final report

Project code: B.FLT.1004

Prepared by: Cheryl McCarthy and Peter Brett
University of Southern Queensland - Centre for Agricultural Engineering

Date published: 31 January 2019

PUBLISHED BY
Meat and Livestock Australia Limited
Locked Bag 1961
NORTH SYDNEY NSW 2059

Feasibility of induction automation R&D

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

Executive Summary

A review of opportunities for feedlot induction automation technologies completed in 2017 identified that induction automation had a positive value proposition. Subsequently, a framework whereby induction automation R&D could be undertaken and demonstrated was proposed via establishment of a dedicated induction facility with collaboration from industry partners. This project investigated the feasibility for induction automation R&D by identifying an industry partnership and priority research areas achieved via meetings with feedlot operators, software providers and equipment manufacturers.

A ranked list of R&D priorities for induction automation was workshopped with representation from large feedlots and equipment manufacturers. The top three priorities were identified as: immobilising animals, semi-automation of application of veterinary chemicals and pharmaceuticals, and endpoint and health management (walk over weighing). Within immobilising animals, the top two potential products for R&D were head restraint, and full body restraint. Automation and sensing incoporated into mechanical design has potential to deliver calm and restrained animals at induction that caters for variable characteristics, size and behaviour of each animal, with potential cost justification through savings in operator and animal safety, and raising the accuracy to which measurements and therapy can be applied.

Table of Contents

1 Background

All cattle arriving at a feedlot undergo induction, which involves animals being guided through a laneway into a crush, where animals are processed individually by a team of 3-4 staff every 20-30 seconds. Major induction tasks are restraining the animal, ear tagging, application of drenches and mouthing for dentition, and the process is currently labour intensive and very physical. Feedlot induction is a key priority identified by the Australian feedlot industry for the application of automation technologies, to enhance labour efficiency, worker safety, application of animal therapy (e.g. drenches) and animal health.

MLA review project B.FLT.0247, completed in 2017, identified that there was positive value proposition in feedlot induction automation. The key opportunities for automation were: (i) smooth and continuous motion of animals into the induction crush; (ii) a wireless Internet-Of-Things framework for tools, transducers and data used around the induction crush; and (iii) development of an induction automation demonstration facility with industry partners, where technologies could be developed, trialled, evaluated and exhibited. The present project has scoped out opportunities regarding (iii) an induction automation demonstration facility with industry partners.

2 Project Objectives

The Research Organisation will achieve the following objective(s) to MLA's reasonable satisfaction:

For construction of a potential feedlot Integrated Automation Development Facility (IADF):

(1) Design a facility in consultation with feedlot stakeholders that integrates automation technologies that exhibit a positive ex-ante cost-benefit analysis
(2) Ensure where possible that the designed facility is built to be future proof or retrofittable for future technologies
(3) Determine feedlot location and equipment supply partners
(4) Determine in-kind donations of capital or expenses for construction
(5) Determine sources of cash funding and quantum for capital and expenses for construction
(6) Deliver site plan and drawings (Autocad or equivalent) to enable construction of a feedlot Integrated Automation Development Facility (IADF)
(7) Determine in consultation with partners experimental methodology and expenses over subsequent phases of the project to determine the value proposition to automation

3 Methodology

3.1 Revised outcomes as guided by MLA

As the project progressed, the project objectives underwent a subtle shift within the theme of work to deliver value of a specific nature to the industry. As opposed to defining a full national automation pilot for automation technology for feedlot induction, the outcome was guided

toward the development of a multi-partnership to explore high priority applications defined by industrial partnership. It is expected that the new approach would arrive at the original vision in the longer term, guided by industry preferences, and with potential for expansion and integration with other R&D.

3.1.1 Options for induction automation R&D demonstration sites

The following list was assembled to review options for potential induction automation R&D demonstration sites, from which it was determined that multiple options, rather than one, would be most desirable going forward.

1. Research feedlot already being developed in an ALFA / MLA initiative with a university or commercial feedlot, which will be jointly managed by MLA and the partner, and will incorporate induction facilities as well as other typical feedlot facilities.
2. A dedicated induction demonstration facility at a commercial feedlot with high throughput of cattle, where cattle processing can be easily switched between with and without induction automation R&D, such that overall throughput is not negatively impacted by induction automation R&D.
3. A commercial feedlot collaborating on a case-by-case basis for component technologies in induction automation R&D.
4. Combinations of the above.

Consequently, the aim of the project was adjusted to become aligned with generation of a framework for further R&D and collaboration for induction automation, plus a priority list and top two products for induction automation R&D.

3.1.2 Project timeline

The project timeline is provided below with initial, and updated, activities.

Timeline	**Initial planned activities**	**Updated planned activities, as guided by MLA**
Item 1. Individual meetings Jul-Aug 2018	USQ to meet feedlot operators, software producers and equipment manufacturers	No change
Item 2. **Partners Meeting 1** Sep 2018	To enable interaction between potential partners, to set the culture and need for in-kind support, nature of the working Partners' agreement	To enable interaction between potential partners, to set the nature of the working Partners' agreement, and determine industrial priorities for R&D
Item 3. Interim discussions Sep 2018	Interim discussions	No change
Item 4. **Partners Meeting 2** Oct 2018	To press in-kind support pledges, determine industrial priorities and set requirements in the design of the facility and the outputs to launch Phases 2 & 3 of the project	To discuss induction automation R&D partnership considerations (e.g. R&D priorities, IP, collaboration agreements) and invite expressions of interest in R&D applications by partner feedlots

Item 5. Detail overall plan Oct-Nov 2018	Detail overall plan	Detail overall plan
Item 6. **Partners Meeting 3** Nov 2018	To consider a presented design of the Facility (by USQ in response to Partner views) and to support the promotion of the plan to authorities such as regional council bodies	Individual meetings, instead of a Partners Meeting, between USQ and partner feedlots to formulate R&D applications for induction automation
Item 7. Final Report End of Jan 2019	Final Report and documents	No change

3.2 Individual meetings

Six meetings were held with feedlot operators and feedlot equipment manufacturers, between March and August 2018, towards the co-ordination of Partners Meeting 1.

3.3 Partners Meetings 1 & 2

Partners Meeting 1 was held on 14 September and Partners Meeting 2 was held on 9 October. Discussion items and outcomes from the meetings are provided in Section 4.

4 Results

4.1 Outcomes of Partners Meetings 1 & 2

Partners Meeting 1 occurred on 14 September and was attended by JBS, Thompson Longhorn, Grassdale and Whyalla feedlots, and USQ and MLA. The feedlot industry participants of the meeting identified and discussed their R&D priorities at the meeting, and minutes are provided in Appendix A. Following the meeting, a summary list of the discussed priorities was developed. The R&D priorities fell into the categories of animal catch and restraint, inventory controls, sensor and scanning technologies, and other.

Partners Meeting 2 coincided with the BeefEx conference and was held on 9 October, with the same feedlot industry participants. Minutes of Partners Meetings 2 are provided in Appendix B. Feedlot industry participants of the meeting were invited to provide their ranking of R&D priorities (via form in Appendix C). All participants responded and the summary table of responses is provided in Table 2. MLA encouraged the participating feedlots to express their interest in involvement in R&D applications in the upcoming MLA research funding call.

USQ distributed the ranked list of R&D priorities to the participants of the Partners Meetings to invite further discussion for development of R&D applications.

Table 2. Overall ranking

Rank	R&D area	R&D Priority	Overall feedlot	
			Score	Priority
1	Restraint	Immobilising animals – head restraint technology	3.0	High
2	Restraint	Immobilising animals – full body and head restraint	3.0	High
3	Inventory	Application of veterinary chemicals and pharmaceuticals – semi-automation	3.0	High
4	Scanners	Endpoint & health management – walk over weighing	3.0	High
5	Restraint	Automatic restraining – computer operation of conventional crush	2.5	Med-High
6	Inventory	Inventory management systems – automation	2.5	Med-High
7	Scanners	Dentition – Age	2.5	Med-High
8	Restraint	Automated Bud Box or Cattle movement up races	2.0	Med
9	Scanners	HGP, Defect, Foreign Object detection	2.0	Med
10	Scanners	Dentition – Teeth	1.5	Low-Med
11	Other	Automatic washdown of induction facilities	1.5	Low-Med
12	Inventory	Application of veterinary chemicals and pharmaceuticals – full automation	1.0	Low
13	Scanners	Identification of Breed and Sex	1.0	Low

5 Discussion

5.1 Opportunities for restraints in cattle feedlot induction

There are two prominent critical aspects to restraining cattle for measurement and therapy, which form the top two priorities in feedlot induction automation R&D:

1. A secure and non-injuring head restraint with clear working access for operators.
2. Calm approaches and systems for animal guidance and the point of catch.

Integration of solutions to these aspects would be ideal to maintain safety and integrity in the feedlot induction process. Automation technology offers opportunity to optimise solutions that will deliver calm restrained animals by responding to the characteristics, size and behaviour of each animal, for the required operator tasks. Sensor and actuation technology is available to enable targeting and application of restraint.

The design of solutions must deliver an acceptable value proposition to a range of Australian feedlot sizes, to offer broad support to the Australian industry. In business sense, justification of cost will be through savings in operator and animal safety, and raising the accuracy to which measurements and therapy can be applied. Feedlot operators need to be fully aware of potential improvement in these costs. This can be difficult to assess as the consequences of animal restraining injuries, and inadequately delivered therapies, pass unnoticed at the induction process and surface later and without connection to specific induction events.

5.1.1 Head restraint

The requirements of head restraints are complex and most critical for operator safety. There is some conflict between the degree of restraint, flexibility of application (e.g. how the neck is

extended) and the degree of access required that can be found in the various designs available. In the induction process for feedlots, the adaptability of mechanisms to cattle is vital to efficient and effective operation. A moving head presents significant risk to operators and the variety of animal presentation at the restraint often leads to significant delays in the process, increases the potential of injury to operator and animal, RSI and incomplete therapies. There are numerous video links on the internet demonstrating example solutions, each with different benefit and complexity (for example, Table 3).

Table 3. Comparison of head restraints models.

Model 1	Model 2	Model 3	Model 4
• 2 bars • Allowed up and down head motion • Mechanism fixed on doors • Need to keep animal head up ready for restraining	•Up and down head motion possible •Inspection of teeth difficult •Have to pull hard on head to lift up –RSI •Very noisy	•Many levers and contraptions •Difficult for operator •All mechanical	•Cumbersome •Cannot drench •Cannot inspect teeth •Noisy

5.1.2 Calm approach to the point of catch

The method for restraining the body of the animal is usually by a 'crush', or squeeze mechanism with a front and rear door. There are different solutions available with differing operator access points to the body. Considerable operator concentration and skill is required to dynamically trap the animal with successful, efficient and safe operation. The exact presentation of the animal, particularly in head and neck position, is important for the tasks to be performed. Calmness, size, shape and presence of horns will have an impact on the ideal approach for each animal. With a large throughput of animals at typically 3 per minute, this can lead to operator stress and fatigue, and consequential variation in performance.

An alternative to a crush mechanism is a centre track conveyor. These have been installed in abattoirs with successful results on the kill floor. This approach constrains animals, and the containment maintains calm cattle such that the process could be carried out smoothly. Three animals per minute is typical and is similar to that required in feedlot induction processes. Systems could be adapted to carry out certain measurements and therapies automatically, increasing precision and reducing pressure on operators respectively.

The design and use of centre conveyor systems was originally stimulated by the work of Temple Grandin (1988; 2012; 2015), a world authority on the design of races and cattle feed systems. The work of Grandin reports the benefit of central track conveyors in 1988. Grandin describes the efficiency gains and associated benefits of maintaining calm cattle, and the considerations that lead to successful systems that is relayed by others in subsequent considerations in abattoirs (Craig et al. 2016). Acceptability to feedlot induction needs particular consideration of the capital and operational costs.

5.2 Achievement of each project objective

5.2.1 Objective 1: Design a facility in consultation with feedlot stakeholders that integrates automation technologies that exhibit a positive ex-ante cost-benefit analysis

As the project progressed, the project underwent a subtle shift to become aligned with generation of a framework for further R&D and collaboration for induction automation, plus a priority list and top two products for induction automation R&D. Partners Meetings 1 & 2 were held and determined a ranked list of priorities for induction automation R&D.

5.2.2 Objective 2: Ensure where possible that the designed facility is built to be future proof or retrofittable for future technologies

The top three priorities identified for induction automation R&D were immobilising animals, semi-automation of application of veterinary chemicals and pharmaceuticals, and endpoint and health management. Of these, head restraint, and full body restraint, were the top two priorities in immobilising animals. It is desirable that an improved head restraint is retrofittable to existing crushes, as well as low noise, low risk of injury, high ease of head access, and compatible with wireless Internet-Of-Things concepts for feedlot induction.

5.2.3 Objective 3: Determine feedlot location and equipment supply partners

The project has determined potential collaborators for further R&D proposals about induction automation, through meetings with various feedlot operators throughout the project. Feedlot location and equipment supply partners will be incorporated into R&D proposal/s.

5.2.4 Objective 4: Determine in-kind donations of capital or expenses for construction

The project has determined potential collaborators for further R&D proposals about induction automation. Specific detail of in-kind contributions will be incorporated into R&D proposal/s.

5.2.5 Objective 5: Determine sources of cash funding and quantum for capital and expenses for construction

The project has determined potential collaborators for further R&D proposals about induction automation. Specific detail of funding, capital and expenses will be incorporated into R&D proposal/s.

5.2.6 Objective 6: Deliver site plan and drawings (Autocad or equivalent) to enable construction of a feedlot Integrated Automation Development Facility (IADF)

The shift in project focus resulted in site plans and drawings for an IADF not being required in this project. The project had identified two potential locations for an IADF prior to the change in focus. R&D proposals for head restraint, and full body restraint systems, will contain engineering sketches of physical components.

5.2.7 Objective 7: Determine in consultation with partners experimental methodology and expenses over subsequent phases of the project to determine the value proposition to automation

It is expected that the value proposition for automation will be demonstrated through savings in operator and animal safety, and increased accuracy of application of therapies to animals.

6 Conclusions/Recommendations

Meetings with feedlot operators and manufacturers indicated strong interest in induction automation R&D, and that there is existing capacity within the feedlot industry for collaboration and development of new induction automation technologies.

The most appropriate format of a demonstration site for induction automation R&D, e.g. an industry-wide site or an individual collaborator site, is likely to be project-specific. Consequently, the project underwent a subtle shift toward the development of a multi-partnership to explore high priority applications defined by industrial partnership. This provided a more workable arrangement for addressing specific needs of industries, respecting a certain level of early confidentiality and encouraging the building of new showcased solutions.

Partners Meetings 1 & 2, which were held with representatives from large feedlots in Australia, indicated several potential priority areas for induction automation R&D. A priority list was determined through rankings of R&D priorities by feedlot industry participants of Partners Meetings 1 & 2. Immobilising animals, semi-automation of application of veterinary chemicals and pharmaceuticals, and endpoint and health management (walk over weighing) were identified as the highest priorities for induction automation R&D.

The top two priorities in immobilising animals were head restraint, and full body restraint. Improved head and body restraint presents savings in operator and animal safety, and increased accuracy of treatment applications. Mechanical designs augmented with automation and sensing has potential to deliver calm and restrained animals that caters for variable characteristics, size and behaviour of each animal.

7 Key Messages

- There is strong interest in induction automation R&D, and there is existing capacity within the feedlot industry for collaboration and development of new induction automation technologies.
- Immobilising animals, in particular head restraint, or full body restraint, is the top priority for induction automation R&D, and forms the basis for the top two products to be generated by future R&D.
- Mechanical designs augmented with automation and sensing has potential to deliver calm and restrained animals that caters for variable characteristics, size and behaviour of each animal.
- Semi-automation of application of veterinary chemicals and pharmaceuticals, and endpoint and health management (walk over weighing) are the highest priorities for induction automation R&D, following immobilising animals.
- In business sense, justification of cost will be through savings in operator and animal safety, and raising the accuracy to which measurements and therapy can be applied.

8 Bibliography

Craig T, Clarke R, Thomson P (2016) Final Report-Innovative Race and Knocking Box Design Concepts. AMPC.

Grandin T (1988) Double rail restrainer conveyor for livestock handling. Journal of Agricultural Engineering Research 41(4):327-338.

Grandin T (2012) Center Track Conveyor Restrainer for Beef Cattle. Grandin Livestock Handling Systems Inc. Available: https://www.grandin.com/restrain/new.conv.rest.html

Grandin T, Shivley C (2015) How Farm Animals React and Perceive Stressful Situations Such As Handling, Restraint, and Transport. Animals 5:1233-1251; doi:10.3390/ani5040409, ISSN 2076-2615.

9 Appendix

Appendix A - Minutes from Partners Meeting 1

Appendix B - Minutes from Partners Meeting 2

APPENDIX A

MLA Automation Pilot for Feedlot Induction

Partners Meeting 1

Date: Friday 14 September 2018
Start time: 1pm (expect to close by 2.30pm)
Location: USQ P9 building Toowoomba and Zoom teleconference

MINUTES

Present: Joe McMeniman (MLA) **JM**, Cheryl McCarthy (USQ) **CM**, James Palfreeman (JBS) **JP**, Byron Wolff (Thompson Longhorn) **BW**, Rick Young (Mort & Co) **RY**, Daryle Belford (Whyalla Beef) **DB**, Peter Brett (USQ) **PB**.

1.Welcome and participant introductions.
CM welcomed those present at the meeting and led the introductions. She described the current project funded by the MLA that will plan a pilot facility for exploration of automation technology for the industry, and described the premise for this vision based on the output of an earlier MLA study on'Time and Motion' analysis of feedlot induction operations.

2. Aims of the pilot on automation technology
The aim is to raise adoption of beneficial technology offering a positive value proposition in the industry. To prime the discussion, PB outlined possible principal topics of automation feedlot induction pilot derived from the output of the earlier 'Time and Motion' MLA study. The automation topics listed were to:

i. Integrate data to derive greater information and enable future-proofing with regard to new technology opportunities.
ii. Assist with animal calming prior to the crush.
iii. Smarten tools to reduce burden on operators, reducing fatigue, increasing safety and increasing working lives. (Skilled staff retention)
iv. Eliminate human error on inputting data.
v. Enable specific controlled therapies based on measurements to reduce cost and time.
vi. Optimise the order of processes to increase efficiency.
vii. Change the approach to measurements to increase efficiency, deliver real-time information and reduce cost.

3. MLA Aims on project outcomes
JM described that in 2015, MLA had identified that there was potential for automation to improve processes in feedlot induction, and that this needed proper evaluation. The technology is moving on, and now there is opportunity with scanning technology, and other new approaches. The MLA have been working closely with ALFA to focus on feedlot induction. It is clear that collaboration between expertise in automation technology, sensing

needs, technology providers combined with the techniques explored and experience of the feedlot industry will identify the principal areas adding greatest potential in practice. Products will follow this lead if addressed collectively by the industry.
Meat and Livestock has two priorities for this project:

(1) Identifying collaborating sites to conduct prototype development and automation research. Determine requirements of a collaborating site to participate in a future MLA research project.
(2) To develop MLA R&D research applications at the conclusion of the project that develop products that are commercially adopted in the area of induction automation.

4. Long and short term priorities of the industry.
The industrial expertise present RY, BW, DB and JP contributed extensively to the discussion. It was considered that improvements needed to be made in:

- Inventory controls
- Wastage and shrinkage
- Approaches to weighing, and potential for health assessment and sorting with walk-over pressure pads
- Segregation of cattle by breed, sex and age
- HGP detection, foreign object tracing, defect identification
- Accuracy in rolling stock-take
- Accuracy/ consistency in measurement overall
- How to maximise the value-potential in mobile scanning technology
- Ways to screen and reliably deliver therapy with more detailed measurements efficiently / application of hormones, vaccines
- Improvements in restraints that are safer for operators and animals, particularly head restraining / automatic restraining
- Pen-riding and throughput of cattle in induction and hospital sheds after induction
- Prediction of production potential and carcase performance at induction
- Automatic washdown of induction facilities

Short term was regarded to be better use and some augmentation of current techniques and combined with current automation / semi-automated advances and considerations of the technology. Longer term could be 10 years ahead with automation in herd management.

Looking ahead, the following issues were raised as potential building blocks to support improved practice and operation in the industry:

- Awareness of what is available, its potential value and adoption into induction sheds is an issue to overcome.
- Automated restraints were considered likely to be a better solution than current solutions and gaming technology could offer a strong starting point to some of the solutions needed in the future.
- Addressing the possibility of reduced processing by limiting the amount of draft sorting at the terminal end of the feeding period.
- Could some assessments occur between point of receival and induction?
- Could animals be assessed rapidly in-pen, potentially reducing the number of animals sent to the hospital / induction shed unnecessarily.

- The way that animals are handled is highly variable between the different layouts of induction processes with implications on calmness of animals and human resource used.
- Is there an ideal standard design of layout, processes and equipment?
- Solutions to automation of control in bud-boxes would need to work from a focus on human operator behaviour and skills.

5. Views on future participation and contribution within the project
This discussion identified that there is interest within the industry and that a solution to enable free discussion on a wider range of issues would be an advantage if it can be achieved.

BW expressed willingness for Thompson Longhorn to host prototype development at their site.

6. Any other views and business

JM and CM thanked the attendees for their time, interest and discussion points at the meeting. A lot of ground had been covered through the exchange of views.

Partners Meeting 2 will be held at the following time and venue:

Tuesday 9 October, 1pm to 2:30 pm
MLA Office, 8/2 Upper Dairy Hall
45 King St, Bowen Hills, QLD 4006

Some points of the discussion will look at short and longer term priorities and the approach for working into the future. An agenda will be circulated.

7. Meeting Close

APPENDIX B

MLA Automation Pilot for Feedlot Induction

Partners Meeting 2

Date: Tuesday 9 October 2018
Start time: 1pm (expect to close by 2.30pm)
Location: MLA Office, 8/2 Upper Dairy Hall
45 King St, Bowen Hills, QLD 4006

MINUTES

Present: Joe McMeniman (MLA) **JM**, Cheryl McCarthy (USQ) **CM**, James Palfreeman (JBS) **JP**, Byron Wolff (ThompsonLonghorn) **BW**, Rick Young (Mort & Co) **RY**, Daryle Belford (Whyalla Beef) **DB**, Danielle Shirley (Whyalla Beef) **DS**, Peter Brett (USQ) **PB**.

1. Welcome and participant introductions

Cheryl McCarthy welcomed those present and indicated the aims of the meeting:

- To set out the priorities for Automation Technology to advance the induction process for feedlots.
- To consider views on considerations for confidentiality and other matters enabling future collaboration by parties participating in future developments.

2. Ranking of Short and Longer Term Priorities

JM indicated a useful outcome from the meeting would be to rank priorities where automation can be applied to advance induction processes. Working from suggestions of Meeting 1 JM had compiled a table of broad categories. The participants agreed to add suggestions to the table following the meeting.

General discussion identified that some key enabling aspects are animal restraining (including head restraint), methods for optimising use of drugs / chemicals, and automated weighing and identification of various properties of animals to optimise processing effort. There were other aspects that will need to be addressed in time.

Important aspects will be the benefit of integration and future proofing such that further developments later can be adopted.

Compatible with the form mentioned above, short term should be priorities that can be delivered in the form of products for the industry within a few years. Longer term will also require initial feasibility of ideas.

ACTIONCM to circulate the table on priorities electronically.
ALL to return priorities to CM by 8 October.
CM to circulate summary of results to meeting participants.

3. MLA's obligation to the industry and the federal government around R&D projects

JM outlined the operation of the MLA and its obligations to levy paying industry and the government who contribute to funds available for R&D in the industry. Compatible with its aims, this project is to seek advice on the consensus of value priorities for development of automation technology that can be applied in practice (Item 2 above). Industrial participation in the development will be important to produce systems appropriate for offering value and benefit in practice. The outcomes of projects, in terms of new systems offered, would need to be communicated to the broader industry.

4. Confidentiality expectations (and bounds)

The discussion indicated that there would need to be a consortium agreement between parties working on projects on IP and disclosure while new systems were in development.

5. Intellectual Property

The general consensus was that commercial benefit was more likely gained by being 'First to market' as opposed to taking out IP protection in the form of patents.

6. Prototype Facility

A prototype pilot facility is an appropriate approach to investigating automation technology solutions, particularly as integration is a significant factor in capitalising on new techniques for measuring and automatically constructing information.

The host is an important participant. This participant has the benefit of working with different sub-contractors over time and will be able to accept interested parties within the industry observing benefits of the latest ideas as they are developed. Other sub-contractors can be various companies and research organisations with specialist skills wishing to make their contribution to the development.

BW expressed the interest of his company adopting the host role. The meeting participants endorsed this announcement as a great opportunity.

7. Future Phases

The next stage in this project is to develop new R&D applications in the frame of progressing benefit with appropriate value proposition for the feedlot induction process.

There will be no formal meeting of all participants during the remainder of the project. Instead JM is looking for specific research ideas and research proposals.

JM asked if participants had an idea and wished to work with USQ to approach CM. Alternatively, if there was a desire to work with an alternative research provider then JM will be open to discussing how to take the idea forward.

Proposals will need to be submitted into the MLA & ALFA R&D application selection process. The next call for proposals from the MLA is January 2019.

ACTION ALL to consider whether they wish to be involved in a R&D application for feedlot induction automation, and make contact with CM and PB, or with JM by 22 October.

8. Meeting Close

The participants were thanked for their time and enthusiastic participation in the project.

APPENDIX C

Automation of Induction – Ranking of R&D Priorities

R&D area	R&D priority	Feedlot priority (Low, Medium, High)
Animal catch and restraint	Automatic restraining – computer operation of conventional crush	
	Immobilising animals – head restraint technology	
	Immobilising animals – full body and head restraint	
	Automated Bud Box or Cattle movement up races	

R&D area	Priority	Feedlot priority (Low, Medium, High)
Inventory controls	Inventory management systems – automation	
	Application of veterinary chemicals and pharmaceuticals – semi-automation	
	Application of veterinary chemicals and pharmaceuticals – full automation	

R&D area	Priority	Feedlot priority (Low, Medium, High)
Sensor & Scanning technologies	Dentition & age	
	HGP, Defect, Foreign Object detection	
	Identification of Breed and Sex	
	Endpoint & health management – walk over weighing	

R&D area	Priority	Feedlot priority (Low, Medium, High)
Other	Automatic washdown of induction facilities	