Final report

A guidepost to digital transformation: Non-vertically integrated beef cattle feedlots

Project code: P.PSH.1342

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Date published: <Day, Month and Year - e.g.10 April 2015>

PUBLISHED BY
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NORTH SYDNEY NSW 2059

This is an MLA Donor Company funded project.

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

Abstract

Feedlots have a unique position in the grain-fed beef industry as the conduit between breeders and processors (abattoirs). However, guideposts and pathways for digital transformation for feedlots have yet to be clearly established. This project aimed to explore and pilot innovation strategies and development through technology, with a focus on non-vertically integrated feedlots. Key internal and external stakeholders were engaged to determine initiatives across key themes of automation, reporting, value creation and quality improvement.

Two case studies demonstrating the value of digital change were identified, in addition to a realised commercial benefit by way of reduced dollar costs per SCU. Cross-benefits of digital transformation also resulted in fostering a data culture across operational staff and enhanced customer value that was difficult to quantify. Overall benefits to industry include providing practical recommendations for digital adoption, demystifying the costs of digital change and outlining the importance of systems and connectivity to tackling information-sharing and information quality challenges. Overcoming these challenges will be critical in light of future CN30 obligations and qualification of animal welfare standards for the red meat industry.

Executive summary

Background

This project focussed on exploring broad innovation approaches through the lens of digital transformation, with a focus on commercial practicality for non-vertically integrated beef feedlots seeking to enhance productivity through technology.

Objectives

The primary aim of the project was to investigate innovation capabilities across the following key business areas:

- Digital innovation and infrastructure
- Antimicrobial stewardship
- Sustainability and environmental stewardship (CN30)
- Animal health and welfare

This aim was achieved, with significant 'lessons learnt' particularly in the areas of digital innovation and infrastructure for broader feedlot industry application.

Methodology

The project was divided into three stages:

1. Identifying and conducting baseline activities to ensure adequate digital infrastructure was in place to support digital transformation initiatives; and

2. Implementing digital change across key objective business areas; and

3. Evaluating the benefits and costs of digital transformation.

Results/key findings

The project was successful in achieving its objectives with significant time savings and positive qualitative feedback from operators around the usefulness of technology in operations. Two case studies involving live budgeting for a meat brand customer and automation of commodity scheduling / management were discussed.

For a standard 20,000 SCU feedlot, the total annual cost of incremental software was $3.50/SCU.

Benefits to industry

Overall benefits to industry are outlining documented methods of digital transformation and change that other industry participants may be able to adopt and explore.

Future research and recommendations

Several recommendations were outlined for adoption by feedlot operators to enhance their attractiveness as a potential strategic partner to processors, in addition to providing a pathway for non-vertically integrated feedlots to make meaningful investment into their systems in preparation for future challenges the red meat industry may face around sustainability and animal welfare.

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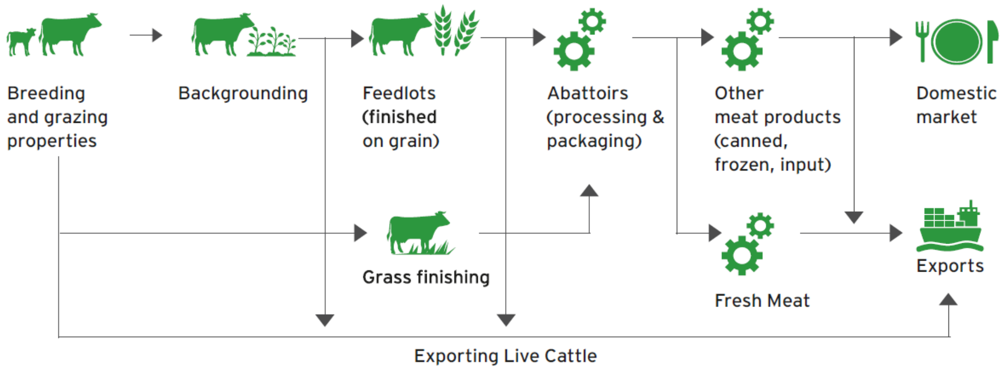
1. Background

1.1 Industry background

Feedlots have a unique position in the grain-fed beef industry as the conduit between breeders, producers and processors (abattoirs).

Figure 1: The Beef Supply Chain (Source: Ernst & Young)



Currently, grain-fed Australian beef exports account for up to 35% of total Australian beef exports (DAFF, 2023). Average growth in the sector has been concentrated in larger feedlots (>10,000 cattle on feed) as feedlots realise greater efficiency, competitiveness and profitability through economies of scale (DAFF, 2023).

Nonetheless, the constant challenge of operating feedlots at scale is maintaining quality whilst balancing human resource constraints (often due to rural proximity) and competitive efficiency.

Vertically integrated feedlots can more easily gain competitive advantage through increased transparency, information-sharing and centrally managed technologies and resourcing (Jie et al, 2015). In contrast, non-vertically integrated feedlots often manage standalone feedlot businesses (some with backgrounding operations), with access to resourcing and opaque information-sharing between supply chain participants remaining a significant challenge. This is exacerbated by the high level of fragmentation amongst the Australian red meat industry, with processors being the only participant with touch points across the supply chain (AMPC, 2016).

Around 98% of feedlots in Australia are owned by farming families with the remaining 2% owned by vertically integrated processors (ALFA, 2015). Although these processor owned feedlots are among the largest in Australia (representing ~22% of overall industry capacity), the more numerous - albeit smaller - operators continue to make up a majority of the feedlot industry (ALFA, 2015).

Technology has the potential to bridge this competitive gap by enabling smaller feedlot operations to 'do more with less', whilst also increasing their attractiveness as a potential strategic partner to other supply chain participants (in particular, processors).

1.2 Recent connectivity advancements - Starlink

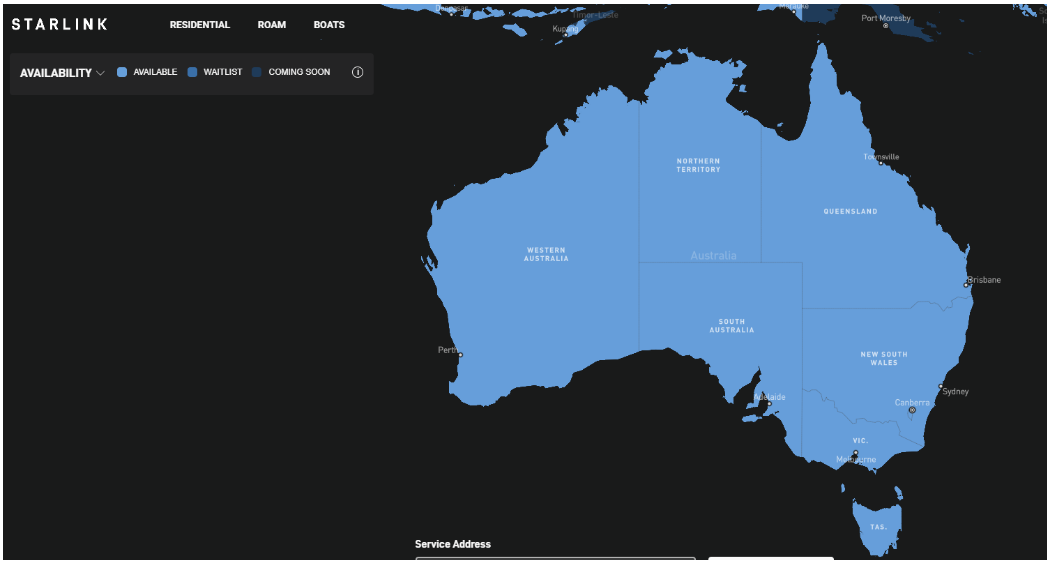
Concurrent with the emergence of AI applications empowered by large language models, recent advances made in near Earth low-orbit satellite internet (Starlink) has made universal connectivity across the globe now possible.

Starlink launched in Australia at the beginning of this project in late 2021, and was adopted within the feedlot's connectivity infrastructure shortly after access was made generally available in Australia in early 2022.

Many of the findings, guidelines and methods outlined in this project will assume that most, if not all, are already utilising Starlink to help partially solve one of the major challenges for rural agribusinesses: connectivity.

Starlink currently covers 100% of Australia's land mass (see Figure 2 below).

Figure 2: Starlink Coverage Map (Source: Starlink)



2. Objectives

The primary objectives of this project were to explore and pilot methods of digital transformation relevant for cattle feedlots across the following four key business areas:

1) Digital innovation and infrastructure
2) Antimicrobial stewardship
3) Sustainability and environmental stewardship (CN30)
4) Animal health, welfare and genetic improvement

An additional overarching objective throughout the project was to document the methods employed and challenges encountered to provide a useful and commercially practical ‘guidepost’ for digital transformation in beef cattle feedlots.

These objectives were successfully met, with some significant lessons learnt in effective implementation of digital change. In addition, several case studies were identified that served to highlight the positive impact innovation through technology can bring in a feedlot context.

3. Methodology

3.1 Baseline activities

The prerequisite to beginning project activities was to first baseline the existing digital infrastructure available, with the aim to address any major deficiencies to ensure digital transformation activities could be supported.

Existing reference architecture was baselined across two primary areas: connectivity and systems.

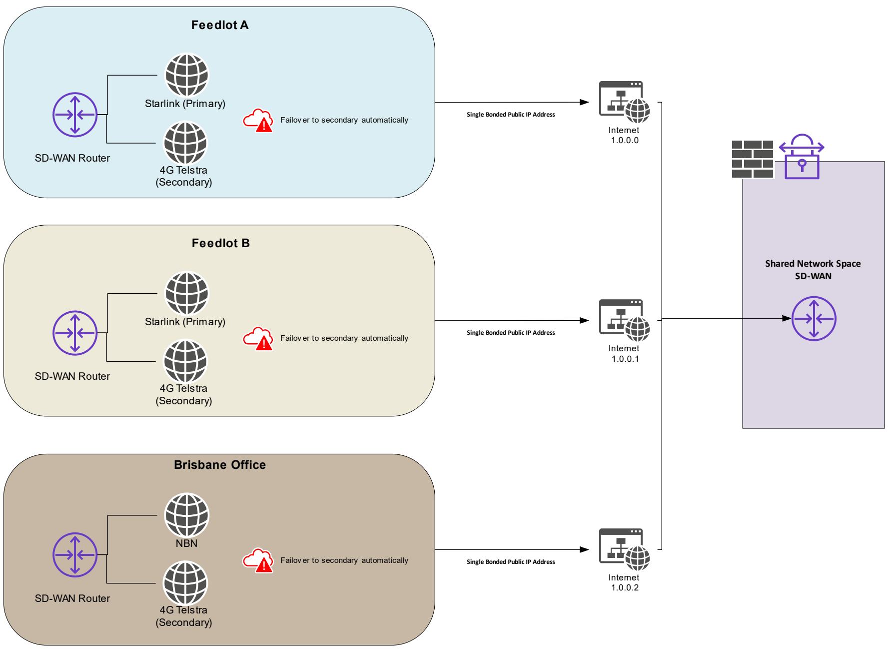
3.1.1 Connectivity solution architecture

The connectivity architecture employed the use of Starlink as the primary internet connection, with 4G Telstra networks as a backup at each rural property. Starlink network connections are prone to occasional dropout due to poor weather conditions, significant cloud cover and as satellites changeover every ~90 minutes.

Both networks (Starlink/4G) are broadband bonded together, which creates a single bonded connection utilising the bandwidth capacity of each circuit (upload/download) and presents itself to the network as a single IP address. This is managed as part of an SD-WAN solution, a cloud-first architecture that uses software to connect and extend enterprise networks across geographical locations.

See Figure 3 below for architecture employed.

Figure 3: Connectivity Solution Architecture



3.1.2 Systems solution architecture

Currently, the dominant off-the-shelf feedlot management systems (FMS) in use are the eLynx product suite, which includes FY3000 (FeedBunk3000 / Weighbridge3000) and StockaID applications.

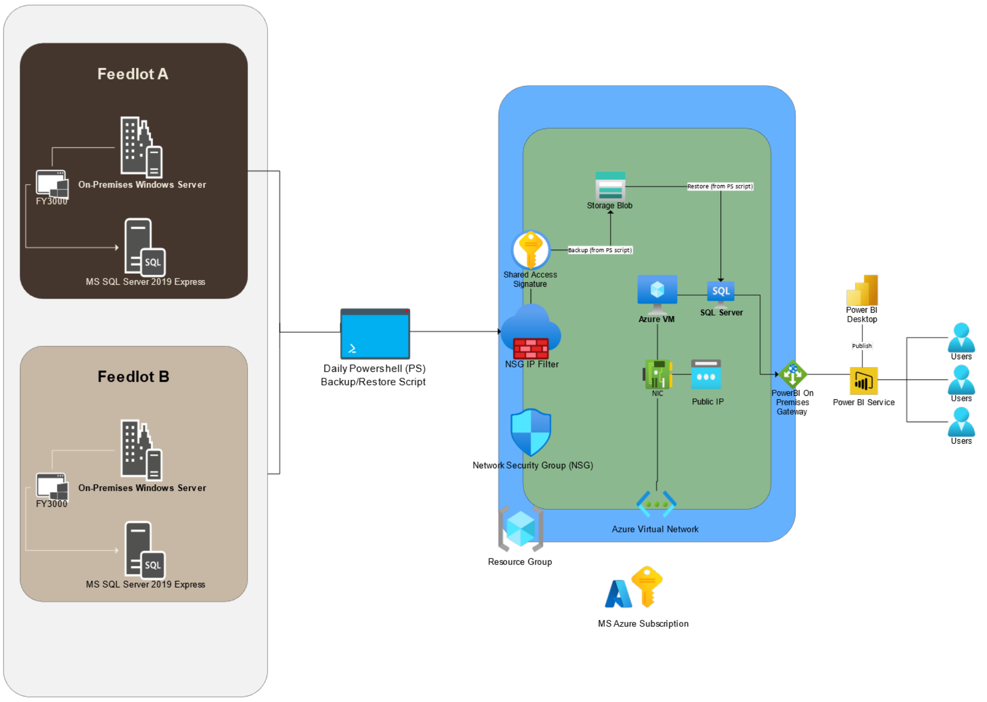
These applications run off a Windows systems OS architecture and are on-premises only applications (i.e: they do not store data / operate on the public internet).

Given feedlot operators use the eLynx FMS for day-to-day operations, a critical component of the project was to ensure that server performance at the feedlot was not impacted as part of any digital transformation activities and/or development.

The eLynx FMS writes data to a back-end SQL Server / Microsoft Access database located on the same on-premises server. To access this data, the data was replicated by rehosting the same SQL Server workload on the cloud (Virtual Machine). Microsoft Azure was chosen as the designated cloud service provider (CSP). Data replication was achieved via a scripted (MS Powershell) backup/restore process running on each server daily. This is known as a "lift and shift" hybrid migration approach.

The implemented approach and reference architecture for the lift and shift solution is outlined below in Figure 4.

Figure 4: Lift and Shift - MS Azure



3.2 Implementing digital change

Following the completion of baseline activities (outlined previously in Section 3.1), several digital initiatives across the business were identified.

These initiatives centred around several themes:

1) **Automation and reporting** – how can we create efficiencies through technology?
2) **Customer value-add** – how can we deliver value to customers through technology?
3) **Compliance and quality** – how can we monitor and increase our standards of quality control through technology?

Microsoft PowerBI was chosen as the reporting / presentation software to be used for data visualisation, reporting and data modelling. The primary data of interest used was eLynx application data accessed via the Microsoft Azure VM cloud-replica (see Figure 4 previous).

3.2.1 Automation and reporting

Internal stakeholders within the business were briefed on the role of PowerBI and the joint investment into the pilot digital project with MLA. Staff across the business were asked to think about their role and functions within the business and to suggest any potential areas where they might benefit from increased automation.

In addition, a high-level canvas of existing reporting processes (daily, weekly, monthly) used across operational teams was conducted to identify potential report automation and enhancement.

3.2.2 Customer value-add

Specific customers were selected as part of the trial program to better understand their needs and servicing requirements from the perspective of data and information-sharing. They were asked to provide commentary on both mandatory ("must haves") and optional ("nice to haves").

3.2.3 Compliance and quality

Internal QA, feedlot managers and operational stakeholders were engaged to better understand risk areas around compliance and quality at the feedlot. Several angles were explored - from a compliance/regulatory perspective (NFAS, DAFF) through to industry best practice (animal welfare metrics, operational KPIs).

3.3 Evaluating the profit & loss of digital change

At the end of the project, a reflection and review of the digital roll-out was conducted to ascertain the 'profit and loss' of innovation in the business. One of the primary objectives was to review the commercial impact of digital transformation, with other secondary objectives around understanding the qualitative impacts on employee satisfaction, retention and further points for improvement.

4. Results

4.1 Evaluation of digital change

4.1.1 Automation and reporting

The high-level canvas of existing operational reporting yielded a significant number of reports that were being run by staff, particularly on a daily and weekly basis. The primary use of these reports was for operational management purposes and reconciliation, to ensure that operations across the various feedlot functions were being performed correctly and as a secondary control for error-checking.

Many of these reports were automated and then delivered to stakeholders through on-demand PowerBI reporting – for example, weekly operational reports.

As part of these ongoing automation efforts over the project period, engagement from internal stakeholders gradually increased as many began to 'visualise' the benefits from time-savings and efficiencies. It also served as a learning experience for many, as staff were able to also observe the types of automation possible through technology.

Over time, this culminated in a flurry of ideas - particularly from operational stakeholders – around new reports and dashboards to create. It also highlighted the importance of data quality, as dashboards created an element of a 'living tool' outside the simple academic exercise of 'running a report'.

In essence, this served to kick-start a data culture across the business.

4.1.2 Customer value-add

Customer feedback and engagement was very positive, with one meat brand customer selected as a trial for the creation of a customer portal through PowerBI.

This customer portal aimed to replace as much of their existing reporting being delivered as possible, freeing up time for both sides to focus on more meaningful tasks and discussion. This included more time to focus on discussing meat markets, forward pricing and forecasting, and enhanced processor performance and feedback.

A demonstrated innovation outcome of this portal will be further discussed as a case study in Section 4.3.1.

4.1.3 Compliance and quality

Many of the risk areas identified were around specific (and individual) compliance and best practice standards that were difficult to track daily, primarily due to the resource burden of calculation. Compliance and quality at a feedlot level was high, however given the volume of cattle turn-off for a larger feedlot, a consistent concern was on those that may "slip through the cracks".

Given each and every cattle will enter the food chain, a need to systemise individual animal compliance was identified. Technology was a key enabler of this.

As a result, several key dashboards and tools were created across several key areas that targeted feedlot and individual animal compliance, including antimicrobial usage, health protocol and treatment compliance and NFAS compliance standards.

4.2 Evaluating the profit & loss of digital change

Throughout the project, significant benefits were gained by way of time savings, increased productivity and cross-benefits of fostering a data culture.

A conservative estimate of ~68.1 hours / week of time savings (~1.7 FTE) was accrued over the project period through digital change initiatives. A feedback survey was also issued to all department and line managers across two feedlots, with over ~87% of respondents saying technology was "very useful" (based on a score of 1-5) to their daily activities.

A word cloud was then generated to capture and highlight common themes across respondents in relation to the digital project (see Figure 8 below). The common theme identified was around the need for continuous improvement and innovation, and further training/understanding of the 'why' behind digital change.

Figure 5: Word cloud of feedlot operator feedback (generated using ChatGPT-4o model)

The annual operating costs of the digital project was evaluated based on incremental software costs. The total incremental cost (software and subscriptions, ex-labour) equated to ~$70,000 p.a. For a standard 20,000 SCU feedlot, this equates to an incremental systems cost to the feedlot operation of $3.50/SCU.*

Overall, it is difficult to definitively quantify the net profit/loss that innovation and technology can bring. Time savings, although more easily quantifiable, often results in re-allocated time spent on higher order / value tasks. The net impact of this is increased productivity without necessarily a direct reduction in labour costs.

A summary of the benefits and costs are provided in Table 1.

* Assume 20,000 SCU feedlot. 100-day reference animal on feed, equating to 1 SCU per head, at 100% annual capacity utilisation over the year.

Table 1: Benefits and costs of innovation

<table>
<tr><th>Benefit / cost</th><th>Units</th><th>Total units</th><th>$ Impact (p.a.)</th><th>$ Cost per SCU</th></tr>
<tr><td>Time savings</td><td>Hours / week</td><td>68.1 hrs / week</td><td>$106,236*</td><td>($5.31)</td></tr>
<tr><td>Data culture</td><td rowspan="4" colspan="4">Unquantifiable</td></tr>
<tr><td>Employee satisfaction/retention</td></tr>
<tr><td>Improved risk control</td></tr>
<tr><td>Customer satisfaction</td></tr>
<tr><td>Software costs</td><td>$ / year</td><td>70,000</td><td>($70,000)</td><td>$3.50</td></tr>
</table>

*Assume Pastoral Award June 2024 average annual wage (MA000035) of $30/hr.

4.3 Case Studies

Below outlines two case studies across different areas of the feedlot operation that demonstrate real-life examples of how technology was utilised to add value or create efficiencies over the project period.

4.3.1 Case Study 1 – Real-time budgeting for a meat brand customer

As part of the customer portal pilot (see Section 4.1.2), the meat brand customer requested the ability to have “live” costs for all mobs on feed and a dynamically projected cost per kg of dressed weight. The purpose of this was to enable their meat pricing team to have a more accurate view of pre-processor costs to maximise the value of end-customer pricing.

An additional budget page was created within the customer portal that updated on a daily basis as new feed and consumption was billed, as ration costs changed, and as projected exit dates and confirmed truck-out dates adjusted more closely to exit.

4.3.2 Case Study 2 – Automating commodity scheduling

A lightweight, custom commodity scheduling and management system was built using the cloud-replica data from eLynx on Microsoft Excel and set-up to refresh on a daily basis. This enabled efficient flow of information from operational systems (eLynx) into a front-end system used by commodity managers to manage inventory levels with higher accuracy and without data entry required.

This also significantly reduced risk through systemisation of the commodity scheduling process and enabled cross-training opportunities across different staff members.

5. Conclusion

The concept of 'decision paralysis' is defined as the state of indecision when faced with multiple options. This phenomenon rings especially true, particularly in traditional and physical world industries such as agriculture, when faced with the question of "how can we leverage digital technologies effectively?"

Put simply, the challenge often is knowing where to begin.

The purpose of this project was to explore and pilot methods of innovation relevant for feedlot businesses, with a clear focus on commercial practicality for non-vertically integrated feedlots. The secondary objective was to provide guideposts and a pathway for such feedlots to explore beginning their own digitisation efforts.

5.1 Key findings

The key findings from the project were as follows:

- **Digital transformation is commercially viable:** the cost of connectivity and digital automation/delivery was previously prohibitive or unknown. The project demonstrated that digital transformation can be achieved across both operational and management functions in a standalone non-vertically integrated feedlot with a commercially positive impact.
- **Digital champions drive progress:** having the right software and systems within a business is important, however the true value is in unlocking the potential of these systems. The project demonstrated that for every system, it needs to have its own champion to ensure its success.
- **Data culture can be nurtured:** a data culture encourages making decisions based on objective data, with decision-making enhanced through standardisation and industrialisation. The project demonstrated that this is a significant cross-benefit of automation efforts and creates synergies with intuition-based decision makers.

5.2 Benefits to industry

The Australian red meat industry is fragmented vertically throughout. Clearly, vertically integrated operations can take advantage of their control across the supply chain and gain efficiencies through information sharing, end-product pricing and centrally managed resourcing.

However, many of the current and future challenges surrounding the grain-fed beef industry and their solutions will rely on cooperation across the supply chain. Given the majority of feedlots are not vertically integrated (~78% of industry capacity), it may be more important than ever that systems connectivity and the capacity for information-sharing and information quality across these smaller industry players is strengthened. This will help ensure all industry participants are better prepared to address broader red meat industry complex areas.

Fast-approaching are challenges in sustainability, where information sharing across activities (and their associated emissions) and industry will be critical. Another area is around the need for industry qualification (and quantifying) of animal welfare standards, which will have broad implications on the grain-fed beef industry's future social license to operate.

6. Future research and recommendations

Key recommendations for industry arising from the project are as follows:

- **Get connected:** invest time to understand your connectivity infrastructure and ensure that access to internet is prioritised.
- **Invest in your systems:** underutilisation of systems – particularly operational ones, is often overlooked. Oftentimes key operational systems (e.g. FMS) need to be evaluated to ensure they are being fully utilised to address problem areas. Pick a champion for each system.
- **Leverage the cloud:** given the connectivity challenge can at least be partially solved with new technologies (Starlink), offload compute resources to cloud providers to ensure operators are not impacted by digital transformation initiatives and avoid expensive infrastructure upgrades.
- **Work backwards**: decide on key areas to improve and/or areas of concern, then work backwards to determine the data, technology and systems required to effect technological change in the chosen area. This helps alleviate decision paralysis.
- **Apply a common data model**: use a common data model across your operations and dashboards to ensure that metrics are consistent with ordinary business user definitions.

Future research in this area may be around enhancement of connectivity solutions to enable live-data tools to be used by operational users at point of occurrence.

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