final report

[INSERT CATEGORY]

Project code:	**A.COM.0227**
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Date published:	**Oct 2015**
ISBN:	**[MLA to provide]**

PUBLISHED BY

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

Manual leap III for Small to Small Medium Australian Processors

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

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Abstract

The concept of the manual measure Leap III single tower system is to enable a processor to install a manually operated system with respect to the measuring station, but still with a single tower automated cutter. The concept will result in an estimated lower per head benefit than the fully automated system, however still aimed at a less than two year payback.

The impact on the meat industry is that a Manual Leap III System will allow smaller processors to introduce technology to their site without having to invest in a full blown X-Ray system. With this technology introduced there is potential that in the future the processors invest further with an x-ray module replacing the manual measuring station, and/or a second tower being added if the processors throughput also increases to over 5 cpm.

In addition it is felt that this entry model may also be a good way for the larger processors, who are still not engaging in the full automated system to try a smaller version of the system before committing to a fully automated solution.

Executive Summary

The concept of the manual measure Leap III single tower system is to enable a processor to install a manually operated system with respect to the measuring station, but still with a single tower automated cutter. The concept will result in an estimated lower per head benefit than the fully automated system, however still aimed at a less than two year payback. With this technology introduced to a site there is potential that processors will invest further in the future with an x-ray module replacing the manual measuring station, and/or a second tower being added if the processors throughput also increases to over 5 cpm.

In addition it is felt that this entry model may also be a good way for the larger processors, who are still not engaging in the full automated system to try a smaller version of the system before committing to a fully automated solution.

The design of a Manual Measure Leap III system was presented to a number of processors with positive feedback being received from all, each seeing the benefits for the small to small medium sized processor as well as seeing it as a way of introducing automation to larger processors that are hesitant about investing in fully automated systems.

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1 Background

For the past fifteen years Scott Technology has been developing their vision of a fully automated bone-in lamb concept jointly with MLA (and supported by various Australian processors) as depicted in Figure 1. The first three components of the vision: (1) Single energy x-ray, (2) Primal cutter, and (3) middle machine, are installed in Australian processing plants operating at greater than 7 cpm. Scott and MLA are also embarking on the early development of a Leap VI – Boneless Forequarter System, DEXA grading and forequarter processing (LEAP V) within Australia and a pending project is being developed for the hindquarter system, and additional modules to the middle machine (again all for larger processor throughput).

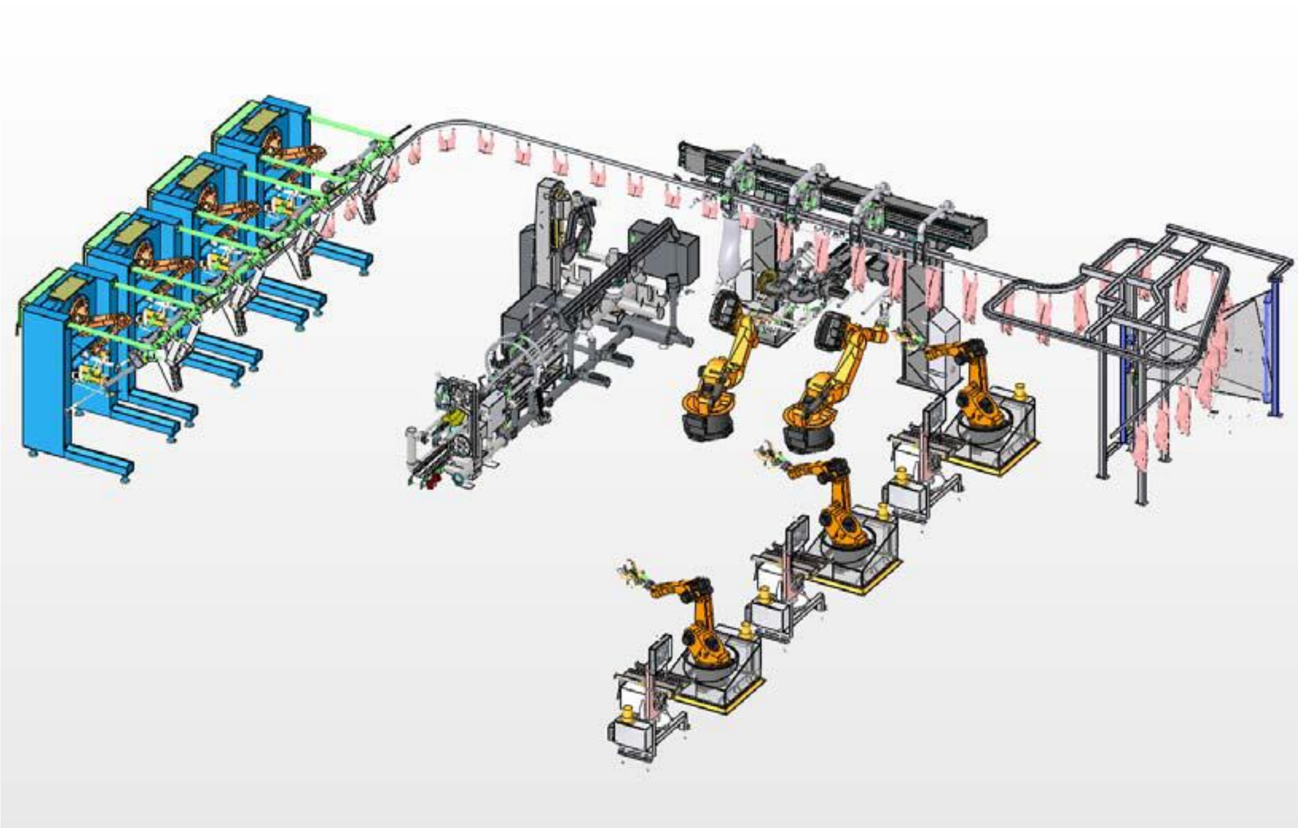

Figure 1: Boning Room Vision (fully automated bone-in room, with producer feedback and boneless forequarter processing)

Scott Technology (and MLA) are aware that since Scott has shown processors that getting the first cuts into a lamb carcase more accurately returns a significant yield benefit. This is demonstrated in plant by most companies now utilising more than one operator at the head saw (i.e. the saw that the primal cutter replaces) and/or having people prior to the head saw place knife cuts into the side of the carcase as a cutting guide for the head saw operator. This was not the case prior to Scott, MLA and Greenleaf demonstrating the cost of inaccuracy at the head saw process. Although this approach has improved the yield recovery of the manual head saw it still relies on the head saw operator to follow the suggested knifed cutting line indicators. In addition the knifing is being undertaken on a carcase without opening the cavity which also reduces the accuracy of the knifing stage. Scott (and MLA) believe that by developing a manual measuring station that will open the carcase cavity and allow the operator to use a laser line measuring device which then feeds to a primal tower (that will need a new carcase opening clamp mechanism) will increase yield to smaller processors. Both the initial marking of the cut locations and the actual cut locations will be a significant improvement on the already improved manual process of one person operating the head saw and multiple people operating the head saw and/or pre-marking the carcase for the head saw operator.

2 Project Objectives

The concept of the manual measure Leap III single tower system is to enable a processor to install a manually operated system with respect to the measuring station, but still with a single tower automated cutter. The concept will result in an estimated lower per head benefit than the fully automated system, however still aimed at a less than two year payback. The first primary design consideration is to enable processors to undertake the installation themselves (i.e. they are supplied with install drawings and 'Lego' modules to be bolted together). Processors will also be provided with all of the drawings required around ensuring a safety cell is incorporated into a 'Processor installed' option. Alternatively Scott will still offer a turn-key solution to processors. The secondary primary design consideration is on enabling processors to truly use this as an entry point into the Leap automation suite, by ensuring that an x-ray module can replace the manual measuring station (with the first cutting tower is retained albeit with replacing the manual measuring clamp with the current forequarter cutting clamp), and/or a second tower can be added if the processors throughput also increase in the future to over 5 cpm.

Finally, Scott believe that this entry model may also be a good way for the larger processors who are still not engaging in the full automated system to try a smaller version of the system before committing to a fully automated solution. A mobile try-before-you-buy offering is plausible as well for large, medium and small processor alike. Probably in a refrigerated container that can be left at a processing facility for one month to evaluate the benefits of MLA and Scott's past investment in this Leap III area.

At the conclusion of the project, MLA and Scott will have:

1. Conceptually designed and priced option(s) for a manual measure single automated primal tower Leap III, including an expected cost benefit based on existing Greenleaf reports and belief of the percentage of benefits retained by the manual measure system.

2. Feedback from five processors (Selected by MLA) on why they would or would not buy the concept (after item 1 is completed).

3 Methodology

For this project Scott developed concept designs for a manual measure single tower automated primal LEAP III system, these were presented to MLA and one was nominated (the pure manual system) as the preferred option for presentation to processors. Costing and anticipated Cost benefit wasl be provided based on existing Greenleaf reports. The feedback from the processors was presented to MLA.

4 Results and Discussion - Section

The Scott design team developed four concepts for evaluating by both MLA and Australian Processors. The main difference to the concepts is whether the measure station is truly manual, or incorporates either vision and/or weight based assistance on the manual measure. A fifth concept, for completeness, utilises a single x-ray tube to undertake the forequarter cut height and still needs an operator to manually identify the required forequarter pitch.

The key factor in the review was the reduction in cycle speed. With the standard 10/minute system operating 2 cutting towers which each performs a cut it was obvious to use a single tower for a 5/minute system.

With only one cutting unit to perform both cuts (forequarter/middle separation and middle/hindquarter separation), it was necessary to review clamping. A clamping unit was designed in principle which has provision for clamping either the forequarter or the middle.

Assessment was made in principle of the cutting units and towers, and it was felt that no significant cost savings could be made on these without compromising machine performance. Furthermore, with the aim of being able to upgrade the machines to full specification in the future there has been a reluctance to make substantial changes to the core technology. However, it is possible to omit the drive mechanisms for both scallop cutting angle adjustment and pitching (for forequarter removal), and these can become options depending on the processor’s needs. The final outcome and recommendation is to leave scallop cutting as an option and forequarter pitch as a standard. This is based on the Greenleaf analysis of the x-ray primal.

The overhead transfer was assessed and it was realised that the transfer speed will virtually match that of the 10/minute system as having two cuts performed within a single cycle means that the machine operation remains fast. For this reason it was felt that the full control of the overhead transfer would be necessary.

The scanning system is seen as an area where some compromise can be made in machine specification. The full specification system incorporates an x-ray room capable of scanning every carcass travelling at 10/minute which is highly accurate but adds substantially to the price and the footprint. This is difficult to downsize to suit 5/minute, so other more economic scanning systems were also considered.

4.1 Scanning Options and Budget Costing

The sections below detail the various options considered and give budget costings of each.

Option 1 (Budget cost $910k)
Manual laser measurement system.

Option 2 (Budget cost $1,110k)
Basic cut position estimating: using reference data from an external camera (measuring length) and a weigh scale, an algorithm would be used based on previously collected x-ray data to estimate cutting heights. Pitching is not possible in this system and accuracy may be quite low.

Option 3 (Budget cost $1,280k)
Manual Measurement: The original primal system at CRF Colac (plant now owned by ALC, and a new X-Ray Primal has recently been installed) incorporated a manual measuring station. While this requires the “running cost” of an operator, this has the potential to remove a degree of uncertainty around cut accuracy (a good operator will be reasonably accurate, albeit with variation across a day/week and between operators) and removes the need to develop a fresh set of analysis algorithms.
A variation on this is shown where a camera and laser on a frame is lowered into the chest cavity, with the operator selecting the cut position via the video output. The operator could control the motion of the camera and laser and select when the laser is lined up with the cut. This would ensure the chest cavity is not disturbed and therefore there would be better conformity between the selected cut position and the actual cut position.

Option 4 (Budget cost $1,400k)
Fully Automated Camera System: This is a combination of Levels 1 and 2 whereby a camera system and automatic algorithms automatically sense the cut positions, with the lower camera being lowered into the chest cavity to view the ribs (rather than viewing the outside). As previously shown, this system may be less accurate than manual measurement (although we now have x-ray data to help improve the model), but it would ensure the system is completely automatic.

Option 5
Single X-Ray Fully Automated: Using an x-ray unit to obtain the accuracy of the full system, this unit would have the x-ray beam turned to the horizontal (we currently use vertical) and the carcass would be lowered through it. The second image would be obtained by reorienting the x-ray hardware prior to raising the carcass back to the rail. Expense of this unit is relatively high, but so too would the accuracy be, and the footprint is not expected to be excessive (albeit that significant confirmation is needed to ensure radiation safety).

These options are shown in Appendix.1 of this report.

5 Success in Achieving Objectives

5.1 Processor feedback

Following review of the options in Section 4, Scott recommends that pure Manual Measure (without any cameras), including forequarter pitch, concept be pursued and this option was presented to the following Australian processors:

- JBS
- ALC
- Southern Meats and WAMMCO
- Thomas Foods International

Feedback from all was positive and responses were as follows:

ALC – could see the advantage for smaller plants not able to commit to a full blown X-Ray Primal system. Obviously the system would not be applicable to ALC who have X-Ray systems at both their Sunshine and Colac Plants. ALC representative commented that it was similar to a concept he had discussed a couple of years ago.

JBS – was interested in this concept for JBS's smaller Tasmanian Plants

Southern Meats and WAMMCO – commented,

- that it would be great for Southern Meats in the interim as the plant was not yet at > 7 cpm. They stated they could run most of their production on the manual measure and overflow on a bandsaw. Then, when the time was right they could add X-Ray and/or an extra tower. Hence a great way to introduce technology to the site now.
- Once the system was installed at southern WAMMCO could see it in operation and use this as another step in committing to the fully automated 10 cpm cell.

5.2 Cost Benefit Analysis

The Ex-post value proposition for Scott's Automated Ovine X-Ray Primal Cutting Systems prepared by Greenleaf Enterprises is attached as Appendix 2 to this report. Figure 2 from this Ex-post report shows the benefits derived from Scott's X-Ray system compared with manual cutting and is shown below.

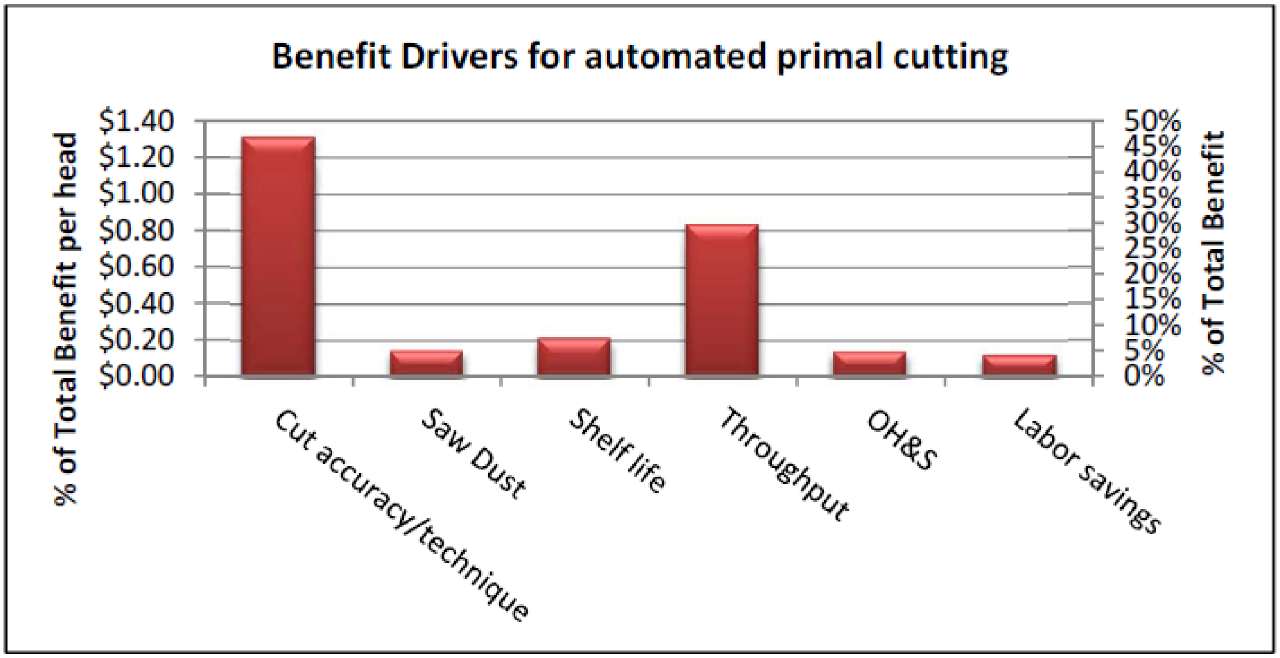

Figure 2 Summary of benefits delivered from Scott's x-ray primal cutting solution

It can be seen from this table that the derived benefits per carcass are as follows:

	Benefit derived/carcass
Cut Accuracy/Technique	$1.25
Saw Dust	$0.15
Shelf Life	$0.20
Throughput	$0.80
OH&S	$0.18
Labour Savings	$0.10
TOTAL	**$2.68**

Using percentages of benefits that can be transferred to the Manual Measure system we derived the benefit per carcass shown below.

	%	Benefit derived/carcass
Cut Accuracy/Technique	70	$0.88
Saw Dust	100	$0.15
Shelf Life	100	$0.20
Throughput	0	$0.00
OH&S	100	$0.18
Labour Savings	0	$0.00
TOTAL		**$1.41**

Hence gross benefit using Manual Leap III system is $1.41/carcass.

For a plant processing 5cpm, or 513,000 carcasses per year this equates to a gross benefit of $723,330.

As stated in section 4.1 the budget cost for a Manual Leap III System is $910k. Allowing $200k to install the system the total cost is $1,110k.

Hence including installation the payback period is 1.5 years.

6 Impact on Meat and Livestock Industry – now & in five years time

As implied in Section 5.1, in the feedback from the processors, the immediate impact on the meat industry is that a Manual Leap III System will allow smaller processors to introduce technology to their site without having to invest in a full blown X-Ray system. With this technology introduced there is potential that in the future the processors invest further with an x-ray module replacing the manual measuring station, and/or a second tower being added if the processors throughput also increases to over 5 cpm.

In addition it is felt that this entry model may also be a good way for the larger processors, who are still not engaging in the full automated system to try a smaller version of the system before committing to a fully automated solution.

7 Conclusions and Recommendations

Currently, in parallel to this project a Scott : MLA 50:50 project is completing the build of a demonstration unit using the Pure Manual concept. Hence in addition, due to the positive feedback received from processors as part of this, it is recommended that a project be proposed and approved to transport the system around to various processors for demonstration.

8 Appendices

8.1 Appendix 1 – Manual System design options

8.2 Appendix 2 – Ex-post value proposition for automated Ovine X-Ray Primal Cutting Systems