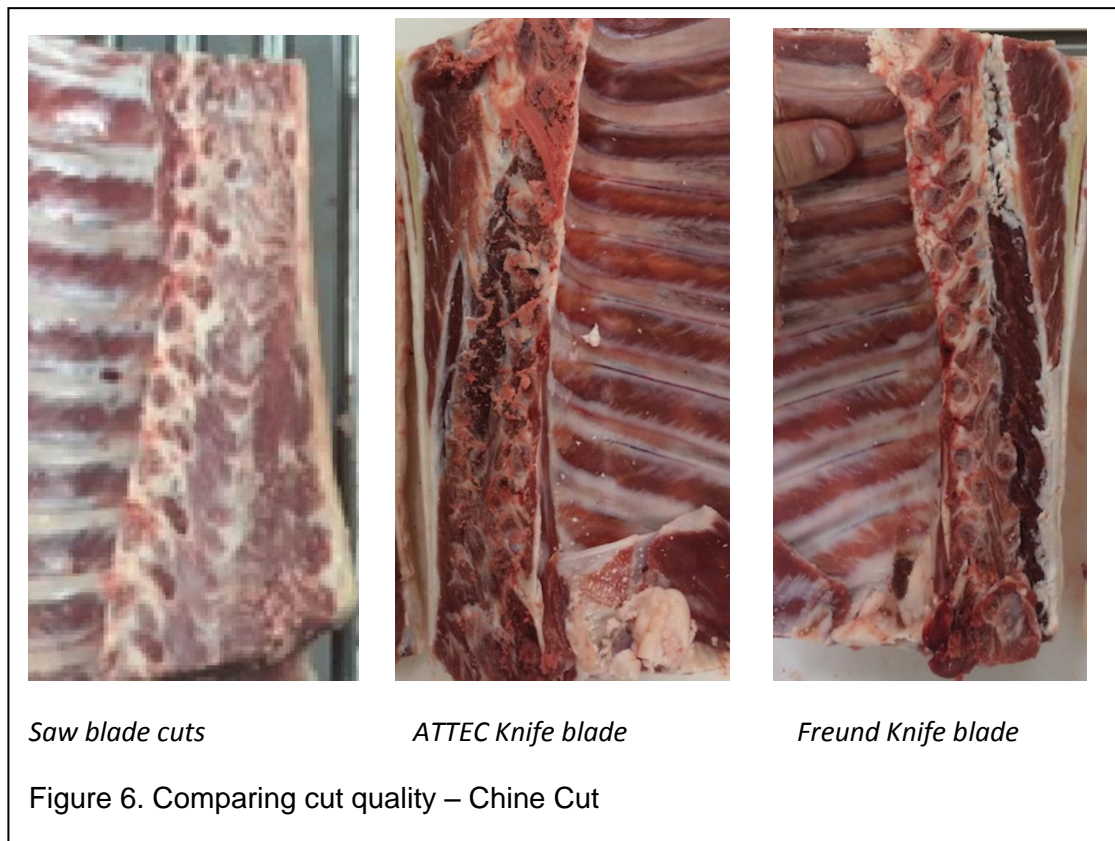
In the benchmark data reported the rack rib length against a 38mm target was 4mm as in Milestone 1 report.

Measurements of rib length strips give a weight of 6.33 grams per mm of increase in rib length for a cap-on rack. This (as in Figure 3, bottom left calculation) gives an estimated 5% increase in rack weight with the LRBM based on an 11mm increase in rib length and a 2% based on the 4mm benchmark from current process as documented in Milestone 1 report.

The quality of the process may be considered greater with the ATTEC LRBM, given the capability to achieve the target rib length on the flap cut more consistently.

Another consideration in the process is the use of knife blades of different design and avoiding the use of saw blades as in band-saws or the in the BLM machine.

Figure 4 presents images of the cuts on the racks and when examined close up the quality of the cuts on the LRBM can be seen to greater when compared with processes that use saw blades.



Finally, the operating speed of the machine has been tested to be 450 barrels per hour against the current nominal operating speed of 360 carcass per hour.

4.2.3 **Milestone 2 - Concluding remarks and the next steps**

Milestone 3 has been reached for benchmarking the ATTEC Lamb Rack Barrel Machine (LRBM) against the current process at Fletchers.

The machine is also situated in the cutting room for further trials, planned against commercial targets, which will be included in the final report.

The flap cut position is more consistently cut by the LRBM and trials on 100mm rib length rack have documented a 99mm hit rate average from the LRBM compared with an 89mm hit rate average of the current process for the same. In the benchmarking of the current process as reported in Milestone 1, the current process shortfall was 4 mm. In any case, the current evaluation is that the ATTEC LRBM is more consistent on the flap cut compared with current process and based on weight estimations a 2% to 5% rack weight yield can be expected from the rib length consistency achievable from the ATTEC LRBM.

The machine may be operated at 450 carcasses per hour taking into account the latest changes on the carrier, requiring more time for loading as compared with the past reported speeds in excesses of 1000 barrels per hour.

The cut quality is considered much improved when using knife blades and this is observed and documented in photographic form.

It is important to note that the cuts leading to the breakup of whole carcasses that produce the rack barrels use band-saws and the bone dust from previous stages would transfer forward to the ATTEC LRBM. It is recommended that Fletchers consider using knife blades, where this can be effective in eliminating bone dust and also improving primal cut yields.

4.2.4 **Subsequent Performance Trials against Commercial Targets**

A performance trial plan was conducted, comparing ATTEC LRBM to alternative industry equipment – the BLM machine.

This trial was conducted under normal production conditions, using Fletchers specifications.

It trial involved comparison data of 160 lambs over four specification categories (38mm, 55mm, 75mm, 100mm rib lengths). The lamb carcasses varied in weight from 17.3 kgs to 23.8 kgs, averaging 20.0 kgs.

The trial demonstrated a substantial labour saving, or at least one (1) labour unit and possibly more, depending on cutting room configuration and product specifications.

P.PIP.0451 Fletcher Comparison Trial
 ATTEC LRBM v's BLM
 160 Lambs in total
 20 Lambs per rib length (38mm, 55mm, 75mm, 100mm) per machine

	Carcass Weight (kgs)	Barrel Weight (kgs)	Barrel Yield (%)	Loss ATTEC LRBM (kgs)	Loss ATTEC LRBM (%)	Loss BLM (kgs)	Loss BLM (%)	ATTEC LRBM v's BLM Loss Improvement (kgs)	ATTEC LRBM v's BLM Loss Reduction
Average	20.0	3.765	18.85%	0.0106	0.3%	0.0713	1.9%	0.0606	85%

Figure 7: Yield loss through ATTEC LRBM v's BLM machine

Fig. 7 shows yield improvement through reduced loss. This loss is from the cutting action used by the BLM and band-saw blades, and is in the form of meat and bone dust.

In contrast, the ATTEC LRBM uses rotating blades, which slice, rather than using teeth to cut – virtually eliminating meat and bone dust

Daily Volume		4,000	
Additional Value using ATTEC LRBM over BLM on Loss			
	Per	Kgs	Value @ \$20/kg
	Lamb	0.061	\$1.21
	Day	243	\$4,851.00
	Week	1697.85	\$33,957.00
	Month	4,851	\$97,020.00
	Year	8,212	\$1,164,240.00

Figure 8: Value return on ATTEC LRBM v's BLM machine - in process

Fig. 8 demonstrates financial savings made from improved losses by using the ATTEC LRBM rather than the band-saw/BLM process. It takes into account the range of rib length specifications (38mm, 55mm, 75mm and 100mm), and is based on processing volume of 4,000 head per day.



ATTEC LRBM 38mm rib length



BLM 38mm rib length



ATTEC LRBM 55mm rib length



BLM 55mm rib length



ATTEC LRBM 75mm rib length



BLM 75mm rib length



ATTEC LRBM 100mm rib length



BLM 100mm rib length

Figure 9: Comparison Trial

5 Discussion

5.1 Project Objectives

- 5.1.1 To initiate a change management process for effective installation and testing of the ATTEC Lamb Rack Barrel Machine.

Machine adaptations and change management has been initiated on the Fletchers site to provide for effective installation and testing on the ATTEC Lamb Rack Barrel machine, see part 4.1.

- 5.1.2 To document performance capability in respect of cut accuracy, speed, yield and consistency comparing band-saw and the Rack Barrel machine

Trials have been conducted in a structured format, with documented results included in part 4.2 of this document.

There are also labour savings associated with the LRBM project. The current process has a band-saw operator who makes 3 band saw cuts –

1. Remove loin
2. Remove left rack flap
3. Remove right rack flap

The LRBM eliminates the need for the 2 & 3 to be conducted manually by the band-saw operator, as this function is performed automatically.

- 5.1.3 To quantify the benefits specifically for Fletchers

The benefits for Fletchers are many, including improved yield, improved product consistency, product presentation, OHS/WHs advantages and labour savings.

- 5.1.4 To produce an open report, presenting the findings (without compromising confidentiality).

The ATTEC Lamb Rack Barrel Machine proposes to replace several functions already performed by either a band-saw and/or the BLM machine.

Some band-saw functions were previously partly superseded by the BLM machine.

The ATTEC LRBM is the latest in semi-automated modular processing, which the trials demonstrate substantial advantage over predecessors. The machine is not only faster, it cuts with greater rib length precision, improved yield, better final product presentation and provides labour savings.

Refinement in process and design have allowed new process volumes to be incorporated, whilst remaining at commercial speeds.

The ATTEC LRBM offers a cost effective solution with excellent returns to the lamb (and possibly mutton) processing industry.

6 Conclusions/Recommendations

The trials performed under this PIP clearly nominate that the current process (band-saws and the BLM machine) provides a sub-specification outcome for Fletchers in terms of –

- Eye muscle damaged racks = 3 (14% of trial)
- Bone dust loss = 1%
- Rib length shortfall= 4 mm (11%)

The trials conducted under this PIP clearly demonstrate the ATTEC LRBM provide substantial increases compared to the current process in –

- Rib length (10% in length)
- Rack yield (2% - 5% through weight of saleable product)
- Product quality (surface bone dust elimination)
- OHS/WHS savings
- Labour savings (1 labour unit)

The improved product quality generated demonstrated by the ATTEC LRBM is substantially better than alternative processes –

- reducing the need for additional labour for cleaning / scraping
- improved presentation
- increased shelf-life

Production speed was conservatively tested at 450 per hour.

The value addition created by the ATTEC LRBM against existing commercial targets is substantial.

Operators were not placed in a position of being near moving blades or parts whilst using the LRBM. This compares to a high exposure using the previous band-saw process. There are substantial OHS/WHS benefits associated with the LRBM, specific to each processing site and their respective insurance policy.

The project has identified two areas for further research.

- Processing mutton through the LRBM
- Processing full rack barrels through the LRBM

Consideration for processing of a full rack barrel OR mutton may be the subject of further PIP projects.

7 Key Messages

The ATTEC LRBM allows processors to produce rack products, knowing with confidence that they are very accurate in terms of rib length. This confidence converts to substantially improved yields for the processor and the industry, generating improved financial outcomes.

Presentation and shelf-life improvements are substantial, also generating additional processor and industry value.

The ATTEC LRBM also eliminates the need for operator to be near blades or moving parts whilst processing. This functionality presents two outcomes for the industry –

1. Improved confidence that workers will not become injured whilst performing the rack cutting process
2. Reduce OHS/WHS costs