Final report

MEQ Sheep Probe early adoption of hot carcase marble measurement
Final Report [Public version]

Project code:	P.PSH.1364
Prepared by:	Robert Frew [Assisted by MSA and Callan Daley, MEQ] Frew Foods International Ltd Pty
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Abstract

This project aimed to deliver an early adoption and evaluation of the MEQ hot lamb grading probe to measure hot lamb carcase marble score to improve accuracy and consistency compared to current visual grading methods. This project will develop operating protocols to enable adoption of a grading solution using the hot carcase marble measure for future adopters. Specifically, the project will evaluate the integration of the MEQ hot lamb grading solution into a lamb processor's workflows and business data management systems, including feedback to producers. General learnings from this project will be used to develop generic guidelines for adoption and integration of new OM technologies.

Specifically, the MEQ device(s) was ordered and commissioned, including the supporting software, on plant at the pilot site (Frewstal, Stawell) and was tested to be trial ready. Data integration protocols were developed with device training and equipment hand over to the operations ready for trial work. Technical support provided as required.

The critical design components were identified and included in the MEQ solution were:

i)   Carcase Identification linking capability
   • Wand capability was critical to link carcases to probe data
   • Frew Foods to arrange Wand capability with Cedar Creek

ii)   MEQ technical support & training of Frew Foods operators
   • MEQ monitors probing and delivers operator reports daily, including calibration reports, with alerts / notifications provided to Frew Foods IT team with missing carcases being flagged

iii)   IT capability
   • Frew Foods IT resources in place to assist with automated data capture. Cedar Creek assisting Frew Foods to capture MEQ, DEXA and other compliance data centrally

iv)   Resourcing & dedicated Frew Foods operators
   • Once system setup, tested and operable, dedicated operators were required preferably several trained dedicated operators that cycle across shifts (i.e. 2h at a time)

Successful integration was achieved through:

•   Data collection on over 100,000 lambs
•   Integration with on-site processing software
•   R&D conducted on improving workflow & process
•   Developed training and maintenance protocols with the site
•   Supply of timely & insightful data to site management

The Probe is now in use commercially across all Frews lambs in order to collect a data set that represents the quality of the population for brand creation and marketing. The grading terminal successfully displays the MEQ IMF% value on the screen as the carcase is graded, which then allows for carcase sortation as the body enters the chillers.

While an initial MSA review and preliminary analysis of Frews MEQ data was conducted by MSA, further validation of Frews lamb data is required in order to understand the value proposition of sheepmeats cut model to the business.

Executive summary

Background
The purpose of this project is to deliver a system that can deliver individual hot carcase IMF% values to a processor than can be used to support branding and marketing.

The questions being addressed are:

- Is the MEQ system capable of providing this data
- Can the on-floor systems be integrated with the technology
- Can carcases be sorted based on IMF% range
- What can be done with the data to support the creation of a premium brand and market

This is designed to display to the broader processing industry that lamb IMF% is not only an important attribute to capture but can be collected at high chain speeds on individual hot carcases. The results of this project will be used to justify broader adoption of objective technology and create awareness for premium IMF% brands & markets.

Objectives
The overall objective of the project is to deliver an early adoption and evaluation of the MEQ lamb probe to measure hot lamb carcase marble to improve accuracy and consistency compared to current visual grading methods. This project's primary objective is to ensure consistent grading results to provide the most accurate supply chain feedback. This will drive producer engagement with brand specifications and improve genetic gain.

The specific objectives of the project were:

- Test and trial integration of developing equipment and integration of software into feedback systems including MSA grading outputs
- Evaluate the integration of the MEQ lamb probe into Frews' workflows and business data management systems, including feedback to producers
- Evaluate device grading capabilities across multiple classes of animals
- Develop protocols on how to integrate new OM technologies including data captured into existing business systems
- Develop generic guidelines for adoption and integration of new OM technologies

Methodology
Frew Foods will trial and validate the MEQ grading probe as an early OM adoption project in a phased approach:

- Determine the most efficient & suitable installation location for an MEQ device
- Install, train & commission the MEQ Probe
- Work with Frews to develop carcase sortation based on IMF values
- Handover all use, maintenance & commercial use of the device

The project was successful in determining the population of carcases with the plant that fell within certain brand specifications. It was also successful in proving MEQ's viability to be a commercial system capable of capturing individual hot carcase IMF%. A key result of the project was that the carcase population fell into a slightly higher average IMF% bracket than previous data collected by MEQ, displaying a high-quality population of lamb.

Results

The MEQ solution commissioned, including the supporting software, on plant at the pilot site (Frewstal, Stawell) and was validated to be trial ready. The critical design components were identified and included in the MEQ solution were:

- Carcase Identification linking capability
- MEQ technical support & training of Frew Foods operators
- IT capability
- Resourcing & dedicated Frew Foods operators
- Dedicated operators required preferably several trained dedicated operators that cycle across shifts (i.e. 2h at a time)

The Probe is now in use commercially across all Frews lambs in order to collect a data set that represents the quality of the population for brand creation and marketing. The grading terminal successfully displays the MEQ IMF% value on the screen as the carcase is graded, which then allows for carcase sortation as the body enters the chillers.

While an initial MSA review and preliminary analysis of Frews MEQ data was conducted by MSA, further validation of Frews lamb data is required in order to understand the value proposition of sheepmeats cut model to the business.

Benefits to industry

With Frews developing accurate IMF measurement capability of individual carcases, this will position them to be early adopters also of the cuts-based MSA sheepmeat model, yield LMY% using DEXA and animal health disease reporting, thereby providing feedback to their livestock suppliers. The potential solution will integrate an optimise plant data business management system couple with RFID hook tracking capability from legging through to the boning room. Adopting technology like this will provide greater consistency to brand owners which encourages greater investment as they know it will be rewarded in optimal product categorisation.

There have been significant benefits to the industry displayed in this project. These include but are not limited to:
- Successful integration with on-site software that displays an ability to be used widely
- Display of an ability to capture a high population of individual hot carcase IMF% at a high chain speed
- Proven capability of rolling out large scale user training & maintenance of the MEQ system

Future research and recommendations

Based on the results of the project, it is recommended that future research and development focuses on how to support processing businesses build an awareness in the market for how to promote high quality lamb & how different IMF% level impact consumer experience. Once the value proposition has been built out for processors, it becomes much easier to introduce quality grading to the industry as a whole. Further validation of Frews lamb data is required in order to understand the value proposition of sheepmeats cut model to the business.

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1. Project background, scope and objectives

1.1 Background

Red meat traits are graded using manual and primarily visual subjective methods. Not only are these manual grading methods tedious, they are also open to inaccuracies in the data captured. Developing precise objective measurement methods is an industry strategic 2025 imperative to capture more accurate data to support alternative pricing methods for producers. There are a number of objective measurement technologies at various stages of validation and accreditation for grading red meat traits. This project was submitted in response to an open call for co-investment proposals from businesses seeking to trial and adopt emerging objective carcase and/or live animal assessment technologies. While some technologies may not yet have achieved AUS-MEAT accreditation, the opportunity was open to all technologies for businesses to test and trial integration of developing equipment, and, where applicable, integration of software to enable MSA grading outputs from these technologies to plant systems.

There are currently no protocols for the adoption, implementation and integration of new objective measurement technologies into processor business operational and feedback systems. An early adoption process is required to drive the adoption of OM technologies for Australian red meat producers & processors. An open call process attracting various partners across several OM technologies at various stages of development and validation provided an opportunity to engage both the users (processors) and providers. Commercial prototype MEQ devices are currently installed online at GMP, Teys (Wagga) and ACC for hot and cold grading applications for beef and lamb. This engagement is accelerating commercialisation plans between the various providers. This early adoption project builds on the existing lamb and beef trial work and will accelerate adoption and industry uptake, subject to forthcoming accreditation.

This project has come about as MEQ and Frew Foods has been in engaged in discussions over several years to look for an opportunity to work together when MEQ was sufficiently developed to do so and be used commercially. Now that this is the case it is optimal time to progress with such a project, especially as the industry has formalised IMF as a trait for the MSA Lamb profile. The precursor to this is that Frew Foods has been in regular contact with MEQ Probe as Frew Foods had identified the IMF input as an important counterparty to the LMY data being collected. Having the IMF value will for the first time enable the population being processed to be evaluated from an eating quality perspective and most importantly ensure when Lamb is categorised it will deliver a consistent eating experience for Frew Foods partners and ultimately consumers.

Frew Foods has identified areas of value that a hot measure can provide and is seeking to deploy the system for the purpose of assessing the variance in the population processed as IMF is not a MSA trait. The goal is that the MSA proposed sheep cut plan could be used with the inclusion of MEQ given Frew Foods has a DEXA installed and commissioned. The value is to enable hot carcase marbling technology to be used in lamb. This will give confidence to the industry that technology can be applied at this stage of processor workflow. This would be a world first when incorporated with the MSA profile and would further reinforce to the global lamb consumer base that Australia is a leader in innovating. Adopting technology like this will provide greater consistency to brand owners which encourages greater investment as they know it will be rewarded in optimal product categorisation.

The purpose of this project is to deploy, commission and adopt the MEQ Probe system for the purpose of obtaining hot carcase IMF data. Frew Foods has identified areas of value that a hot measure can provide and is seeking to deploy the system for the purpose of commercial trials where Frew Foods will work through all of the steps to integrate the technology internally and educate its partners for

the purpose of mutual benefit. This project aims to deliver an early adoption and evaluation of the MEQ handheld probe to measure hot IMF in lamb.

This project will develop operating protocols to enable adoption of a grading solution using MEQ handheld probe for future adopters. Specifically, the project will evaluate the integration of the MEQ lamb probe solution into Frew Foods' workflows and business data management systems, including feedback to producers. This project will contribute to a series of case studies generated through concurrent early adoption projects of several objective measurement (OM) technologies that were identified through an Open Call process. General learnings from this project will be used to develop generic guidelines for adoption and integration of new OM technologies.

1.2 Project scope

The purpose of this project is to deploy, commission and adopt the MEQ Probe system for the purpose of obtaining hot carcase IMF data. This project aims to deliver an early adoption and evaluation of the MEQ hot lamb grading probe to measure hot lamb carcase IMF to improve accuracy and consistency compared to current visual grading methods. This project will develop operating protocols to enable adoption of a grading solution using the hot carcase IMF measure for future adopters. Specifically, the project will evaluate the integration of the MEQ hot lamb grading solution into a lamb processor's workflows and business data management systems, including feedback to producers. General learnings from this project will be used to develop generic guidelines for adoption and integration of new OM technologies.

1.3 Expected outcomes

The outcome of this project to is have MEQ Probe be used for commercial trials and quantify the value in working with internal and external stakeholders. The expected outcome is that Frews would plan to use this technology on a long-term basis and after the life of the project. The outcome is that a case study of learnings of integration of MEQ hot grading probe into business workflows and operating systems will be used to develop generic guidelines for adoption and integration of new OM technologies.

The outcomes of this project are to commercialise the use of hot grading tools and in particular intrusive measures that open opportunities that other technologies cannot provide. It would be expected that other processors who have a similar workflow will see the value defined in this project and want to adopt hot measures. The outcome of this project to is have MEQ Probe be used for commercial trials and quantify the value in working with internal and external stakeholders. The expected outcome is that Frews would plan to use this technology on a long-term basis after the project concluded.

2. Objectives

The overall objective of the project is to deliver an early adoption and evaluation of the MEQ lamb probe to measure hot lamb carcase marble to improve accuracy and consistency compared to current visual grading methods. This project's primary objective is to ensure consistent grading results to provide the most accurate supply chain feedback. This will drive producer engagement with brand specifications and improve genetic gain.

The specific objectives of the project are:
- Test and trial integration of developing equipment and integration of software into feedback systems including MSA grading outputs
- Evaluate the integration of the MEQ lamb probe into Frews' workflows and business data management systems, including feedback to producers
- Evaluate device grading capabilities across multiple classes of animals
- Develop protocols on how to integrate new OM technologies including data captured into existing business systems
- Develop generic guidelines for adoption and integration of new OM technologies

This project will contribute to a series of case studies generated through concurrent early adoption projects of several objective measurement (OM) technologies that were identified through an Open Call process. General learnings from this project will be used to develop generic guidelines for adoption and integration of new OM technologies.

3. Methodology

Frew Foods will partner with MLA and MEQ to trial and validate their grading probe. The below methodology is not sequential, and therefore some activities will overlap, including:

- Deployment and Commissioning of the MEQ Unit
- Integration with core Frews IT infrastructure (MEQ + Frews IT resources needed to collaborate)
- Consistent probing and assessment at a population level as to distribution of carcase IMF
- Map out the sorting process to help optimise chiller use to grade of carcases
- Train the Frews team to operate the system
- Commercial Trials for actionable business decisions with Frews clients using the data - externally and internally (education is key)
- MEQ to develop a software-based simulation for the optimal flow of carcase to sort into the chillers
- Frew to resource operators to probe

The following method is proposed:

i)   Project planning, design and equipment supplied (Milestone 1)
ii)   Equipment commissioned and test (Milestone 2)
iii)   Device trials and optimization (Milestone 3)
iv)   Final report (Milestone 4)

3.1 Project planning, design and equipment supplied [Milestone 1]

Conduct kickoff meeting with Frews project team, MEQ and MLA. Form steering project group. Trial plans, design and integration requirements. Supply MEQ lamb probe hardware. The progress report, including trial plans, design and integration requirements will be submitted to MLA for approval.

3.2 Equipment commissioned and test [Milestone 2]

Commission trial ready MEQ probe and systems. Data integration protocols. Device training & technical support. Conduct pre-commercial trials collecting daily value (10,000 lamb carcases probed). Initiate testing protocols. Integration with core Frews IT infrastructure. The progress report, including commission devices, training and testing protocols submitted to MLA for approval.

Go/No Go decision Point: Trial-ready MEQ probe commissioned, initiated training and testing protocols, and trial plan approved as scheduled.

3.3 Device trials and optimisation [Milestone 3]

Data collection and data integration as per trial plan. Device training & technical support. Review device performance and usability. System optimisation. Sorting simulation software built for review. The progress report, including trial work submitted to MLA for approval. Frew dedicated personnel trained to operate the system.

3.4 Final report [Milestone 4]

Confidential report of commissioned, training and testing protocols, data collection, integration systems, and trial results. Includes recommendations for ongoing R&D, including sorting capabilities. Public case study of lessons learnt for early adoption of OM devices. Final reports (confidential & public) including new pre-commercial R&D priorities, submitted & approved by MLA.

4. Results

4.1 Project planning, design and equipment supplied [Milestone 1]

4.1.1 Start-up meeting

The project was initiated with a start-up planning meeting with Frew Foods, MEQ and MLA. A project steering group was formed and pre-project engagement and project planning between Frews, MEQ & MLA was conducted, as required.

4.1.2 Develop trial plans

Trial plans, including Design plans, design & integration requirements were developed and reviewed as the work schedule periodically.

4.1.3 Design & integration requirements

Design plans, design & integration requirements, including the required components:
- Data collection and data integration
- Device performance and usability

- Optimisation & redesign
- Plant accessibility, livestock supply and available grading staff
- Availability of MSA graders for validation trials

Some critical design components were discussed and agreed by the Project Steering group to be included trial plan, including:

- Carcase Identification linking capability
- MEQ technical support & training of Frews operators
- IT capability
- Resourcing & dedicated Frews operators

4.2 Equipment commissioned and test [Milestone 2]

4.2.1 Commission trial ready MEQ probe and systems

The MEQ Hot carcase probe was successfully commissioned and installed into the Frews slaughter processing chain (Refer to Photo 1).

The following outcomes were achieved:

- Probe commissioned and approved by MEQ installation team
- Completed full system calibration
- Completed full system correction
- Approved Probe positioning, steriliser location and accessories
- System tested on carcasses and spectra approved by MEQ technical team

Photo 1. MEQ System installed in Frews Slaughter Floor

4.2.2   Data integration protocols

The timeline for data integration is dependent on the supply and commissioning of Frews' RFID tracking solution. While Frews' order for RFID is being processed, the current identification method will be used whereby mob-based identification only will be available as there is no unique ID capability for individual carcases. Once RFID is supplied data integration protocols can be initiated. The trial plan has been adjusted to align with supply and commissioning of a RFID solution for tracking individual carcase.

4.2.3   Device training & technical support

The following device training and technical support has been delivered:

- MEQ technical support has been provided to demonstrate to supervisors the day-to-day probe operation, including start-of-day procedure and end-of-day calibration
- Further ongoing training of Frew Foods operators' will be implemented once RFID installation is completed
- In the interim, potential dedicated device operators have been identified and training procedures has been discussed and agreed to be rolled out by supervisors

4.2.4   Pre-commercial trials collecting daily values (10,000 carcases probed)

Pre-commercial trials collecting daily values has been achieved, specifically:
- MEQ technical support provided to capture probe measurements of approximately 10,000 carcases (n=9,971) across a four-day pre-commercial trial period
- Daily probe values were collected as mob-based data due to the RFID wand not being installed
- Optimised probe technique and operating protocols developed by MEQ operators
- Installed counter-balance and stand to aid the MEQ user in probe operation

4.2.5   Go/No stage gate meeting

The project steering group meeting identified that the priorities and next steps, including:

- RFID solution was required to support hook tracking as a priority
- Re-training staff will be completed once RFID hook tracking is fully functional
- Once RFID solution commissioned, it will be synced to MEQ
- Requiring rail changes
- Frew Foods were finalising a R&D scope to share with MLA once all hardware & software modification quotes had been finalised from IT provider
- It was agreed that MEQ to make contact with IT provider on how to format MEQ data files to integrate with Frew Foods IT systems
- Chiller 5 being commissioned, and once completed Frew Foods will have capability to pre-chiller sort (in chiller 5)

4.3 Device trials and optimisation [Milestone 3]

### 4.3.1   Data collection and data integration as per trial plan

Data was collected using the hot carcase probe on greater than 8000 lamb carcases. Data integration is underway with conversations to cedar creek. Final integration is due to begin once RFID capabilities have been accomplished, which were significantly delayed due to manufacturing issues and ordering. MEQ also met with the Allflex installation team to discuss a plan of action and system integration requirements.

4.3.2   Device training & technical support

The device will undergo final user training once the RFID unit has been installed w/c 17th October. Pre-training of operators has been completed with the existing installed unit across multiple slaughter floor staff. MEQ provides constant technical support and has internet access to provide real time user feedback and support while the system is in operation.

4.3.3   Review device performance and usability

The MEQ device was deemed to be operating under suitable conditions and performance on over 8000 carcasses. The usability of the device was also proven by this data collection across a week of operation and maintenance. Further testing will be undertaken over the life of the project as the system will be in constant operation [Refer to Photo 2].
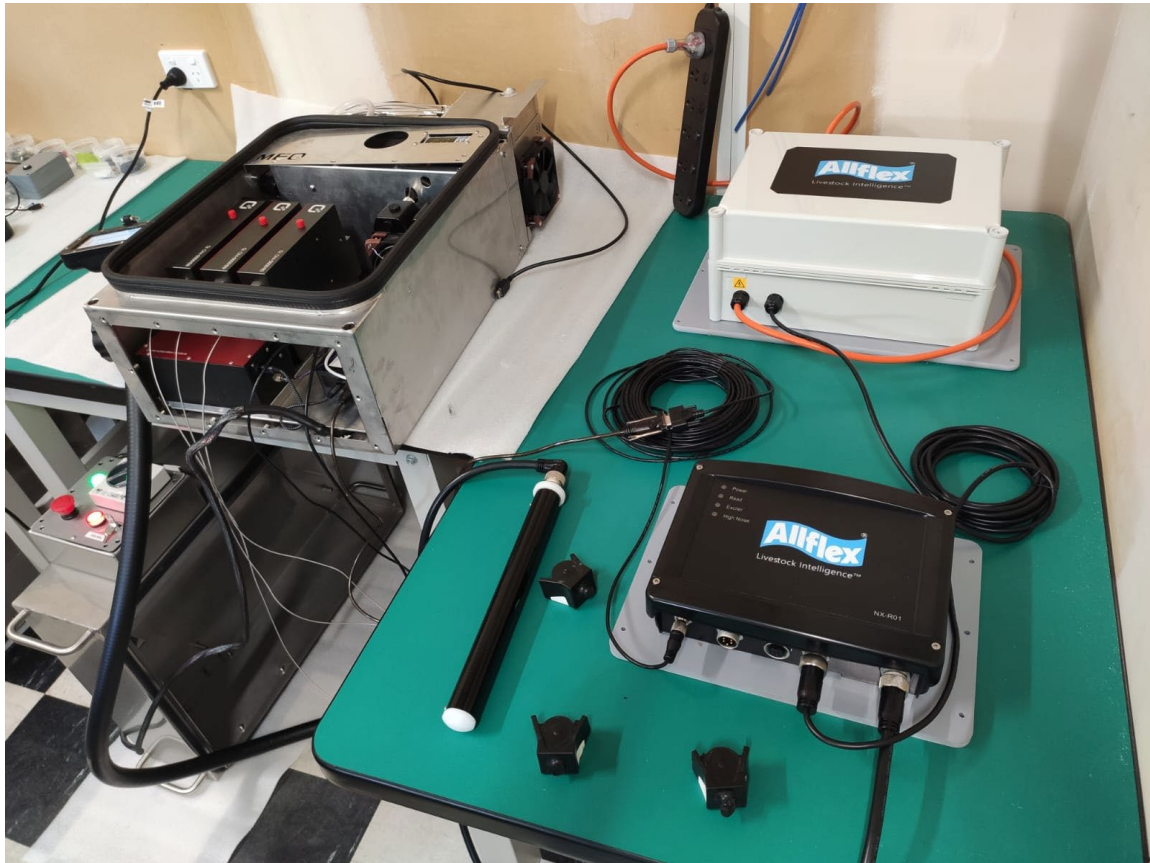
Photo 2. MEQ testing completed on Allflex RFID system. Proven integration capability.

4.3.4   Detailed validation data and analyses

Detailed validation data was analysed from

i)   25,061 carcases measured by the MEQ Probe between 17/10/22 and 09/11/22
ii)   30,997 carcases measured by the MEQ Probe between 10/11/22 and 15/12/22
iii) 49,359 carcases measured by the MEQ Probe between 16/12/22 and 10/02/23.

[Confidential data not detailed in this public report].

4.3.5   Sorting simulation software built for review

Sorting simulation will be designed and built once Frews has completed modifications to their rails to allow for sortation.

4.3.6   Publications

The following are a list of project related publications, including:

- MEQ probe unlocks (sheepmeat) premiums - [*Source Sheep Central, 5 August 2022*]
- Lamb carcase data to be dished up via App - [*Source AgTrader, 15 September 2021*]
- Red meat R&D: Eating quality tool a step closer to commercial reality [*Source Beef Central, 14 October 2021*]

A company update of the project was provided to the project team including Frews project team. This included an MSA update on preliminary review of application Sheepmeat cuts model using MEQ Probe data.

4.3.7   MSA preliminary analysis of MEQ Probe data in Sheepmeat cuts model: Preliminary considerations

A preliminary analysis of a sample of MEQ Probe data collected on Frews lambs was conducted with MSA technical input.   A company update of the project was provided to the project team including Frews project team. This included an MSA update on preliminary review of application Sheepmeat cuts model using MEQ Probe data.

The key take-outs were:

- Resource flock shows EQ variation in sheepmeat eating quality still exists [Source: MLA Resource Flock – data on file]. There is NO correlation between weight and eating quality but what this shows is that there is a wide range in eating quality within the resource flock lambs. [See Figure 1].
- LAMBPLAN Terminal Genetic Trends showing impacts of IMF% and eating quality. [See Figure 2].
- LAMBPLAN terminal data showing impacts on LMY. [See Figure 3].
- Application of sheepmeats cut model by applying nine cut by cook combinations including Stir Fry, Slow Cook, & Low 'n' Slow cook options being testing in 2020/21. For LMY if plant

does not have a DEXA, the next most accurate way to measure is GR measurement. [See Figure 4].

- Frews International eating quality outputs using MEQ Probe to measure IMF on lamb loins grilled at 5 days ageing. [Confidential data not detailed in this public report].
- Improvement of eating quality with ageing shown on lamb loins grilled at 5 days aging and lamb loins grilled at 20 days aging. [Confidential data not detailed in this public report].

Source: MLA Resource Flock – data on file
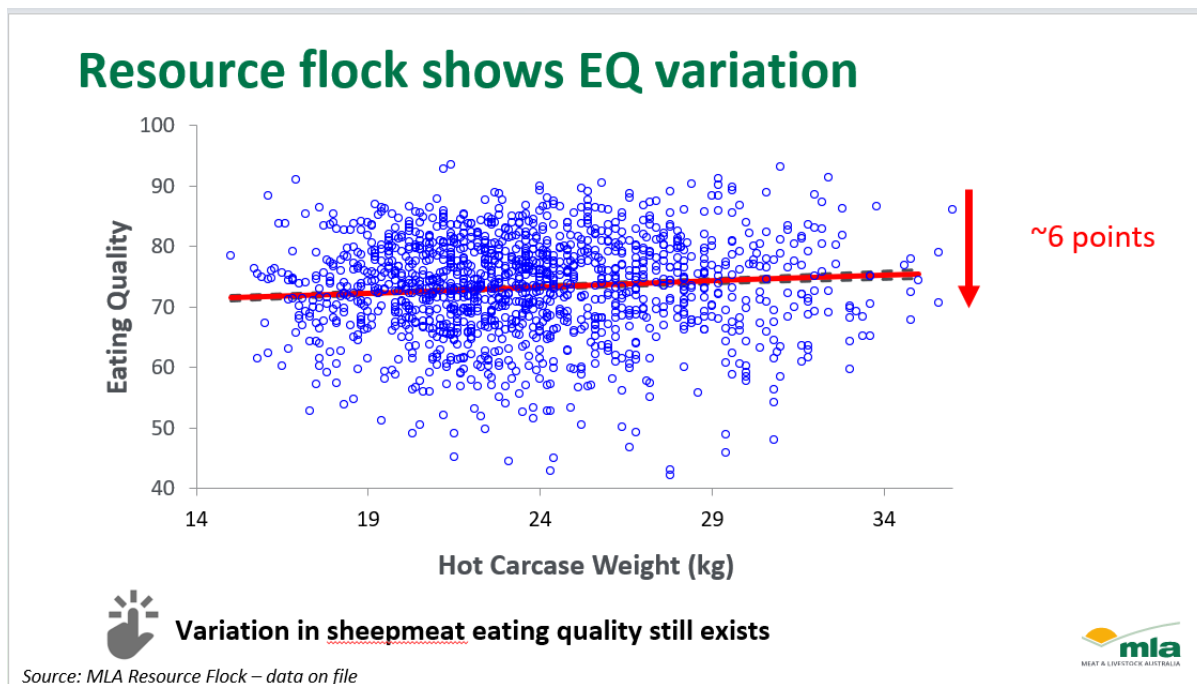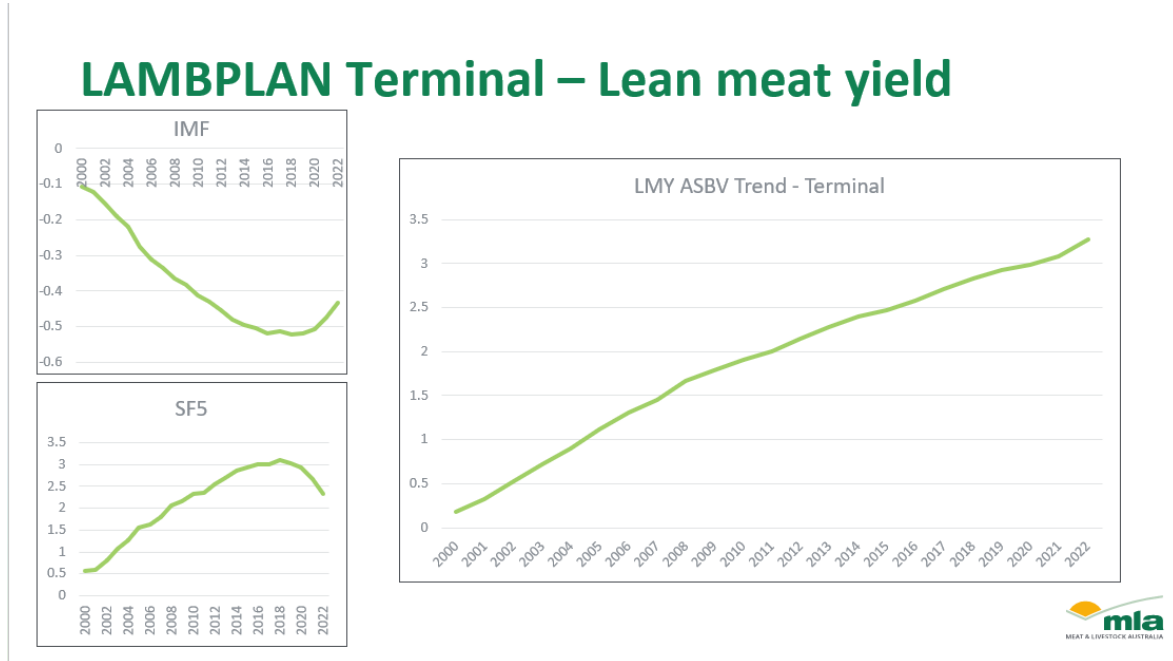
Figure 1. Correlation between weight and eating quality of resource flock showing EQ variation.
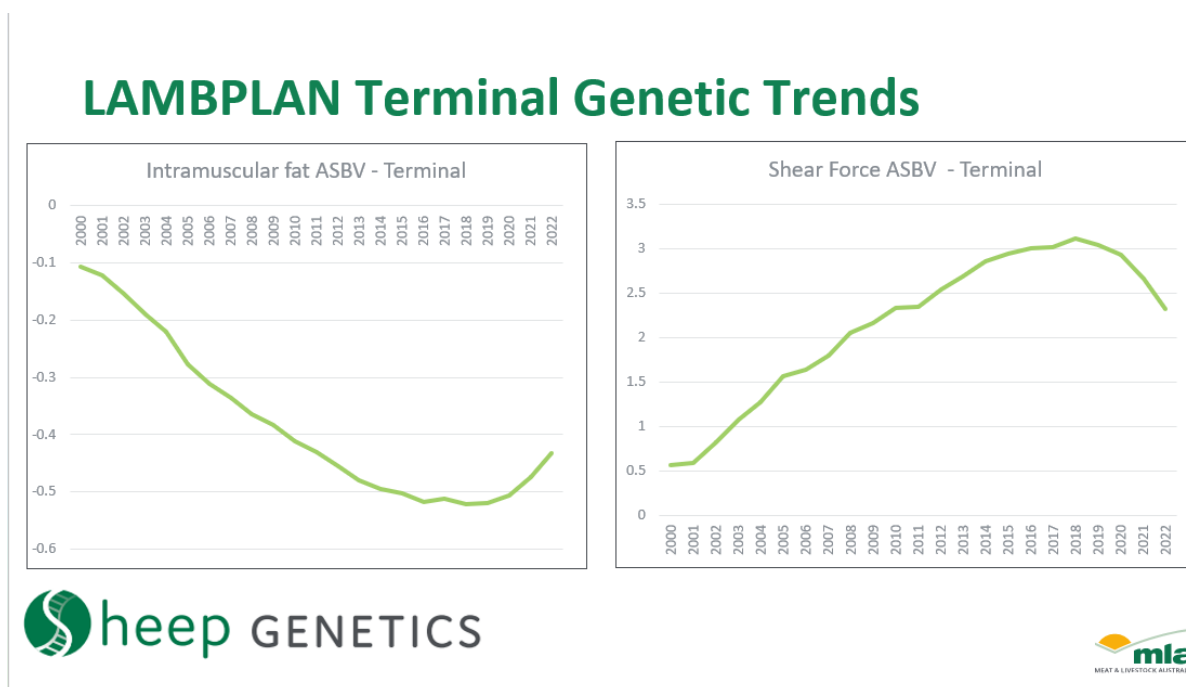
Figure 2. LAMBPLAN terminal genetic trends showing impacts of IMF% and EQ

Figure 3. LAMBPLAN terminal data showing impacts on LMY.
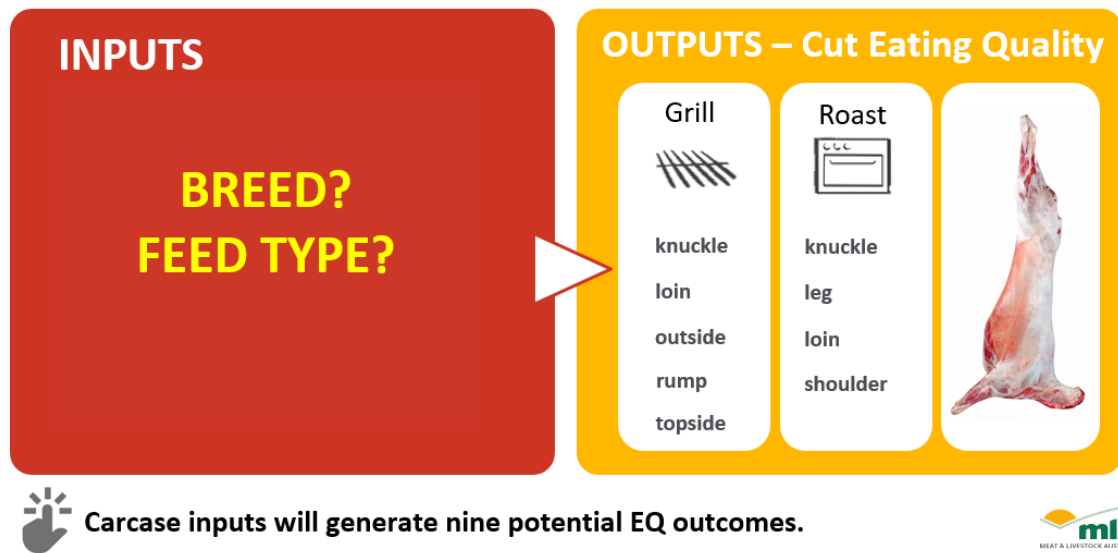
Figure 4. Application of sheepmeats cut model by applying nine cut by cook combinations including cook options being testing in 2020/21.

4.4 Reporting

4.4.1   Final report

Confidential report of commissioned, training and testing protocols, data collection, integration systems, and trial results. Includes recommendations for ongoing R&D, including sorting capabilities. Public case study of lessons learnt for early adoption of OM devices. Final reports (confidential & public) including new pre-commercial R&D priorities, submitted & approved by MLA.

4.4.2   Company presentation

A company update of the project was provided to the project team including Frews project team. This included an MSA update on preliminary review of application Sheepmeat cuts model using MEQ Probe data.

5. Key considerations on adoption of OM [Frews MEQ Case study]

5.1 Project brief [Snapshot]

This project aims to deliver an early adoption and evaluation of the MEQ hot lamb grading probe to measure hot lamb carcase marble score to improve accuracy and consistency compared to current visual grading methods. All of the following objectives have been completed which will be displayed in this report.

The specific objectives of the project are:

- Test and trial integration of developing equipment and integration of software into feedback systems including MSA grading outputs
- Evaluate the integration of the MEQ lamb probe into Frews' workflows and business data management systems, including feedback to producers
- Evaluate device grading capabilities across multiple classes of animals
- Develop protocols on how to integrate new OM technologies including data captured into existing business systems
- Develop generic guidelines for adoption and integration of new OM technologies

5.2 Process of adoption

Through the course of this project there were several challenges with the process of adoption, including:
- Labour & staffing
- Capital works
- Plant priority level assigned to project
- Technical difficulties with 3rd party suppliers
- Supplier delays
- Chain speed & workflow of the chain

However, these were all worked through by MEQ & Frews to reach the desired outcome which has been achieved with the Probe relocated into its final position, capital works completed, operators trained, site priorities aligned & software integration completed. This required more resources and time than expected which delayed areas of the project which were then prioritised and solved.

If revisiting this project, it would be critical to ensure the correct priority is assigned to the project while also building out the marketing and branding behind a premium IMF% brand before the completion of the project. This would allow for the product to reach market much sooner and become proactive rather than reactive.

5.2.1 OM Technology install & evaluated for trial ready

The images below detail the final changes made in the Probe location in order for it to complete the hot grading trial on over 100,000 lambs. The system was installed to be in the most workflow efficient position. [Refer to photos 3 and 4].

Photo 3. MEQ Probe fully installed at Frews.

Photo 4. MEQ Probe fully installed at Frews with RFID reader in view.

5.2.2 Data integration protocols

In order to achieve the desired outcome and maximum value, MEQ had to be able to communicate their grading data to the plant IT system immediately after capture to allow the carcase to be recorded with the value associated. [Refer to photo 5].

This was completed by:

- Creating robust data sending services interacting directly with Cedar Creek
- Ensuring the system had full access to appropriate IT services to allow MEQ could diagnose & update the system easily
- Frews can download all MEQ data from the Cedar Creek system and have it already linked to plant carcase data, allowing for analysis & workflow tools
- MEQ has supplied Frews with the ability to view broad level analysis on each day of data that is collected

5.2.3 Training dedicated OM device

All training and handover was managed by MEQ, ensuring that each operator within the plant was comfortable with the Probe's operation, pack-up & maintenance. Specific members of the maintenance team were instructed how to complete any major works on the system or part replacement, with all spares supplied to the site engineering department. The user also receives real-time feedback on their performance via the MEQ Scan score system.

Photo 5. MEQ Scan score screen, giving operator feedback in real time.

5.2.4   Data analysis and visualisation

There has been an extensive data analysis & visualisation carried out in section "4.3.4 Detailed validation data and analyses". [Confidential data not detailed in this public report].

This analysis has been further developed by incorporating plant data into an MEQ insights portal which can be used to analyse each day of production and how the population performed in relation to all captured traits.

5.2.5   Hot grading trial & data analysis

The hot grading trial was successfully completed and data analysed by looking at the distribution of IMF% through the population.

This was achieved through:

- Data collection on over 100,000 lambs
- Integration with on-site processing software
- R&D conducted on improving workflow & process
- Developed training and maintenance protocols with the site
- Supply of timely & insightful data to site management

5.2.6   External company support

The only external assistance required during this project was a collaboration between MEQ, Frews & Cedar Creek to ensure the IT systems were integrated correctly and data flowing on a regular, steady basis. MLA provided external support through the funding provided in this project scope.

5.3   Key considerations, insights & lessons learnt

The project was successful in determining the population of carcasses with the plant that fell within certain brand specifications.   It was also successful in proving MEQ's viability to be a commercial system capable of capturing individual hot carcase IMF% and integrating this with an on-site processing software system.

A key result of the project was that the carcase population fell into a slightly higher average IMF% bracket than previous data collected by MEQ, displaying a high-quality population of lamb.

5.4   Benefits, value proportions & potential impacts

 There have been significant benefits to the industry displayed in this project. These include but are not limited to:
- Successful integration with on-site software that displays an ability to be used widely
- Display of an ability to capture a high population of individual hot carcase IMF% at a high chain speed
- Proven capability of rolling out large scale user training & maintenance of the MEQ system

Some of the next steps that Frews can continue to extract value from the MEQ Probe system are:

- Automate boning room processes
- Package product based on IMF%
- Begin feeding data back to suppliers & farmers

These additional value adding areas can now be explored as the MEQ system has demonstrated a baseline ability to provide reliable & consistent data on individual hot carcases. Refer to Table 1.

Table 1. Apparent value propositions for Frew Foods MEQ solution.

Technology enables	Value created by
1. Increased consistency and efficiency in carcase grading	Increase supplier and customer confidence in product grading outcomes and feedback
2. Hot carcase sortation	Pre-chiller sortation to improve processing efficiency and carcase to market allocation
3. Improved feedback to suppliers	Confidence in data enables producers to improve compliance to specifications
4. Automated cutting and yield prediction	Processing efficiency delivered by automation and informing cut plans to maximise carcase value
5. Automated sortation of offal disease and defects	Precise identification of offal disease and defects

5.5　　Potential barriers to adoption

Through the course of this project there were several challenges around:
- Labour & staffing
- Capital works
- Plant priority level assigned to project
- Technical difficulties with 3rd party suppliers
- Supplier delays
- Chain speed & workflow of the chain

However, these were all worked through by MEQ & Frews to reach the desired outcome which has been achieved with the Probe relocated into its final position, capital works completed, operators trained, site priorities aligned & software integration completed. This required more resources and time than expected which delayed areas of the project which were then prioritised and solved. Refer to Table 2.

Table 2. Apparent barriers to adoption and opportunities.

Apparent barriers	Opportunity
Trust the data	✓ Continue to support early OM adoption ✓ Support data comparison & benchmarking
Capability & capacity	✓ Training device company champions ✓ R&D investments in semi- & full auto devices ✓ Support data integration in business IT systems
OM impacts on $	✓ Support data comparison & benchmarking ✓ Support provided to help review/revise business rules
OM solution(s) costly	✓ Customised support offering for each OM early adoption pilot
Right time to adopt OM	✓ Enhanced awareness that both accredited & non-accredited solutions can provide value

Overall the project was a great success allowing Frews to capture IMF% on a major population of their lambs.

6. Conclusion and recommendations

In the current project, equipment commissioned and test was successfully achieved, including:

- Commission trial ready MEQ probe and systems]
- Data integration protocols
- Device training & technical support
- Pre-commercial trials collecting daily value (10,000 carcases probed)

Specifically, the MEQ device(s) was ordered and commissioned, including the supporting software, on plant at the pilot site (Frewstal, Stawell) and was tested to be trial ready. Data integration protocols were developed with device training and equipment hand over to the operations ready for trial work. Technical support provided as required.

The critical design components were identified and included in the MEQ solution, including:

i)   Carcase Identification linking capability
- Wand capability was critical to link carcases to probe data
- Frew Foods to arrange Wand capability with Cedar Creek

ii)   MEQ technical support & training of Frew Foods operators
- MEQ monitors probing and delivers operator reports daily, including calibration reports, with alerts / notifications provided to Frew Foods IT team with missing carcases being flagged

iii)   IT capability
- Frew Foods IT resources in place to assist with automated data capture. Cedar Creek assisting Frew Foods to capture MEQ, DEXA and other compliance data centrally

iv)   Resourcing & dedicated Frew Foods operators
- Once system setup, tested and operable, Frew Foods will require dedicated operators, preferred several trained dedicated operators that cycle across shifts (i.e. 2h at a time)

Successful integration was achieved through:

- Data collection on over 100,000 lambs
- Integration with on-site processing software
- R&D conducted on improving workflow & process
- Developed training and maintenance protocols with the site
- Supply of timely & insightful data to site management

The Probe is now in use commercially across all Frews lambs in order to collect a data set that represents the quality of the population for brand creation and marketing. The grading terminal successfully displays the MEQ IMF% value on the screen as the carcase is graded, which then allows for carcase sortation as the body enters the chillers.

While an initial MSA review and preliminary analysis of Frews MEQ data was conducted by MSA, further validation of Frews lamb data is required in order to understand the value proposition of sheepmeats cut model to the business.

Through the course of this project there were several challenges around:

- Labour & staffing
- Capital works
- Plant priority level assigned to project
- Technical difficulties with 3rd party suppliers
- Supplier delays
- Chain speed & workflow of the chain

However, these were all worked through by MEQ & Frews to reach the desired outcome which has been achieved with the Probe relocated into its final position, capital works completed, operators trained, site priorities aligned & software integration completed. This required more resources and time than expected which delayed areas of the project which were then prioritised and solved.

Overall the project was a great success allowing Frews to capture IMF% on a major population of their lambs.

6.1 Key findings

The project was successful in determining the population of carcasses with the plant that fell within certain brand specifications.

It was also successful in proving MEQ's viability to be a commercial system capable of capturing individual hot carcase IMF% and integrating this with an on-site processing software system.

A key result of the project was that the carcase population fell into a slightly higher average IMF% bracket than previous data collected by MEQ, displaying a high-quality population of lamb.

6.1.1   Project planning & trial design [Milestone 1]

Project planning and design was successfully achieved:

- Conducted start up meeting with Frews, MEQ and MLA
- Form steering project group
- Develop trial plans
- Design & integration requirements

6.1.2   Equipment commissioned and test [Milestone 2]

Equipment commissioned and test was successfully achieved, including:

- Commission trial ready MEQ probe and systems
- Data integration protocols
- Device training & technical support
- Pre-commercial trials collecting daily value (10,000 carcases probed)

6.1.3   Device trials and optimisation [Milestone 3]

Device trials and optimisation phase was successfully achieved, including:

- Data collection and data integration as per trial plan
- Device training & technical support

- Review device performance and usability
- Sorting simulation software built for review

Sorting simulation will be designed and built once Frews has completed modifications to their rails to allow for sortation. This has also been delayed by the manufacturing timeline of the RFID systems.

6.2 Benefits to industry

With Frews developing accurate IMF measurement capability of individual carcases, this will position them to be early adopters also of the cuts-based MSA sheepmeat model, yield LMY% using DEXA and animal health disease reporting, thereby providing feedback to their livestock suppliers. The potential solution will integrate an optimise plant data business management system couple with RFID hook tracking capability from legging through to the boning room. Adopting technology like this will provide greater consistency to brand owners which encourages greater investment as they know it will be rewarded in optimal product categorisation.

There have been significant benefits to the industry displayed in this project. These include but are not limited to:

- Successful integration with on-site software that displays an ability to be used widely
- Display of an ability to capture a high population of individual hot carcase IMF% at a high chain speed
- Proven capability of rolling out large scale user training & maintenance of the MEQ system

7. Future research and recommendations

Based on the results of the project, it is recommended that future research and development focuses on how to support processing businesses build an awareness in the market for how to promote high quality lamb & how different IMF% level impact consumer experience. Once the value proposition has been built out for processors, it becomes much easier to introduce quality grading to the industry as a whole.

This could include:

- Consumer survey of perception of IMF%
- Engagement with retailers & wholesalers about why IMF% is important
- Marketing courses on how IMF% can be sold and presented to the consumer
- Broad scale roll-out and support of objective grading for hot carcase lambs
- Creation of value proposition tools that can calculate a processors savings or gains based on a few metrics that can be input by the site.