



AUSTRALIAN MEAT PROCESSOR CORPORATION

Progressing fundamental Vision & Sensing and demonstrating the value of the Australian meat processing industry

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1.0 Abstract

According to MLA, Australia is among the largest and most successful and efficient producers of commercial livestock and leader in the export of red meat and livestock. Nevertheless, the industry faces some challenges especially those ones related to process automation. Lots of companies are using semi-automation e.g. in form of conveyors, but the majority of processes within the red meat industry are related to manual handling. Meat processing facilities are therefore very labour intensive and manual picking and packing of primal cuts of up to 5 kg leads to an enhanced occupational health and safety risk (OH&S) for operators. This is connected with a high employee turnover resulting in a loss of quality and inefficiencies due to a constant training for new employees during operating times. This fact also makes the red meat industry in Australia less attractive as an employer for younger people. Process automation is inevitable for the Australian red meat industry to reduce operating costs, increase OH&S standards, maintain its productivity and increase its attractiveness as an employer.

SAGE was assigned to undertake a brief research to gain an understanding of the current issues within the red meat industry and evaluate whether any solutions in other industries may be modified, adapted or ported over to this industry. These solutions were specifically targeted by integrating of vision and sensing systems. Vision and sensing systems are a key technological challenge as a company processes many different types of primal cuts (variation in size, weight etc.). The industry will require precise sensing systems, which are able to identify different positions and types of primal cuts.

Three Abattoirs in NSW, QLD and SA were visited with AMPC in 2014/2015 to gain an understanding of the existing solutions and differences within the sites. In the first visits the task and research direction was refined to a deeper investigation in Business Optimisation before applying vision and sensing systems, as those systems need preconditions in organisation (technical training for employees etc.) and equipment set up. The upfront investigation in Business Optimisation is essential as implementing vision and sensing systems require a high initial financial investment and need a precise previous planning.

2.0 Project Objectives

The project objectives were to list, in some detail SAGE's findings of some of the most common concerns and ideas collected from the site visits in NSW, QLD and VIC. Where possible, these findings should be linked to some project solutions previously completed in other industries. The result being that AMPC will have a list of concerns, ideas and possible solutions. AMPC can then determine if some or all of these solutions warrant further investment in order to increase the performance and quality of processes in the meat processing industry to aid with the unique challenges and environment associated with it.

At the very beginning of the site visits, the task and research direction was refined to a deeper investigation in Business Optimisation before applying vision and sensing systems, as those systems need preconditions in organisation and equipment set up.

3.0 Executive Summary

SAGE was assigned to undertake a brief research to gain an understanding of the current issues within the red meat industry and evaluate whether any solutions in other industries may be modified, adapted or ported over to this industry. These solutions were specifically targeted around vision and sensing systems. Vision and sensing systems are a key technological challenge as a company processes many different types of products (variation in size, weight etc.). The industry will require precise sensing systems, which are able to identify different positions and types of products. Three Abattoirs in NSW, QLD and SA were visited with AMPC in 2014/2015 to gain an understanding of the existing solutions and differences within the sites. In the first visits the task and research direction was refined to a deeper investigation in Business Optimisation before applying vision and sensing systems, as those systems need preconditions in organization (technical training for employees etc.) and equipment set up.

The sites were visited for one day and intensive discussions in the meeting room or on the shop floor were held with stakeholders along the process line. The visits always commenced on the stock yard and led along the entire value chain to the dispatch area. The major value stream of the carcass and primal cuts was investigated as well as the side value streams such as offal, blood and bones.

For the opportunity analysis the material flow of the carcass was segregated in 3 areas, whereof the process from the boning room onwards bears from SAGE's perspective the biggest opportunities:

- **Stock yard and kill floor**
- **Boning room**
- **Packaging, Storage and Dispatch**

The sites showed a different level of organisation, automation, visual management, IT usage and empowerment of people. Major opportunities are seen in the boning room, packaging and in the side value streams. These are subjective observations and they have to be verified in an in depth VSM (Value Stream Map) analysis of every single abattoir. The detailed paragraphs will use some examples to underpin the statement.

The sites visited are so different that a general approach for all meat works will not lead to viable results. A VSM should be developed for every single site to identify opportunities and cost drivers. A Pareto Analysis helps to prioritise the outcomes. This procedure gives us the best ROI (Return on Invest) for our findings and is a Road map for the future strategy. It also shows us if the site has the right set up for further automation such as cutting edge collaborative robots and integrated vision and sensing systems, or if we have to accomplish some prior steps before going this path.

Introducing Lean principles, as a further step, would help to uncover potentials in procedures and people to become a best in class operation.

Those principles change the focus from optimising separate technologies, assets, and vertical departments to optimising the flow of products and services through entire value streams. It involves the entire workforce and helps to understand the industry and keeps the motivation on a high level. On the long run a Lean approach is inevitable in the Australian red meat industry to

achieve a paradigm shift and stay competitive in the global market.

4.0 Stockyard and kill floor

4.1 In line manufacturing opportunities

Helping aids such as Knuckle pullers, cylinders to remove the skin between pelt and carcass and other useful mechanical devices to reduce physical force need to be focused on in this area. It can be organised with a continuous improvement structure. Thus little aids help to support any single station and to increase productivity in incremental steps, reduces injuries and muscular fatigue.

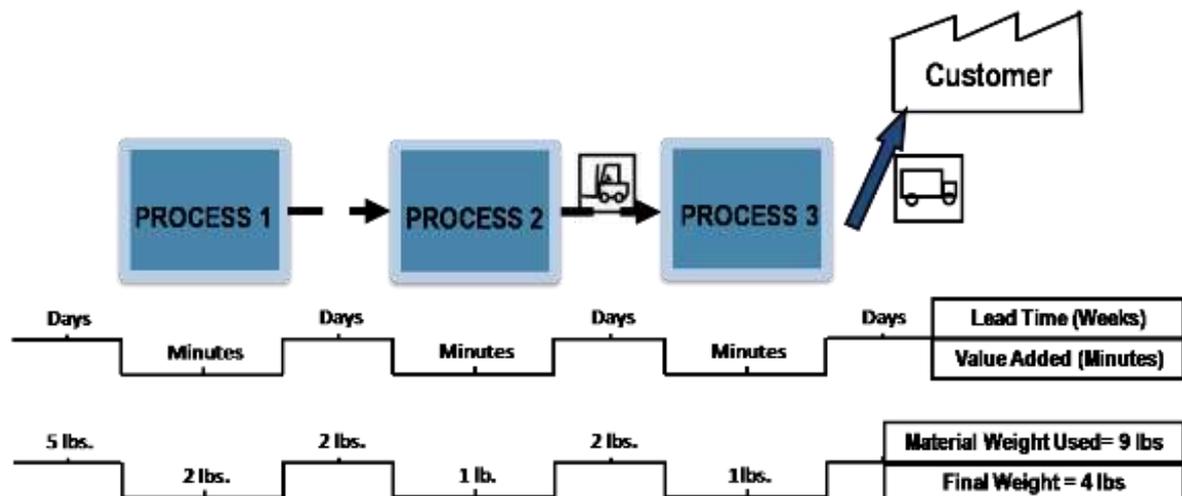
4.2 By Products Offal

Following the value stream of the offal it becomes clear very quickly, that in those side streams a lot of labour is involved unseen as the further processing is captured underground. As learning from other industries the main focus of attention is on the major value stream and sidelines are often neglected. It bears an opportunity for improvement and the same analysis has to be carried out as for the main stream. The offal process has to be value stream mapped and with the outcomes such as major cost drivers, priorities and chances for automation actions have to be taken.

A brief benchmark showed there are already approaches in form of special grippers or vision systems available to sort and handle offal. In point 4.2.1 one of those sidelines is taken out as an exemplar.

4.2.1 Paunch Processing

The assumption is, that the detailed VSM showed a major cost in processing the paunch in equipment and labour.



Source: <http://www.pprc.org>, accessed 24th March 2015

With problem solving tools and involvement of the operators a new layout will be generated with the target to save 3 of the 6 labour. Focus is on streamlining the layout, eliminate double handling, think of lifting devices, automate and use vision systems where it makes sense.

A benchmark within and outside the group will add ideas to establish a best in class paunch processing line. Once this is set up and running, other sites in the group use the synergy and are

able to implement or adapt the developed system.

The freed up operator capacity can be used in other areas to apply the structure and practice for improvement. By doing so the speed of implementation and the change management is increased.

The benefit of this modus operandi is mid-term as increasing overall capacity and not just reducing workforce raise the productivity.

5.0 Boning Room

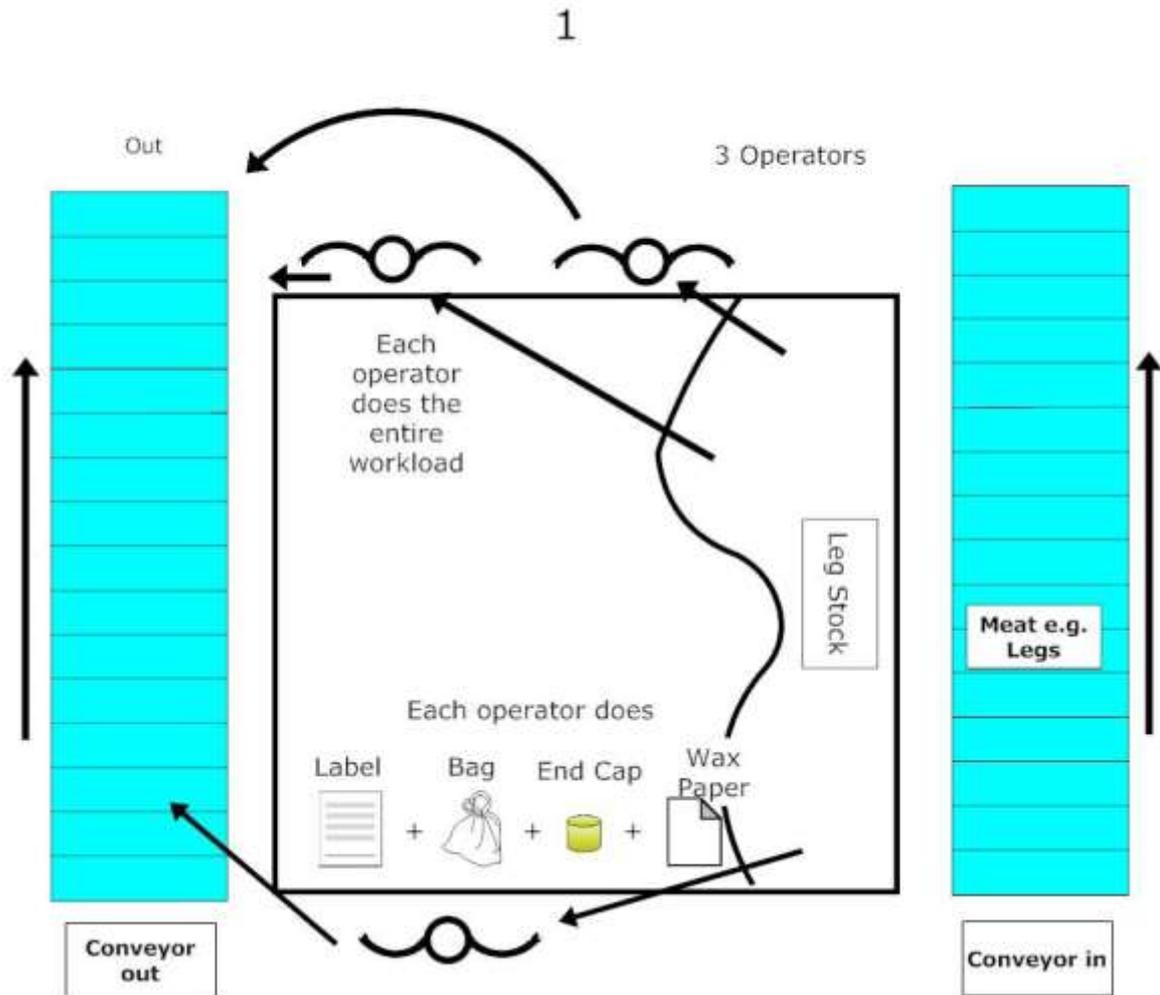
Amongst the 3 sites have been very different boning rooms from a highly automated one with an MES (Manufacturing Execution system) to trace and control every single piece to a semi-automated one. MES systems collect real time data and allow to set immediate countermeasures while the process is running. Therefore the rework is reduced as the quality is checked inline and no value is added to a faulty product.

Highly automated boning rooms prevent double handling compared against semi-automated or even manual boning rooms. The variation in products forces continuous changes of layouts to adjust to the product. Those boning rooms lose traceability and can't assign the product any more to the operator or the carcass, what is a disadvantage for following up KPI's e.g. operator yield, quality data, or a farm to plate approach.

A snapshot observation is taken as an exemplar for short-term improvements, it showed different ways of packaging lamb shanks. Two tables had the same work content by packing lamb shanks in bags, adding a wax paper, applying an end cap to the bone, adding a label into the bag and placing it after on a conveyor belt. One of those tables was approx. 1/3 faster than the other by sharing the work content (see below).

Team 1

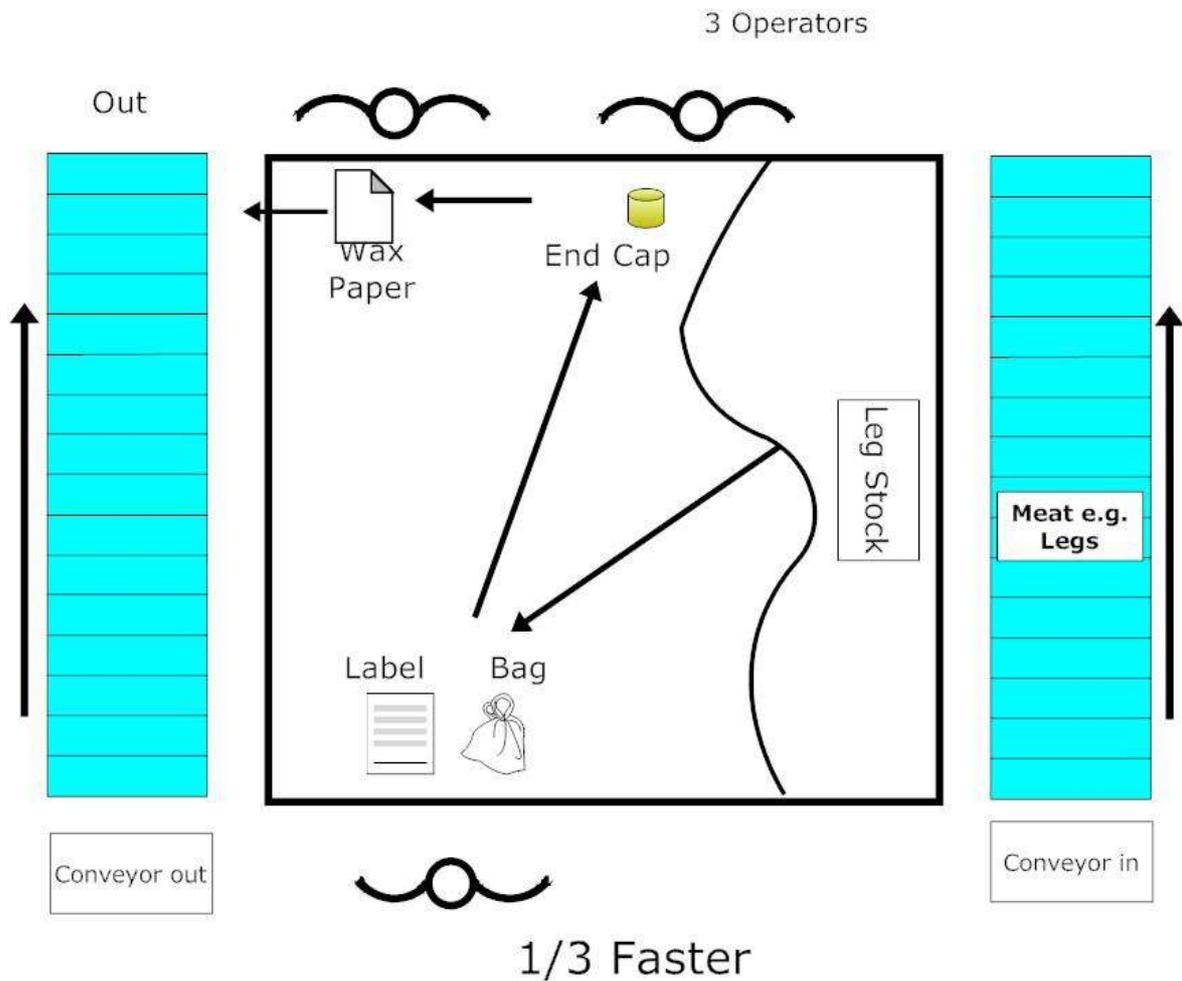
3 operators, each does the entire work content



Team 2

3 operators, each does only a partial work content and moved the product to the next operator

2



Those differences are of an organisational nature and can be addressed by implementing standard procedures developed according to the lean principles and using visual management to train and support those standards. Thus bears opportunities for improvements even with low investments

Vision systems in the boning room are not seen as an easy approach with the right return when there is larger opportunities in the value stream, but it can be done a lot by preparing the product for automated handling at the end of the value stream in the packaging area. Having the right bags, labels, direction on the conveyor, information etc. help to provide this approach.

6.0 Packaging, Storage and Dispatch

6.1 Packaging

The packaging areas in comparison to other industries seem to have a high labour content. The packaging area often causes procrastinations to the workflow within the boning room, as primal cuts are packaged at half the rate than they are produced. All information is on the already bagged products therefore there is opportunity for automation such as Vision & Sensing, bar-QR-DMC (Data Matrix codes) codes , conveyors or even the application of collaborative robots.

6.1.1 Collaborative Robots

Collaborative robots are a new breed of robots which can work in conjunction with humans without safety guards. The applications at present are in the majority pick and place what would suit the red meat industry. Some of them are flexible and can be wheeled to a new task and trained within minutes without a programmer. A vision system is an option to identify products in a defined area and there is no need to present them accurately. A current application in another industry is to pack truffles in boxes alongside human workplaces.



6.1.2 Moving Conveyors



The conveyors work in a way that they have a programmed pattern for a determined box. The conveyor is moved according to the pattern. The Australian red meat industry could use such conveyors in three forms:

1) **Carton-In-Feed Conveyor**

Empty cartons/containers will be filled automatically

2) **Carton packaging conveyor**

Ejection of cartons/containers for the in-feed conveyor

3) **Carton-Out-Feed-Conveyor**

Attach further labels and strapping of cartons/containers

Those conveyors were discussed with a positive feedback in more depth at the Queensland site directly in the packaging area.

6.1.3 Code Scanners (bar-QR-DMC codes)

The major function of code scanners is to be able to localize products at every point in the production chain. The real-time data provided by scanning the codes is important to comply with strict production times. Beside this, the major concern is obviously consumer safety.

This need for meat traceability needs scanning technologies that can be integrated both in simple software environments as well as in environments with complex ERP systems. Code Scanners are supporting the whole supply chain, from delivery of the raw material to product dispatch.

6.2 Storage

When it comes to meat storage, high requirements must be fulfilled like HACCP (Hazard Analysis and Critical Control Points) standards or customer demands for traceability. Meat products are stored chilled or frozen and short-term. Storage solutions for meat products require processes with high availability and fast handling to ensure high throughputs. Cold stores must allow for chilling and freezing fresh meat as well as storing the meat products in those conditions. Therefore warehouse equipment like forklifts are required which are able to operate in an environment with very low temperatures. There are multiple intelligent storage systems on the market. They can range from refrigerated high-bay warehouses with sequential processes or refrigerated heavy load movable storage systems to fully automated refrigerated warehouses. All storage systems need to be germ-free, should preserve a high meat quality and must be selected based on special requirements given by every single site.

Another point to follow up is to shortcut a certain volume of the products and load them directly in containers with a controlled atmosphere for shipment, without running them through the store. To look in depth into this approach a product volume analysis and an accurate value stream map has to be created.



Source: www.ewers-online.de, accessed 27th Juny 2015-07-29 2015



Source: www.ellismh.com, accessed 24th March

6.3 Dispatch

Automated loading docks can be integrated in a holistic approach from packaging to the truck for a safe and fast loading. **Automated guided vehicles (AGV)** are an option when it comes to dispatching red meat products. AGV's are used to carry and pull transported material with active or passive load handling attachments. Active load handling attachments can be a telescopic fork, roadways or conveyors. Passive handling attachments need guide chamfers for picking up and releasing loads. AGV's can be integrated to existing systems and they allow for layout changes. Furthermore they can be adapted to fluctuations in transportation capacities and to an increasing degree of automation. **Automated loading systems** could help loading products without racks or pallets to eliminate returns. Automated loading systems will therefore reduce the amount of time currently needed when loading a trailer with meat products.

Automated Guided Vehicles



High-lift fork truck



Platform truck with roller conveyor



Drive-under tractors

Source: www.mlr.de, accessed: 27th July 2015

Automated loading systems



Source: www.loading-automation.com , accessed 24th March 2015

7.0 MES & QM

A manufacturing execution system (MES) assists the QM with real time information of the production and major KPI's. With such a system quality, yield and operator performance are visible and countermeasures can be set on the spot. Rework is reduced and operators can be trained on the job if any false cut is detected.

An MES system can be linked with automation and vision and sensing systems to achieve greater accuracy and decouple decisions from human errors. Furthermore it is necessary for a traceability of product from farm to plate as we need to know at any point in time.

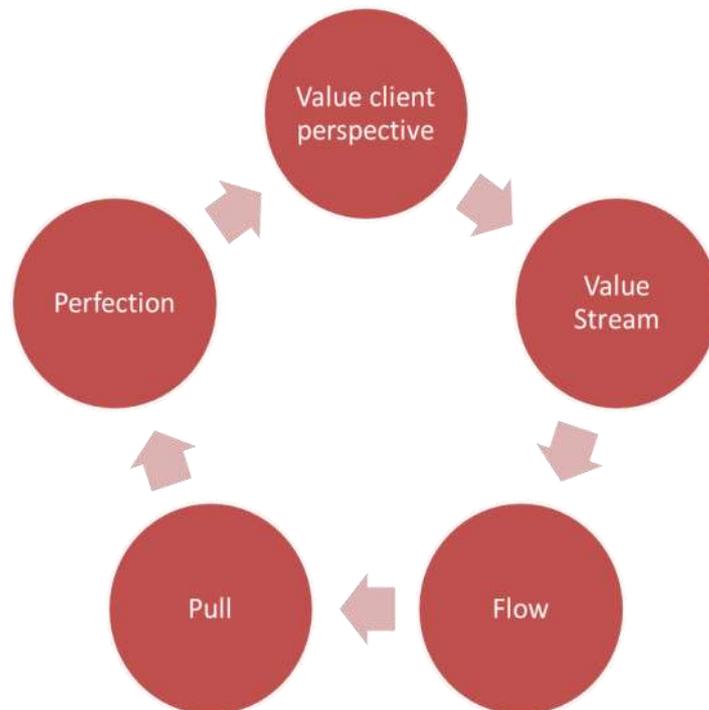
8.0 Lean Thinking

Lean thinking, with its five principles, changes the focus of management from optimising separate technologies, assets, and vertical departments to optimising the flow of products and services through entire value streams. These value streams flow horizontally across technologies, assets, and departments to customers.

It is not a cost reduction program, but a way of thinking and acting for an entire organisation. Simply, Lean means creating more value for customers with fewer resources, which means an increase of productivity.

From my perspective the application of those principles lead to a paradigm shift in the meat industry and help to stay competitive in a global market. It is a strategic decision, which changes the entire way of work with proven benefits to the organisation. Only a holistic approach will lead to a paradigm shift and show the opportunities in organisation, semi-automation, automation and vision & sensing systems. Otherwise it will always be an approach to optimise separate areas, technologies or assets without considering the overall picture.

- 5 Principles of Lean



8.1 Continuous Improvement (CIP) as Lean tool

CIP has to be done at any point in time and not just from one person or a small group. CIP is a culture with involvement of the entire workforce to identify, reduce, and eliminate suboptimal processes.

Setting up a CIP group is essential for a production site to achieve the yearly goals to increase productivity by a determined percentage. CIP groups in different sites must work together to standardise and utilise capacities in a thorough manner.

Those groups assigned on site will improve processes by involving others for gaining new ideas and new process developments. Sharing capacities and capabilities among the CIP groups will also lead to a faster project execution.

8.2 Benchmark as Lean tool

A great benefit for a site within a Corporation is benchmarking between sites in the group for a determined process before redesigning a process. Determine the best in group process and redesign it with involvement of all sites lead to a benefit for all sites.

A global benchmark of who is best in class costs time and money but has a great outcome for bigger projects.

9.0 Attraction of young people to the industry

This is just a remark as all 3 sites raised in the discussions, the issue of attracting juniors to the industry to develop them for the management team. A centralised need for action is seen and early connection to Universities can help to boost the reputation of the industry.

Furthermore early involvement of students in projects can help them to get an impression and they are an additional capacity with a fresh mindset, cutting edge technologies and new tool boxes from lean or six sigma principles taught at the Universities.

10.0 Conclusion

SAGE Automation focused on the Business Optimisation part, before applying vision and sensing systems, as those systems need preconditions in organisation and equipment set up. Those investigations in Business Optimisation will minimise the risk of implementing vision and sensing systems in a great way.

There are multiple opportunities to solve the issues within the Australian red meat industry. First of all a road map has to be developed for every single site to start with the projects which show the highest ROI. Based on the road maps an R & D approach can be developed.

Another possibility is to begin with changes in a pilot area with short-term outcomes to commence the change process and having quick wins for the industry.

There is also the opportunity to introduce vision and sensing systems and automation. Nevertheless, from my point of view there will be the highest benefit for the industry, to start first in the last half of the production (Boning Room & Packaging), as there are more opportunities for optimisation. With changes in those areas, bottlenecks currently experienced by lots of sites can be mitigated.

A further step is implementing a VSM out of the developed road map, which will show the biggest opportunities and areas for savings. A general Lean approach in the red meat industry will help to stay competitive in the future.

To sum it up, SAGE Automation recommends:

- Developing a road map to show most promising projects
- Beginning with changes in a pilot area
- Focusing first on optimisation in the second half of the production process
- Implementing a Lean approach

