Well and Fair: Investigating dairy welfare programs around the world

Lucy Collins, 2021 Victorian Scholar

November 2023

Nuffield Australia project number 2106

Supported by

Well and Fair: Investigating dairy welfare programs around the world.

Scholar contact details

Lucy Collins

Dixie Park Farm Trust

1189 Timboon-Terang Rd, Dixie VIC 3265

0432 092 796

lucyjeancollins@gmail.com

@lucyjeancollins @dixieparkdairying

In submitting this report, the Scholar has agreed to Nuffield Australia publishing this material in its edited form.

NUFFIELD AUSTRALIA Contact Details

Nuffield Australia

Email: enquiries@nuffield.com.au

Address: PO Box 495, Kyogle, NSW 2474

Executive Summary

"If you don't like change, you're going to like irrelevance even less" - General Eric Shinseki.

As one of the few developed countries without a dairy welfare assurance system, an effective program would contribute to maintaining and enhancing Australia's international reputation as a responsible dairy producer. It would align with global trends and expectations for animal welfare, and potentially facilitate market access to countries with more stringent welfare requirements (or requiring equivalency of assurance scheme). Given current European (EU) trade negotiations – at the time of writing – coupled with a large review and update of EU's animal welfare strategy, this may only increase in relevance. And if the government isn't going to do it, perhaps industry should.

The need for standardization of the welfare appraisals required for ongoing market access in the northern hemisphere has led to the development and widespread adoption of numerous national welfare assurance programs. While the intent is to ensure cow welfare standards are being upheld and altruistically improved; the process of development, implementation, adoption, and review of programs varies widely.

A coordinated national conversation around the dairy industry's welfare claims may soon be warranted, or indeed demanded. At some stage the Australian dairy industry will come under scrutiny or increased pressure for more robust assurance. It is an unfortunate truth that sometimes it takes an exposé to push an industry to reactively commit to an assurance program or improve transparency. Similarly, other animal production industries can provide the dairy industry with examples where retailers caught producers by surprise, requiring changes to on-farm animal management systems without prior consultation in response to consumer demands.

It is time the Australian dairy industry got real about welfare and had a whole of supply chain conversation about aspirations for the future. While there are some mandatory and some voluntary animal welfare measures already in place, the implementation of a dedicated program would provide a more systematic and structured approach to assessing cow welfare and offer farmers the ability to benchmark. By establishing clear standards, promoting participation and monitoring outcomes, industry has the potential to contribute to the improved welfare of dairy cows.

The features of successful models, potential barriers to implementation, threats associated with complacency, and opportunities for meaningful change are outlined and explored in this report.

Table of Contents

Table of Figures

List of Tables

Foreword

In 2019, while I was practicing as a dairy veterinarian, a decent and diligent dairy client called for support having received news they had not been compliant with their milk company's new animal welfare audit. Further investigation and consultation revealed the milk company was using a US-based assessment protocol, designed for indoor cows and impossible to achieve compliance in some areas within the context of a pasture-based system. I became curious about the assessment protocol and after some research I was shocked to discover the number of programs in existence around the world, and that we didn't already have one here beyond the Australian Animal Welfare Standards and Guidelines (AAWS&Gs).

As a dairy farmer, frequently espousing that "Australia has some of the best animal welfare standards in the world", had I been naively and comfortably drinking the Kool-Aid? Was this the next industry or processor-driven requirement coming at us? Was cow welfare much better overseas, because of these assessments and assurances? If so, I wanted to know how I could ensure our industry was keeping up, farmers were self-governing, and we were implementing best welfare practices as vets and farmers on home turf. I needed a better understanding of the situation. Given I have a gumboot on both sides of the fence as a dairy farmer and cattle vet, I felt well-equipped to explore these questions with a reasonable level of legitimacy. Cue Nuffield.

Initially I thought I would compare the different programs, package up the findings in a neat little table, deliver the results of my Nuffield and then let industry decide what next. Turns out, not everybody was willing to share the intricate details of their programs, and the question was more complex than I had anticipated. I also realised that a simple comparison wasn't going to help me answer questions about program outcomes on farm, and farmer perception. I needed to talk to lots of stakeholders about their experiences. This made the travel component of my scholarship invaluable, and I am truly grateful to the Nuffield board for allowing postponement of our scholarships during the COVID19 pandemic to ensure this part of our experience was not foregone. It was essential to my study and offered an immensely valuable time of personal and professional growth and development. From micro-dairies to mega-dairies, retailers to processors, veterinarians to auditors, I was able to visit and have conversations with stakeholders operating within a wide range of systems over 19 weeks in 2022, visiting the UK, Singapore, The Netherlands, Canada (Figure 1), the US, Ireland, Spain, Australia and New Zealand.

Fortunately, my fellow farmers were very forthcoming with their time and knowledge, and throughout my travels I received considered, honest and balanced opinions (as well as extremely generous hospitality) wherever I went.

Figure 1: Comparing notes with Dr Kelly Barratt in Canada. In the author's opinion (and after extensive testing), cow welfare discussions are best had over ice cream.

Acknowledgments

I sincerely thank the Gardiner Dairy Foundation for their investment and support of both the Nuffield scholarship program and development of industry leaders in our rural communities. This opportunity has been life changing for me, and I am forever grateful.

I would also like to thank my employers and colleagues for their encouragement and understanding during my extended periods of absence.

To Matt: my Nuffield experience would not have been the same without you. May our minds remain curious, hearts stay open, and adventures continue for many years to come.

We are so grateful to John, Helen, and the entire team at Dixie Park who enabled us to travel the world and subsequently embraced the changes we implemented in our farm business upon our return.

Thank you to my family and friends for always believing in me, for understanding, and for helping me find ground again each time I got stuck in the clouds.

To my inspiring and supportive fellow scholars and Jodie Redcliffe and Rob Bradley at Nuffield Australia: some of us inevitably encounter some incredible highs and devastating lows during our Nuffield experiences – thank you for helping me navigate mine with solidarity.

And finally, to both the Australian dairy and veterinary communities: I'm so proud to be part of such inspiring and collaborative professions. If I have seen further, it is by standing on the shoulders of the giants before me. I hope I am making them proud. I ask myself now what I can do to make the mountain taller so those after me can see farther.

This report is dedicated to Max (1991 Scholar) and Barbe Jelbart, who gave me my first sense of both cows and Nuffield. You may never really know the impact you have on those around you. Choose kindness, always.

Abbreviations

AAWS&Gs – Australian Animal Welfare Standards and Guidelines

ADF – Australian Dairy Farmers

ADIC – Australian Dairy Industry Council

BBB - BoerBurgerBeweging

BSE – Bovine Spongiform Encephalopathy

CFI – The Centre for Food Integrity

CSC – Contemporary Scholars Conference

DFO – Dairy Farmers of Ontario (CA)

EU – Europe

FARM - National Dairy Farmers Assuring Responsible Management (USA)

GFP – Global Focus Program

NFU – National Farmers Union (UK)

NMR – National Milk Records (UK)

NZ – New Zealand

OIE – Office International des Epizooties (now WOAH)

PAACA – ProAction Animal Care Assessment (CA)

PAACO – Professional Animal Auditor Certification Organization

RSPCA – Royal Society for the Protection of Cruelty to Animals

RT – Red Tractor (UK)

TMR – Total Mixed Ration

UNESCO - United Nations Educational, Scientific and Cultural Organization

UK – United Kingdom

US – United States

WOAH – World Organisation for Animal Health (formerly OIE)

Objectives

- To explore existing dairy welfare assurance strategies and consumer trends with the intent of successfully aligning the priorities of both farmers and the public, whist maintaining trust and transparency for all.
- Understand and evaluate international dairy welfare assessment and benchmarking programs, particularly from a farmer's perspective.
- Critically examine adequacy of existing Australian dairy welfare policies, programs, and labelling.
- Consider the feasibility of a farmer led approach to dairy welfare assurance in an Australian context.

Chapter 1: Introduction

1.1 The Australian dairy industry

Dairy is one of Australia's most significant agricultural industries. At the time of writing, the Australian dairy industry is the country's third largest agricultural industry, directly employing approximately 45,000 people. Producing approximately 8.9 billion litres of milk from 1.38 million cows across 4,600 farms; the industry employs over 37,000 people and had a farmgate value of $4.7 billion in the 20/21 financial year (Dairy Australia, 2021).

Although contributing only 2% of global milk production, Australia is the world's fourth largest dairy exporter, with 32% of domestic production destined for export (Dairy Australia, 2021). Historically, national production exceeded domestic consumption and export into growing Asian markets offered geographically convenient trade without the major restrictions of the European markets. However, recent years have seen a slow decline in Australian milk production due to reducing farm numbers, and this has nearly halved the volume of domestic production exported in the past 20 years (International Market Overview). An increasing population has bolstered domestic demand, alongside a strong "café culture" trend where food and beverage industries represent 12% of national dairy consumption (Haas et al., 2019; Dairy Australia, 2021). Despite the many dairy alternatives now available, worldwide milk production is still forecasted for future growth (Haas et al., 2019). This leaves the dairy industry poised for value addition in domestic markets, but vulnerable to campaigns and attacks targeting ongoing contentious issues - including animal welfare.

1.2 Animal welfare in Australia

Currently, there are comprehensive national standards and guidelines available for the care of dairy cattle (with varied incorporation into relevant state and territory legislation), but the Australian dairy industry does not have a national welfare assurance framework or benchmarking program (Dairy Australia, 2017). Encouragingly, this has not stopped industry achieving the voluntary phase-out of several practices no longer justifiable from a social or economic perspective, such as tail docking and routine inductions. The recently released animal welfare policy barometer indicates Australian government is not currently meeting public expectations (Saeri, 2023). Recent national budget announcements demonstrate a renewed commitment to Australia's animal welfare strategy (which lapsed in 2014) and have the potential to provide an overarching national framework to identify priorities, coordinate stakeholder action and improve consistency across all animal use sectors, but the particulars remain (https://www.agriculture.gov.au/agriculture-land/animal/welfare/aaws) (Australian Government, 2023). Current mechanisms of livestock welfare policy development have been criticized by animal welfare organisations as lacking independence, as they are primarily delegated to the Department of Agriculture, which has competing priorities and greater strategic and cultural alignment with the productivity goals of livestock industries (https://www.allianceforanimals.org.au/animal-welfare-policy-barometer?utm_source=nationaltribune&utm_medium=nationaltribune&utm_campaign=news) (Australian Alliance for Animals, 2023). The establishment of independent panels has been recommended.

1.3 Australian dairy farms

Dairy farms vary greatly around the world, with differing herd size, cow breeds, and farming systems. Climatic conditions, target markets, access to labour, cultural norms, owner profile and financial position all influence decisions made. Typically, Australian dairy farms are outdoor, pasture-based systems; calving seasonally or in splits; milking predominantly Holstein Friesians using manually placed machines in a herringbone or rotary dairy; and rearing calves in social groups from birth on a whole milk restricted feeding program (Of and Dairy, 2019; Smith et al., 2022). Nationally, 5% of dairy farm businesses hold organic certification or are in the process of conversion (Of and Dairy, 2019). Automatic milking systems have been commercially adopted but currently only represent a small fraction of the industry (Molfino et al., 2014).

Consistent with international trends, average herd size has increased in recent decades (Beggs et al., 2015; Dairy Australia, 2021). But bigger is not necessarily better. Larger Australian dairy herds (greater than 300 cows) are more likely to have computerised herd records and additional monitoring technologies (such as daily milk cell counts or conductivity), and farms with herds greater than 500 cows are associated with increased grain or concentrate feeding, greater stocking densities and decreased labour units per cow (Beggs et al., 2015). Herds fed total mixed rations have increased odds of clinical hypocalcaemia, lameness, metritis, displaced abomasums and subclinical ketosis (Lean et al., 2022). A larger herd size is associated with factors (such competence deficits in staff) that may increase the risk of adverse animal welfare outcomes on farm, but also additional capacity for protective mechanisms and strategic management of animal welfare issues (Beggs et al., 2015; Lindena and Hess, 2022).

Whilst herd health data is not currently aggregated in Australia, all farms are required to record animal treatments under farm food safety programs. Additionally, some dairy companies oversee compliance of industry policies and AAWS&Gs through internal audits and or self-reporting. Veterinary businesses have also developed farm treatment protocols, which reflect legislative requirements around the prescribing for and treatment of cattle and are reviewed consistent with relevant state Veterinary Practice Acts, and Veterinary Surgeons Regulations.

1.4 Why should we care about animal welfare?

1.4.1 Market access and reputation

“If you want to play in the export market, you’ve got to have your eye on the globe”
Professor Marina VonKeyserlingk, pers.comm., July 2022.

In theory, government and regulatory bodies should play a role in ensuring that livestock production systems meet certain welfare criteria and provide accurate information to customers. They can set guidelines, establish oversight mechanisms, and require transparency and industry-wide accountability. A clear regulatory framework ensures that compliance mechanisms are robust, welfare is prioritized, and misleading or unsubstantiated claims are prevented. However, given the differences in state and territory welfare legislation, and the seemingly glacial pace at which Australian animal welfare regulations are being advanced (the AAWS&Gs were endorsed in 2012, but still have not been universally adopted), it is unlikely that government would regulate such a program.

To maintain confidence amongst consumers and competitiveness in overseas markets, it is imperative to continue to strive towards proactive public engagement and more progressive animal welfare practices and policies. The United Kingdom - Australia Free Trade Agreement has a whole chapter dedicated to animal welfare, which recognizes animal sentience (something most Australian states and territories have yet to recognize explicitly in legislation) and identifies a shared commitment to the continued improvement of animal welfare through laws, policies, and regulations (https://www.dfat.gov.au/trade/agreements/in-force/aukfta/official-text/australia-uk-fta-chapter-25-animal-welfare-and-antimicrobial-resistance) (Australian Government). Australia is currently rated a 'D' under the World Animal Protection's Animal Protection Index, compared to the UK 'B' (https://api.worldanimalprotection.org/#) (World Animal Protection, 2023). The path to legislation is a slow one, and community expectations around animal welfare have never moved faster. Aiming for improved or enhanced cattle management practices beyond industry standards or minimum expectations could provide significant social license benefits, market advantages and value addition opportunities for Australian dairy producers (Ortega and Wolf, 2018).

Figure 2: Some of the many dairy welfare assurance programs and labels around the globe, in no particular order.

1.4.2 Social sustainability

"As an industry, you need to start to engage and make some decisions, or somebody else will make them for you" (Professor Nina VonKeyserlingk, pers. comm., 2022).

Some might argue that in a shrinking milk pool, with an increased domestic market share, assurance for the purpose of market access becomes irrelevant. However, public concern for modern livestock farming practices is well documented, and ensuring and improving animal welfare is certainly a key pillar in securing dairy's social sustainability (Boogaard et al., 2008; Clark et al., 2016; Wolf et al., 2016; Ortega and Wolf, 2018).

People do not shape their opinions based on knowledge and experiences alone; values and convictions also play an important role (Boogaard et al., 2011b). Ambivalence towards modern dairy farming has created "fields of tension" that require careful balancing where often there is no hierarchy, only complex interrelationships (Boogaard et al., 2011a).

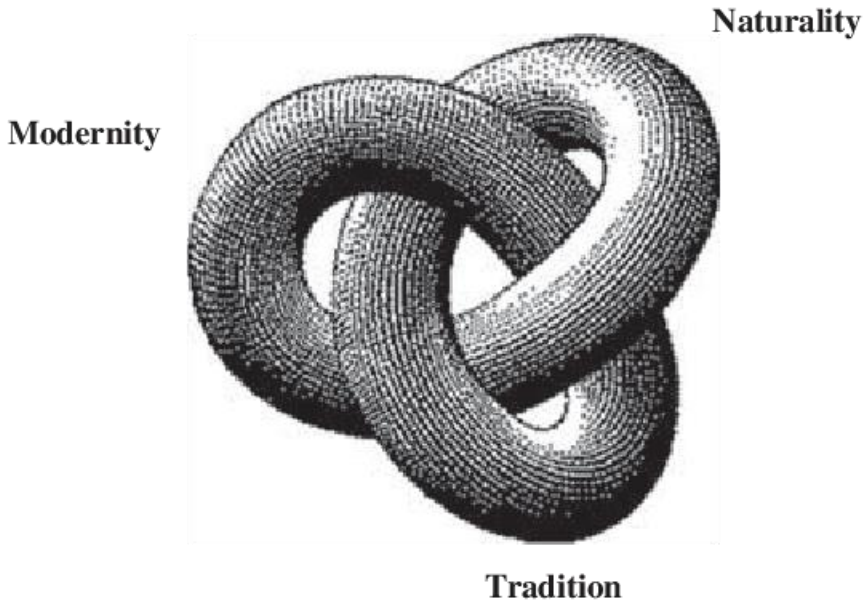

Figure 3: M.C. Escher's "Knot", 2008, © The M.C. Escher Company B.V. Baar, NL.

Recent Australian dairy industry materiality assessments place high importance on animal care, and industry has recognized that resonation with public values and the ethical justification of using animals for food production is a priority (Dairy Australia; Strategic Priorities; 2021 Sustainability Report; Australian Dairy Industry, 2020). Assurance that the dairy industry takes animal welfare seriously and meets public expectations safeguards social acceptability (Ellis et al., 2009; Futureye, 2019).

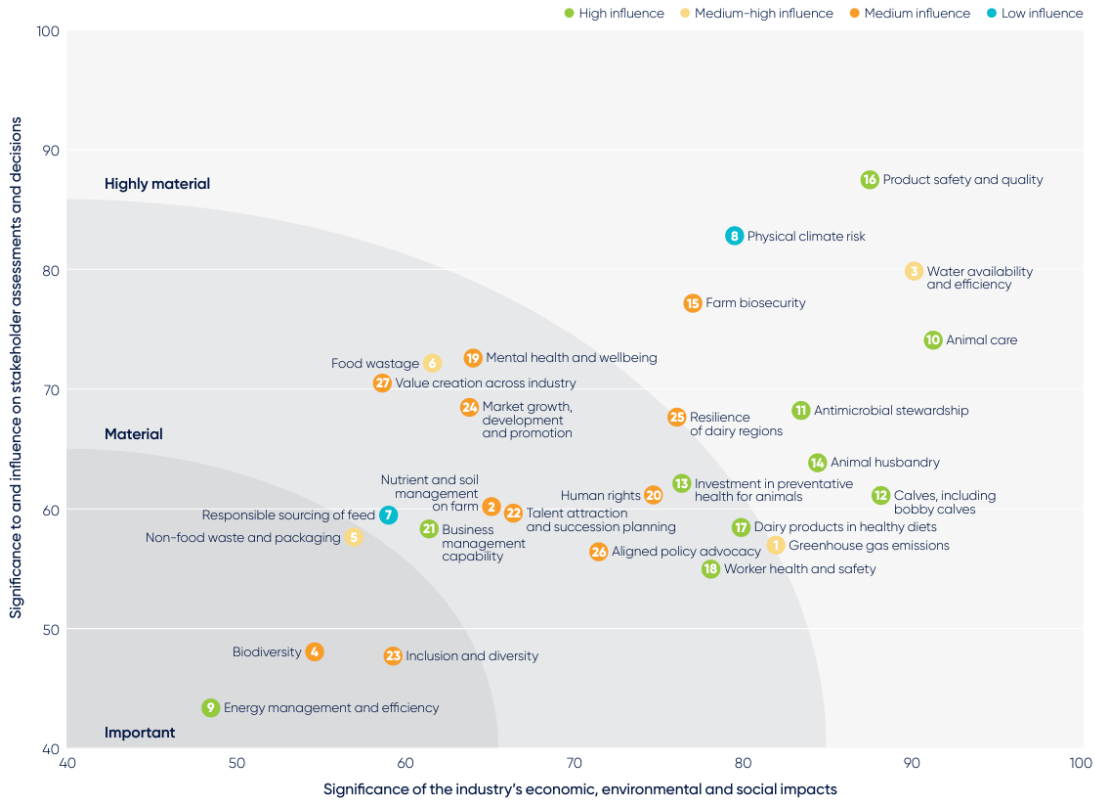

Figure 4: Australian dairy industry materiality matrix, 2019 (Dairy Australia).

In a modern world, it has become evident that those caring for cattle not only have a production imperative as well as a moral responsibility to the animals, but a social obligation to continue to ask: how can we do better? At the time of writing, there are few published studies exploring the Australian general public's aspirational goals for Australian dairy farming systems. Internationally, the consumer lens is turning towards pasture access (Cardoso et al., 2018; Beaver et al., 2020; Hendricks et al., 2022; Jackson et al., 2022). Zero-grazing dairy systems have been banned in Sweden since 1988 following social movement demanding the change (https://www.fao.org/faolex/results/details/en/c/LEX-FAOC019544/#:~:text=This%20Act%20sets%20rules%20relative,procedures%20and%20experimenting%20on%20animals.) (FAOLEX Database) (von Keyserlingk and Weary, 2017; Weary and Von Keyserlingk, 2017a). Preference testing and motivational studies indicate the welfare science behind pasture access is sound (Legrand et al., 2009; Von Keyserlingk et al., 2017). Scientific findings of the European Food Safety Authority even stipulate pasture access should be to "well drained" pasture. (Statement on the use of animal-based measures to assess the welfare of animals, 2012). Overseas research also indicates a public preference for systems where cows exist in social groups, can exercise autonomy, and experience longevity (Mellor, 2016a; Beaver et al., 2020; Jackson et al., 2022).

While still aspirational in various international dairying models, these features are seen as standard for most Australian dairy farms. It is unclear whether, given a different set of cultural norms, the Australian public holds different aspirations. With a small but growing number of farms representing a significant volume of our domestic milk pool adopting housed/TMR systems to manage climate volatility, has industry considered if there is a tipping point where the "clean and green" pasture-based image is lost?

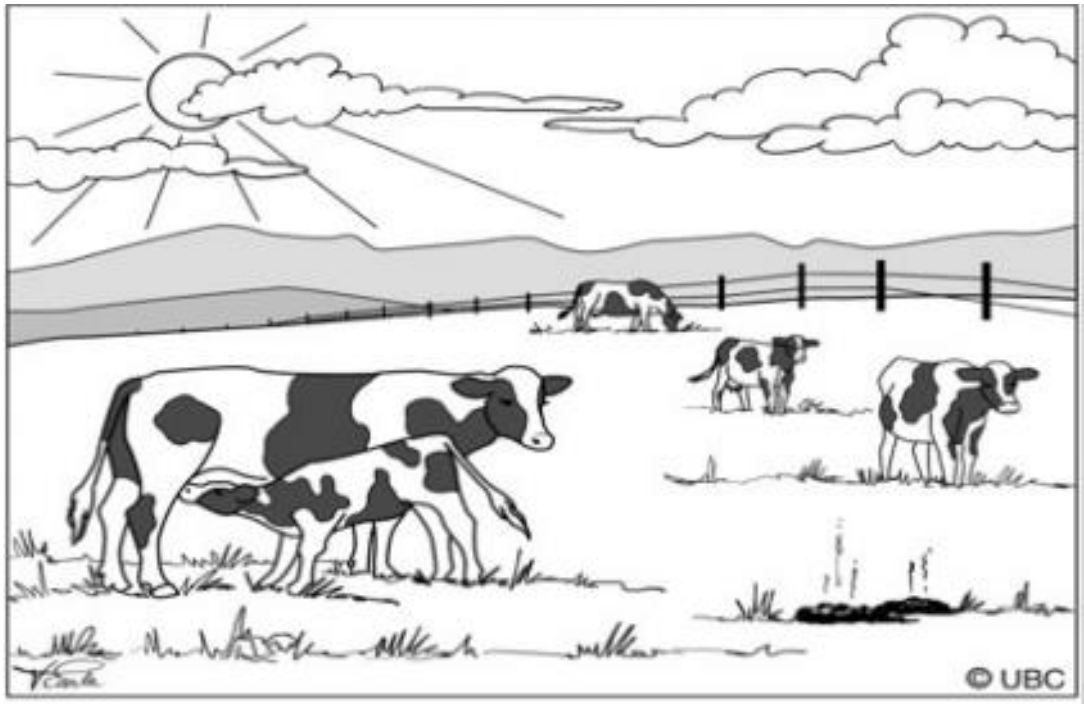

Figure 5: Artist's interpretation of an "Ideal Dairy Farm" based on survey responses from the public. (Cardoso et al., 2016a)

Public participation models have been used with success to assist and inform decision making surrounding animal welfare and identify preferred solutions with maximum impact (Bolton and von Keyserlingk, 2021). This model should continue to be explored within the context of farm animal welfare assurance in Australia.

1.4.3 Value addition

Beyond the farm gate, there is also a convincing argument for concurrent improvement in governance mechanisms for higher animal welfare label claims in Australia. Food Standards Australia contains no current requirements or stipulations around many of these marketing terms for dairy (Food Standards Code user guides). Where public policy does not respond to social pressures, the market might (Chen, 2016).

Labels tell a story and can influence product perceptions, purchasing decisions and alleviate consumer guilt or cognitive dissonance (Levitt, 2018; Haas et al., 2019). And while ethical labelling can certainly push the social moral compass within the market to maintain alignment with civic concerns, prompting change that in time may become standard practice (or even law); these changes are often small, fragile, or relatively incremental (Parker et al., 2018a, 2019).

Unaspiring government mandated animal welfare standards with frail and under-resourced monitoring and enforcement mechanisms, and a lack of legislative framework for definitions in animal welfare such as "pasture based", pose promotional opportunities, but also inherent risk for our industry if we do not address and satisfy public appetite for welfare regulation (Parker et al., 2018c, 2019). We also risk failing the cows themselves if label claims sanitize the difficult areas of production systems, appropriate citizen concerns, foster ambiguity or stand in the way of meaningful welfare progress by "sentimentalising, simplifying and de-radicalising potential solutions" (Francione, 2012; Parker et al., 2018b). Misleading consumers or disseminating performative disinformation via irresponsible marketing or "welfare

washing" is detrimental to the cause of animal welfare, and risks raising consumer expectations to unrealistic standards (Bjørkdahl and Syse, 2021). Consumer trust in welfare labelling is also damaged when expectations are not met surrounding voluntary humane society labelling standards (Free Range Egg Farms fined $300,000 for misleading shoppers with false claims; Egg farmers hit back at what they call myths about their industry - ABC News). Although consumer awareness about specific dairy husbandry practices remains low, once informed the majority express concern or outright rejection of some practices (Cardoso et al., 2017).

With increased transparency comes increased accountability. It is suggested that Australian dairy engage proactively with the broader public, recognizing that industry already has (and is) addressing many challenging animal management issues (Bolton and von Keyserlingk, 2021). Any shortcomings or incidents that contradict a promoted ethical image are likely to have a significant negative impact on brand or industry reputation. Evidence of this already exists in the dairy space: there is no international standard for the term "grass fed", and products with "grass fed" claims and images of cows at pasture can have their origins on farms with totally housed cows, albeit being fed a grass based TMR diet.

Moreover, the challenge of creating "productive tension" rather than genuine tension in the market is one dairy can do without. There is more than enough shelf space for a variety of dairy products with labels that may well enhance the inclusivity and attractiveness of products for a diverse range of potential consumers (Levitt, 2018). The worst thing is to pit ourselves against ourselves when we have much larger common adversaries.

Independent programs focused on specific aspects of animal welfare or niche markets already exist in Australia, and do not preclude from a broader industry program. Private programs may demonstrate compliance with specific welfare criteria, production systems, or consumer preferences that go beyond the possibility of an industry-wide program. Provided they meet or exceed national welfare standards and contribute positively to cow welfare without creating market ambiguity, private programs have the potential to enhance consumer experience and market segmentation, while still working in conjunction with an industry-wide program.

From a farmer perspective, voluntary programs can offer more flexibility and opportunity for alignment with values, production systems, or market preferences. Farmers may select programs that offer standards and requirements tailored to their circumstances or provide market differentiation. Meeting higher welfare standards may attract consumers seeking ethically produced dairy products and can potentially command price premiums.

The balance probably lies in a combination of both national and private programs. A nationally agreed program would set the benchmark for all farmers (beyond minimum legislated standards), whilst allowing for voluntary participation in additional private or commercial schemes that attract price premiums. Commitment and progress tracker tools such as https://welfarecommitments.com and https://welfareprogress.com can help consumers access information and industries demonstrate accountability and progress.

Even with national or even international programs, fragmentation still occurs. In a poorly regulated environment, irresponsible labelling can proliferate to fill product-differentiated niches or higher-value markets, or existing standards are not high enough to fulfil corporate social governance requirements. In the EU, to avoid

consumer confusion and undermining food markets with regards to method-of-production labelling, efforts are being made to improve the regulatory landscape and harmonise information provided to consumers (Di Concetto, 2023). For Australian dairy, these labels are emerging, but there is time to get the system right.

1.4.4 Improved life experiences for cows

Over time, animal welfare science has evolved from the pursuit of minimising animal suffering to striving to provide animals with opportunities to thrive (Dawkins, 2021). Whilst the 'Five Freedoms' have underpinned our contemporary definition of "good" welfare, in a modern world these freedoms are problematic (Mellor, 2016a; b; Beausoleil, 2018). When interpreted as "ideal states" rather than acceptable standards, it is implied that they may be fully met ([ARCHIVED CONTENT] Farm Animal Welfare Council - 5 Freedoms). Comprehending the brevity of such an approach allows us to appreciate that some freedoms can never truly be avoided. Animals must feel hungry to eat, thirsty to drink and pain to avoid noxious stimuli. Biological functioning and physiological health have been long considered the most scientifically acceptable methods defining an animal's welfare within specific, measurable parameters, and when combined with the ability to express natural behaviours, have been the mainstays of animal welfare assessments for many years (Keyserlingk and Weary, 2017).

This has led scientists to consider animal welfare through a more contemporary lens (Table 1), integrating both physiological and mental states and culminating in an animal's welfare status (Mellor, 2016b). As an example (with specific relevance to dairy cows) this could include allowing cattle to shade-seek on a hot day (natural behaviour), reducing the risk of heat stress impacting health and production (biological functioning) and preventing the discomfort of overheating (affective experience) (Keyserlingk and Weary, 2017).

Table 1: The Five Domains framework (Mellor, 2016a).

Physical / Functional Domains							
Survival-Related Factors						Situation-Related Factors	
1. Nutrition		2. Environment		3. Health		4. Behaviour	
Negative	Positive	Negative	Positive	Negative	Positive	Negative	Positive
Restricted water & food; poor quality food	Enough water & food; balanced and varied diet	Uncomfortable or unpleasant physical features of environment	Physical environment comfortable or pleasant	Disease, injury, and/or functional impairment	Healthy, fit and/or unimpaired	Behavioural expression restricted	Able to express rewarding behaviours
Affective Experience Domain							
5. Mental State							
Negative Experiences				Positive Experiences			
Thirst Hunger Malnutrition malaise Chilling Overheating	Hearing discomfort Breathlessness Pain Debility Weakness	Nausea Sickness Dizziness Anger Frustration Anxiety Fearfulness	Boredom Helplessness Loneliness Depression Panic Exhaustion	Drinking pleasures Taste pleasures Chewing pleasures	Satiety Physical comforts Vigour of good health Reward	Goal-directed engagement Calmness In control Affectionate	Sociability Maternally rewarded Playfulness Sexually gratified
Welfare Status							

And so, welfare science and assessment are gravitating towards the inclusion of affective states and considering the importance of provisions towards an animal's lived experience. See Appendix 1. Within the dairy industry, this shift in paradigm is also emerging: The A2 Milk Company moved to a provisions-based globally certified program in 2019 and have committed to third party certification of all farms (including Australia) by 2021. Dairy Australia have also updated their definition of good animal welfare to include mental state (Fraser et al., 1997; A2Milk, 2019; Dairy Australia, 2023).

More research is required to understand the experiences of dairy cattle in an Australian context. Whilst meeting the intrinsic behavioural needs of livestock may not always have clear and immediate functional benefits to cows, preventing the expression of certain behaviours can cause signs of chronic psychological suffering (Hurnik and Lehman, 1988; Jensen and Toates, 1993; Mellor, 2016a; Dawkins, 2021; Mills et al., 2023).

When it comes to welfare, dairy farmers and agricultural advisors tend to prioritise biological functioning, whilst lay citizens place importance on mental states and naturalness (Cardoso et al., 2019). Dairy farmers may view practices with enhanced welfare goals such as calf disbudding or the use of polled semen as having unacceptable production or economic trade-offs, reducing the uptake of such innovations if the knowledge and support required for implementation are not provided (Cardoso et al., 2016). Misaligned values remain a challenge, and this can manifest during the development of metrics for welfare assessment programs.

Industry should also remain cognizant that any assessment attempts to define welfare at a moment in time in what is a cumulation of a lifetime of lived experiences leading up until the point of valuation. Any outcome-based evaluation of animal welfare should therefore include chronic indices of a failure to cope with physical and psychological challenges.

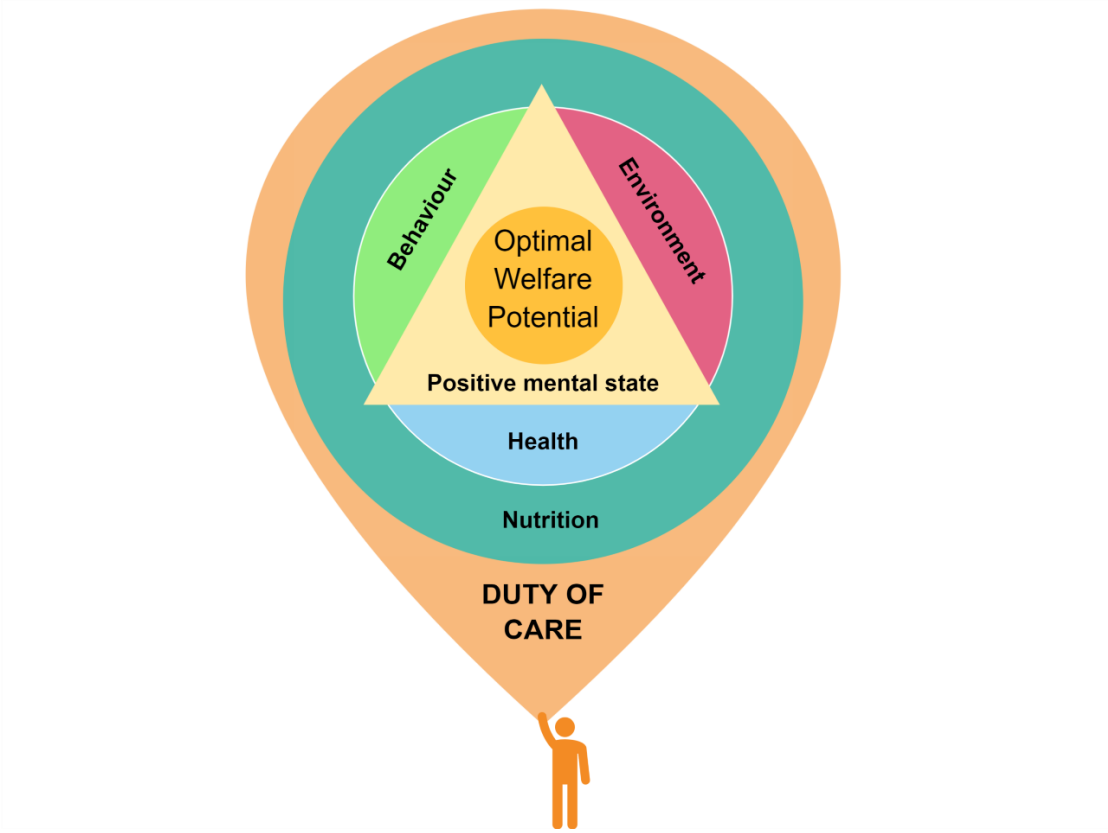

Figure 6: A farmer's duty of care (Dr Natarsha Williams)

Critically, the pursuit of good welfare must be applied to all classes of livestock, including pre-weaned calves, non-replacement calves, heifers, live export heifers, bulls, milking cows, cull cows, and hospital cows. Farmers duty to care for them includes making sure that they identify animals that are sick as early as possible and that make timely treatment and culling decisions. Put simply, any black and white animal will be perceived as a representation of the care of the dairy industry, regardless of its destination or intended use. Welfare assessments at slaughter plants can also provide useful indicators of on-farm conditions (Grandin, 2017). As Professor Marina von Keyserlingk reminded the 2022 National Dairy Farmers Assuring Responsible Management (FARM) conference in Texas, "we can't forget that all dairy cattle ultimately end up contributing to the beef supply, but just because they end up as beef doesn't mean that we should avoid taking responsibility". In Canada, where 25% of beef supply comes from dairy, the beef levy body recognises the need to contribute to risk reduction and contributes funds annually as a silent partner towards dairy research programs and producer outreach.

1.4.5 One welfare

'A world where the welfare of animals is respected, promoted, and advanced, in ways that complement the pursuit of animal health, human wellbeing, socioeconomic development and environmental sustainability' -– OIE Global Animal Welfare Strategy, 2017.

Animal and human health and therefore welfare are intricately linked. The concept of One Welfare extends and intersects the approach of the One Health theme commonly used for human and animal health (Figure 7). This has direct and indirect impacts on

the sustainability of social, economic, and ecological systems. This plays out at both a micro and macro level in dairy farming. For example, a tired and frustrated farm employee is more likely to mishandle animals (Grandin, 2021). On a larger scale, with rural veterinary professions currently experiencing high attrition rates and reduced capacity to provide timely treatment and advice, there is high potential for poorer regional animal welfare outcomes as a result.

Recent research has correlated holistic Ethiopian farming practices with better welfare outcomes for both humans and animals. Cattle experienced improved nutrition, body and coat condition and had reduced evidence of painful or restrictive conditions or husbandry practices, while communities described the connection between increased income and the benefits to animal welfare, and there was strong consensus on the relationship between improved household food security and good animal welfare (Doyle et al., 2022).

Figure 7: One welfare outcomes (One Welfare, 2023)

1.5 Welfare assessments

Welfare assessment programs must meet the needs of the animal. Animal welfare can be assessed using inputs (resource-based) and outputs (animal-based) measures. The former are more readily measurable, typically non-confronting and easily understood by the public; while the latter tend to be more informative about true welfare states and therefore preferred by animal welfare scientists (Laven and Fabian, 2016; Bjørkdahl and Syse, 2021). Both are important to the cow and practical application demonstrates that neither outcome used in isolation provides perfect representation. For example, if a cow is in good health (animal-based) but does not have access to water (resource-based), her welfare is likely to be compromised. Similarly, if a cow is lame (animal-based) but has access to plentiful water (resource-based), her welfare is also compromised. Resources are fundamental to good animal welfare, but not necessarily indicative of optimal welfare outcomes. Animal-based assessments underpin many of these schemes, with clearly defined measurement conventions to achieve representative samples (Welfare outcomes assessment in dairy farm assurance schemes; Main et al., 2007). Programs need to be able to capture welfare outcomes effectively for welfare to be represented truthfully.

As Dr Antoni Dalmau, 2022) told the 2022 World Association for Buiatrics Congress in Madrid, *"if you just measure inputs, you are not measuring animal welfare. You are only measuring risk factors. You need to measure outcomes to truly understand animal welfare. Different production systems have different risk factors, but the way you assess the animals will be very similar. For example, lameness occurs in every system."* In other words, a poorly managed good system can be as bad as a well-managed poor system. It's the welfare outcomes that matter.

Oversimplification is a risk, however. Programs that aggregate individual welfare measurements into an overall "score" for dairy herds receive criticism from welfare experts as the approach removes the impetus for improvement of single contributing factors if an overall score is deemed "good".

Audits do not typically allow for recommendations to be made. A welfare *discussion* tool allows for the capture of nonbinary findings during an assessment, identify teachable moments for assessors and inform modification of a program over time to improve relevance in Australian farming systems (O'Brien and Cronin, 2023). However, as Dr Cassandra Tucker (PAACO) explained, where audits leave room for storytelling, (i.e., 'the farmer had a hard year') it is human nature for validators to want to explain away non-compliances.

Conversely, a hazard analysis and critical control points (HACCP) approach to welfare on dairy farms could allow for the systematic identification and ranking of risk factors and problems (such as input or management issues) based on severity as well as executing corrective actions (Webster, 2008).

It's worth noting that the World Organisation for Animal Health (OIE), already provide guidelines and recommendations for dairy animal welfare, which influence practices in different countries (World Organisation for Animal Health, 2022).Any national program should be placed into a global context. Consistency in standards promotes relevance, clarity, accountability, and fairness when evaluating welfare.

1.6 Program requirements

If an assessment program is the delivery vehicle for improved animal welfare outcomes, there are some critical features to get right:

1. secure long-term funding
2. extensive stakeholder engagement, commitment, and collaboration
3. development of clear standards and a systematic assessment framework that is practical, quantifiable, repeatable, and based on scientific knowledge, best practice, and legal requirements (integrity)
4. training and standardisation protocols for assessors to ensure consistency and objectivity, with regular and ongoing refreshers and updates
5. pilot and evaluation
6. development of a portfolio of supporting materials across various modalities for farmers and service providers
7. robust records and secure and integrated data management systems
8. clear and strategic communication and awareness campaigns to increase consumer/retailer understanding
9. capacity for personalised support and problem-solving during implementation
10. monitoring of compliance and mechanisms for enforcement

11. mechanisms for feedback and evaluation
12. ongoing appraisal with well communicated intent to improve

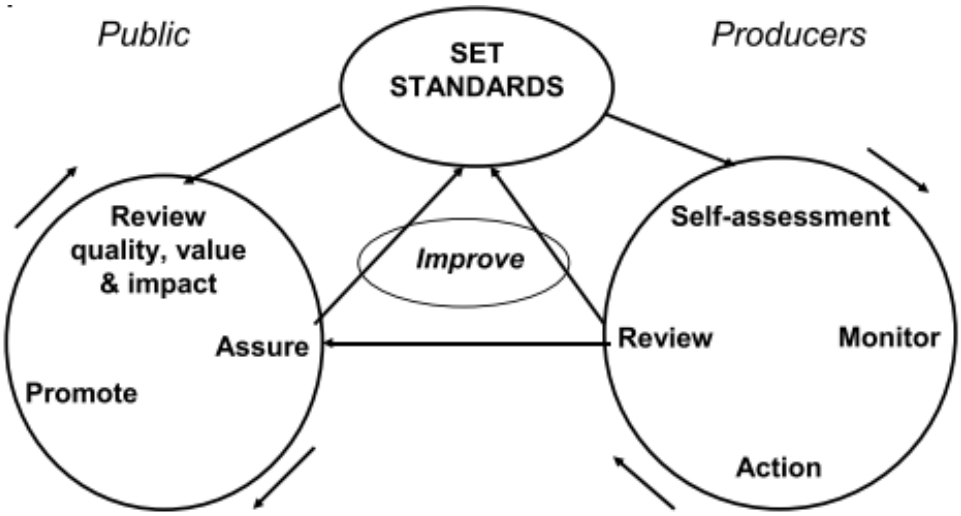

Figure 8: The "Virtuous Bicycle" – a delivery vehicle for improved farm animal welfare (Webster, 2008).

Clear definitions are also important, as outlined in the PAACO Standards for Certification of Animal Welfare Audits-Instrument & Guidelines:

A. Animal Welfare Programs:

Documents and systems that aim to provide guidance, educational materials, and/or standards.

B. Animal Welfare Assessments:

Documents and systems that aim to gather information for educational or improvement purposes and to compare it to a welfare program.

C. Animal Welfare Audit:

Documents and systems that assess conformance to a set of criteria/standards. An audit is a planned and documented activity performed by qualified personnel to determine by evaluation of objective evidence, the adequacy and compliance with established procedures, or applicable documents, and the effectiveness of implementation. There are several types or levels of audits as outlined in the definitions adapted from ASQ:

1. A first-party audit or internal audit is performed within an organization to measure its strengths and weaknesses against its own procedures or methods and/or against external standards adopted by (voluntary) or imposed on (mandatory) the organization. The internal audit is conducted by auditors who are employed by the organization being audited but who ideally have no vested interest in the audit results of the area being audited.

2. A second-party audit is an external audit performed on a supplier by a customer. Second-party audits are generally more formal than first-party audits because audit results could influence the customer's purchasing decisions.

3. A third-party audit is performed by an audit organization independent of the customer-supplier relationship and is free of any conflict of interest. Independence of

the audit organization is a key component of a third-party audit. Third-party audits may result in certification or registration.

(PAACO Standards for Certification of Animal Welfare Audits-Instrument & Guidelines)

Chapter 2: Successful Implementation

"We need to have courage. We need to have vision and we need to give ourselves the time to imagine the world we want to live in, and then work towards it". (Barry Irving, 2023)

2.1 Appropriate resourcing

Regardless of the program, successful implementation requires money. Who pays for this? Should the government just subsidise meaningful change? Many funding models exist around the world:

- some programs charge per cow enrolled
- some are built-in to levies or market royalties
- some require membership fees; and
- some are simply a supply or licensing requirement.

For the most part, it seemed that the farmer was paying, but it could be argued that farmers also stand to benefit the most.

All farms will have unique characteristics and challenges that affect their ability to meet certain welfare program requirements. Factors such as farm size, geographic location, infrastructure limitations, or breed-specific considerations may make it more difficult to comply with certain standards. Adapting existing facilities or practices to align with the program may require investment or operational adjustments, and the benefit of time. Resources and support for farmers during program implementation should not be underestimated.

To assist with the implementation of a program's standards, accessible educational materials and training programs are essential. Workshops, online webinars, and face-to-face learning all disseminate knowledge and skills related to animal welfare practices across a wide variety of farmer segments and learning preferences. Updates and refresher sessions are required to maintain relevancy.

2.1.1 Case study: Farmers Assuring Responsible Management (FARM)

Keeping up with changing society expectations and potential program requirements is likely to pose challenges for farmers, particularly those who face limited access to training or struggle to implement changes within their operations due to resource constraints. The speed at which change can be made is in the hands of the farmers being asked to make them, so ongoing support and engagement is key to success.

The US National Dairy FARM program has built an extensive and enviable array of resources to support participating farmers and industry members since the program's inception in 2009. Covering areas such as stockmanship, environmental and antimicrobial stewardship, biosecurity management, herd health and animal care, worker safety and preparation for evaluation, the resources are either freely available online or purchased at cost price. From informative one-pagers to video series, the team at FARM put time and consideration into developing and updating a resource library that is functional, accessible and extensive. These resources go well beyond the basics or minimum requirements. For example, the stockmanship video series includes a video on how cows perceive their world, and the best management practice

guidelines contains short documents that explain “how to transition away from” a practice no longer considered broadly acceptable.

2.2 Farmer support

A well-received and valuable program will have higher levels of compliance and participation among farmers. To achieve behavioural shift, the “so what” factor must be satisfied. The theory of planned behaviour provides a theoretical framework for which action, target, context, and time can be specified for a particular goal (in this case, program uptake or compliance), and salient factors may then be identified that have the potential to affect the desired outcome; positively or negatively (Ajzen, 1991; Dutton-Regester et al., 2019). Trust, feasibility, and significance have been identified as features critical to dairy farmer adoption (Svensson et al., 2019).

Some farmers may perceive the assessments and inspections associated with welfare programs as intrusive and encroaching on their autonomy and right to farm (Right to Farm Bill 2019 | Policy Commons) . They may feel that their long-standing knowledge and experience in animal care is undervalued or overlooked. Farmers who have been successfully managing their operations without participating in a program may be resistant to additional oversight, administrative burden, or outside intervention.

There is no question that program participation would result in an increased administrative burden for most farms and be a barrier to adoption. Through ongoing farmer engagement, these, and other factors relevant to behavioral outcomes and enabling influencers can be identified and addressed (Borges et al., 2019; Dutton-Regester et al., 2019).

2.2.1 Case study: Arla – by the farmer, for the farmer

“Do it, before it’s done to you” (Arla supplier, 2022)

While farmer-owned or regulated welfare programs risk pushing standards to the lowest common denominator to maintain inclusivity, there are international co-operative models that work. Arla’s premium-based assurance programs (Arlagården, ArlaUK360) ensure farmers are highly motivated to participate. With a board of farming directors who provide input into program development, company decisions are still made for the benefit of the cooperative (which, by default, is good for the farmers).

Arla’s approach is based on a tiered premium system with closed milk pools that motivates on-farm improvements and asks customers to pay for them. By regularly offering well-considered and genuine improvements, retailers are satisfied and have little reason to dictate requirements. As a result, cultural shift and continuous advancement is possible as farmers strive towards best practice to enter these premium milk pools. The welfare dial can be continually turned up, the customer is satisfied, and farmers receive fair recognition and returns for their enhancements.

Arla’s farm management program uses a sophisticated online platform where farmers can monitor their own ‘dashboard’ and are required to input data quarterly on herd health and performance metrics. However, three yearly audits and ‘spot checks’ based on risk-assessments help ensure self-reporting is reflective of on-farm reality, and that ‘every standard is being upheld every day’. The system is comprehensive and clear. There are 30 checkpoints alone for animal health and welfare, including the use of an electronic medicine book requiring not only the recording of all medicines administered and reasons for treatment, but the provision of medicine invoices for verification.

Antibiotics are classified and treatment reasons standardized to ensure data input is correct and consistent, while outcome measures and intervention levels are clearly defined.

With its foundations in data-driven insights, benchmarking and an ethos of continuous improvement, Arla encourages peer-to-peer learning and offers discussion groups for sustainable farming practices. Closing the information loop on data collected on farm helps drive value and engagement for suppliers. Visiting numerous farmer directors and supplying farmers during this research, the sense of pride and collective responsibility attached to membership was evident. The cows seemed well, and the model fair. Notably, Arla also has pathways to withdraw memberships for non-compliant suppliers, although rarely needs to use them. The implications for a dairy farmer with a perishable soft commodity would be disastrous.

The system isn't perfect, however. Arla operates alongside Red Tractor (RT), the UK's largest food and farm standards certification scheme, in which participation is a requirement to access many major dairy supply chains. Professed RT member benefits include: "one assurance accreditation, one fee, one inspection" (Member Benefits - Red Tractor Assurance). However, when private label programs exceed RT standards, they require their own assessments for compliance. As one auditor explained, interoperability between programs is not possible because "a private label audit should work on the basis that the Red Tractor audits have already been passed, but the private label auditors can't assume that. The private label can't risk approving a non-compliant farm because it's been audited to a lower set of standards." (pers. comm., 2022). Congruence is a challenge, and the farmers endure the audit burden as a result.

2.3 Stakeholder engagement

Collaboration and alignment with stakeholders facilitate knowledge sharing, research alliances, and the development of innovations that contribute to the broader welfare goals of the industry. There are quantitative achievements, defined using animal welfare metrics and by monitoring outcomes over time, and then there is qualitative success. Seeking and monitoring stakeholder sentiment provides insights into the perceived efficacy of a program, from a variety of important perspectives. Feedback mechanisms and reciprocity can help inform future investments and iterations of welfare programs and policies. Stakeholders must be willing to exchange information and accept trade-offs in the pursuit of success.

2.3.1 The role of vets

"Whatever program you design is only as good as the people who implement it" (Dr Brandon Treichler, 2022).

Given the public's trust in their ability to provide guidance on animal welfare, it may seem strange that the vets aren't routinely contracted to conduct welfare audits. However, this would not be considered an independent third-party assessment audit and, as Dr Jim Reynolds, Professor of Large Animal Medicine and Animal Welfare at Western University in California, remarks, "clinical vets veterinarians often make terrible auditors. They We are trained to explore causative agents and reasons for clinical diseases and problems and try to solve or treat a problem when we find it. We can't just walk away."

2.3.1.1 Case study: Dr Kelly Barratt and ProAction, Ontario, Canada.

With 18 years' experience as a dairy veterinarian practicing in Ontario, and a dairy farmer in her own right, Dr Barratt was pivotal to the success of the initial ProAction Animal Care Assessment (PAACA) rollout, and engagement with the livestock veterinarians tasked with signing off on annual farm checks. Dr Barratt was able to act as a conduit between vets and farmers, providing two-way accessibility and feedback during the formative years of the PAACA program.

Dairy Farmers of Ontario (DFO) provided funding for veterinarians to deliver training to farmers ahead of the program rollout, both in the classroom and on-farm. This required initial training of interested vets to understand the elements of PAACA, delivered by Dr Barratt. Contrary to an initial assumption, vets were very interested in accessing the training, with over 150 engaged directly by Dr Barratt. They could then be paid for up to two hours of delivery per farmer.

The benefits here were threefold:

- Firstly, vets enjoyed being engaged as the "good cops" as they weren't being asked to complete the audits or required to report non-compliances. They could help mitigate "audit shock" where non-compliances were likely and support existing clients in achieving successful outcomes ahead of assessment, and many developed a deeper understanding of the dairy businesses they worked with. Livestock veterinarians reported the experience as very professionally satisfying and were supportive of the program from the outset.

- Veterinarians were already likely to know which of their clients would require additional support to achieve the required ProAction outcomes or be resistant to change. The program suddenly gave these vets a third party to "blame" for changes they had already been trying to make on farms, and the ability to flag a farm with the auditors ahead of time if adequate change wasn't achieved (which had the additional benefit of reducing auditor workload). By giving vets both "the carrot and the stick", DFO were able to ensure vets delivered both quality training and had the difficult conversations required to affect change at the individual farm level.

- Finally, reviews now indicate that farmers who used vets to prepare for the rollout of PAACA had a 70% chance of passing their first-round audit, compared with 30% of farmers who did not engage a vet prior. Vets, through Dr Barratt, were ultimately a key factor in ensuring genuinely positive animal care outcomes.

2.3.2 If you build it, they will come

While participating in a welfare program can offer potential market advantages, farmers may question whether citizen demand is genuine. Generally, research suggests consumers are reluctant to 'put their money where their mouths are' when it comes to and willingness to pay premium prices for welfare-certified products (Clark et al., 2017; Heise and Theuvsen, 2017).

At a visit to Rabobank, I heard about retailers dictating how producers must operate to mitigate their modern consumer risks. This played out in NZ recently where egg producers who were responding to changes in government regulations regarding hen housing (that were not sufficiently aligned with society's expectations) were left blindsided when retailers upped the ante, resulting in egg shortages and many farmers forced out of production after already having invested millions in upgrading infrastructure (The New York Times; Weary et al., 2015). The below case study

suggests, however, that producers can be the architects of their own futures if they build farming systems communities can trust.

2.3.2.1 Case study: Ruud Zanders (NSch 2022), Kipster Farm, Netherlands

Having grown up around on a poultry farm, Ruud Zanders is no stranger to chickens. Nevertheless, once he learned about the emotional needs of birds with his own largescale poultry farms, he experienced a crisis of confidence in traditional Dutch poultry farming systems.

Ruud reflected: *"in 1948, there were protests for more meat. People were going hungry. Now, people protest for animal justice. We are now producing for the demands of society, but how do we close the gap between producers and the wider community? It's almost impossible to keep livestock at a commercial level in an animal friendly way. All we can do is our best. Producers have a responsibility to make the best thing they can. People don't want to have to make an ethical decision on everything they consume. What's needed is trust."*

This, combined with a growing concern about circularity in agriculture and the ethics of feeding human grade food to animals, was the reason Kipster was founded. An innovative four-way partnership between Ruud (who also studied and lectured in poultry farming and economics), another poultry farmer, a media strategist, and a sustainability entrepreneur.

Quoting Leo Tolstoy, Ruud says: "everyone thinks of changing the world, but no one thinks of changing himself". So, the group set out to design an egg "that even a vegan would eat". Initially, they approached the supermarkets to ask what they wanted. But the category had no industry experience or knowledge. Price was the only universal language. Next, they tried the government, but were also left disheartened by their lack of knowledge and stability. Then came the NGOs and specialist groups. More than 10 of them in fact. And they had longer views, more access to research, and indirect influence over both the retailers and government. Some groups were moderate, some outright activist. The challenge was "to sit with them and ask: what can we do together? If you involve them, they become enthusiastic about what you are doing".

Nevertheless, after securing an exclusive five-year forward contract with European supermarket giant Lidl (sold on the concept alone, they hadn't even built the sheds yet!) and at a fair but firm price calculated using their cost of production (based on fluctuating purchased feed costs) with a normal margin; Kipster's first run of eggs completely sold out, and the business now sells 20 million eggs per annum (for context, Lidl has over 12,000 stores across Europe and the US). The eggs are sold at a mid-range price point, not as high as organic but better than free range. They want to "make the best egg but remain available to the everyday consumer".

Despite being neither organic nor free-range, Kipster have received the highest attainable quality seal from the Dutch Society for Animal Protection: three stars in the well-recognized Beter Leven system (Beter Leven, 2023). Enriched facilities with lower-than-average stocking rates, comparable mortality rates, and value chains for roosters and spent hens helped secure the three-star rating. With a model built on engagement and based on trust and transparency, a notoriously negative animal activist group even went so far as to make a national radio commercial saying they had finally found an egg they were happy with.

Kipster facilities are open to the public and offer interactive and educational community spaces. Prior to COVID19, Kipster received approximately 20,000 visitors a year.

Kipster are now turning their minds to innovations in pig farming, under the banner of Pigster, with construction of their first pig facility set to commence in the second half of 2023 and aims to have meat on the shelves in Lidl in 2024. The visit to Kipster left my mind spinning with possibilities for improved public engagement with (and acceptability for) dairy farming in Australia and questioning whether the industry's positive story around circularity could be better amplified. In the case of Kipster, clever marketing has been critical to their success.

Figure 9: The author standing in front of Kipster's transparent layer building open to the public 24/7, June 12, 2022.

Chapter 3: Where Next?

What this research into dairy farms across four continents has shown is that Australia has relatively fit and happy cows, and comparable or better cow welfare in a global dairy context (according to the usual metrics). What Australia does not have, is the wide-scale evidence to prove it.

3.1 We can't manage what we aren't measuring

There is still a lot not understood about cow welfare from a research perspective, and even more specifically the current cow care situation in Australia. There is a lack of robust data and research. Currently, the best mechanism for monitoring dairy welfare is the triennial Animal Husbandry Survey, commissioned by Dairy Australia regularly since 2005 and recording self-reported responses from a representative sample of 400 dairy farmers interviewed at random via computer assisted telephones.

It seems logical that identifying a farm's risk factors and understanding how they are positively or negatively impacting animal welfare will have benefits to the animals, people, and business, but also broader industry if continuous, albeit incremental, improvements can be achieved.

For example, a consistent pain point across every farm visited - regardless of their country or welfare assessment program participation - was locomotion scoring. Lameness is a major welfare issue with significant production impacts, but it remains an ongoing industry challenge and prevalence can be somewhat normalised by "farm blindness", or the condition perceived as inevitable (Bicalho et al., 2009; Bruijnis et al., 2013; Wynands et al., 2021). Even with rigorous assessor training, subjective measurements may still be disputed due to discrepancies in perceptions or seasonality of causative factors, and inconsistencies between grading systems creates confusion. While farmers are generally motivated to improve herd health and performance outcomes, research demonstrates that Australian farmers typically under-diagnose and report lameness, and lameness scoring only a proportion of a herd is unlikely to give a true representation of prevalence (Leach et al., 2010; Beggs et al., 2019; Ranjbar et al., 2020). Without a robust understanding of the prevalence of common welfare issues in an Australian context and supporting farmer motivational studies, establishing meaningful target metrics is challenging and achieving farmer practice change and welfare improvement may be unsuccessful.

The uptake of automated monitoring systems in dairy is increasing, and precision livestock monitoring technologies are rapidly advancing. Machine learning and pattern recognition allows for the rapid processing of large quantities of data. Once validated, these tools should be explored for incorporation into welfare assessments where achieving objective measurements is challenging. Many of these tools do not need to be installed at the farm level (thereby minimizing the cost burden placed on an individual participant) and could instead remain mobile for application across farms.

3.2 Dealing with data

"Data is the new oil" was a message at the 2022 Contemporary Scholars Conference in Norwich, UK. And with the rise of agtech and advancements in genomics, it seems

data has never been more accessible. But a major question facing many agricultural industries is: what do we do with it?

3.2.1 National Milk Records, UK

The UK's National Milk Records (NMR) recording system already provides industry-level benchmarking across a variety of parameters, including antibiotic usage, mastitis, and mortality. Milk residue detections are helping inform future areas for development, such as the use of pain relief or drenches. This is valuable for farmers to self-monitor and helps inform national programs. Farmers don't pay for the analysis but do pay for the reports. Recognising that national milk pool is unlikely to increase and complacency breed mediocrity, NMR's model for business growth is focused innovating to provide relevant and valued services to its customers.

3.2.2. DataGene, Australia

On home soil, DataGene is an independent and industry-owned organisation responsible for driving genetic gain and herd improvement in the Australian dairy industry (Home | DataGene). DataVat is DataGene's centralised data repository built for Australian dairy farmers, but without the interoperability of independent herd recording software, their value is not yet fully realised. Benchmarking is an incredibly powerful motivational and management tool for farmers (Sumner et al., 2018). But if we cannot access our own data to compare year-on-year, how can we hope to advance industry outcomes? Systemic transformation is imperative. This could change the profit shares of private software companies if utilisation increased and has the potential to rapidly advance the ability to report and review aggregated farm data and animal management across the industry. A central herd health and performance data repository could allow certain stakeholders to draw down the information of relevance for their program requirements, reducing the administrative burden on farmers. Imagine that!

Standardisation of data entry into existing systems is another problem which currently makes benchmarking challenging. For success, an understanding of the issue being recorded is necessary (for example, retained membranes could easily be misclassified as metritis in a herd recording software program, or lameness due to footrot be instead recorded as white line disease). Lack of understanding is a known barrier to improving husbandry practices and welfare outcomes on dairy farms (Leach et al., 2010; Becker et al., 2013). Clear communication between the person diagnosing an ailment (frequently a vet) and the person entering the data is required, and standardisation and synchronicity between different recording systems to facilitate meaningful comparison will follow.

3.3 Let's talk about it

"Science can tell us what our options are, but it can't tell us what we ought to do - society has a say in that!" (Professor Marina VonKeyserlingk, 2022).

While data shows 82% of Australians believe it's important to support the dairy industry and 79% of Australians continue to feel supportive of dairy farmers, just over one quarter of consumers still believe Australian dairy farmers do not do a good job of caring for their animals (Australian Dairy Plan Achieving the Australian Dairy Plan: The firstannual update, 2020). Ongoing progress and industry commitment is required to

sustain community trust and acceptance, even within our domestic markets (Weary and von Keyserlingk, 2017). Mike McCully summed it up well at the 2023 Australian Dairy Conference when he said, "with trust comes expectations."

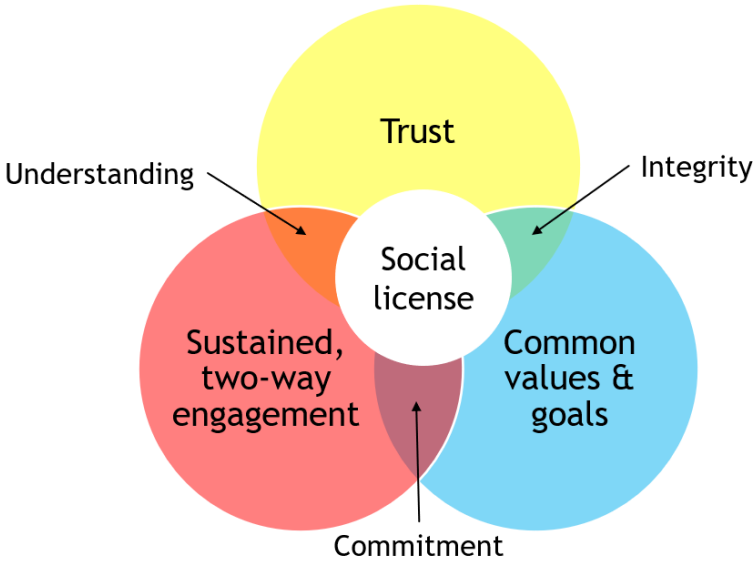

Figure 10: Author's interpretation of the pillars of social sustainability

Transparency fosters trust, through mutual integrity and commitment to shared values. Social sustainability ensues. Coleman (2010) discusses the process of changing beliefs through persuasion, by sharing information:

'Beliefs form a major component of public attitudes, and attitudes have a role in determining how people behave as consumers and as citizens. Their behaviour in turn affects the commercial viability and even the sustainability of animal industries. Beliefs are subjective facts, that is, matters that individuals consider to be true. The process of informing the community necessarily involves changing beliefs and, to this extent, persuasion… The approach that is likely to be most effective is to provide appropriately targeted dispassionate and factual information to the community. In this way, when debates about animal welfare occur, all the stakeholders… who are involved in the debate are more likely to produce good outcomes if discussion is based on a shared understanding of what current practices are and what science can reveal about welfare. Given that the mass media are the preferred source of information, the use of science-based media coverage and informed ethical debate is likely to have the best effect, albeit over a fairly long-time frame.'

Social sustainability in agriculture requires honest conversations and introspection. It requires having humility to listen, curiosity to seek to understand, and courage to want change. But as much as owning our shortcomings, we should celebrate and platform our successes. Attempts to hide practices or provide information to alleviate public concerns are likely to be futile, or even detrimental (Robbins et al., 2016; Cardoso et al., 2017; Hötzel et al., 2017; Weary and Von Keyserlingk, 2017b). Likewise, attempting transparency without meaningful intent reduces public acceptability (Ventura et al., 2016). The Centre for Food Integrity (CFI) encourages industries to meet modern consumers where they are, to engage with clear messaging and amplify stories that resonate. Australian culture harvests tall poppies in favour of the battlers and underdogs, and agriculture is no exception. Dairy Similar to Dairy Australia's highly regarded national Milk Quality Awards (that require input from but transcend any

individual dairy company), welfare quality awards would be one such way in which additional celebration could be achieved.

Relationships of understanding are built on transparency and trust, and assurance programs give confidence to everyone along the supply chain. Following an animal welfare expose in 2017, Steve McLean, Head of Agriculture and Fisheries at British multinational retailer Marks and Spencer, said: "No other retailer has this level of transparency or standards in its dairy supply chain … we faced calls to cut ties with one of our dairy farmers because of a breach of animal welfare regulations. It would not have been the right thing to do. One of our farmers made a mistake, so instead we worked with the farmer to rectify the issue and took the decision to strengthen our standards by asking an independent to assess all our dairy farms. We know how much animal welfare matters to our customers and that they expect the highest standards from us. RSPCA assured standards are the highest in the dairy industry and we are proud of our farmers who work hard day-in-day-out to enable us to achieve this for our Milk Pool." (M&S)

3.3.1 Farm and Food Care Animal Care Helpline, Ontario Canada

Peer-to-peer accountability can also be utilised. Started in 1992 by the Ontario Farm Animal Council to help improve farm animal care, the Farm and Food Care Animal Care Helpline is a confidential "farmer helping farmer" approach to advice and referral on animal care. Peaking at 60 calls in 2017, the helpline averages about one call a month over the last decade, conducting subsequent peer to peer visits to discuss codes of practice with farmers and reducing the number of instances where animal protection agencies have needed to get involved (Farm & Food Care Ontario). This model could have potential application benefits in an Australian context, where capacity and resourcing for the government departments responsible for investigating animal welfare complaints remains a challenge.

3.4 Hold the vision, trust the process

"The most important purpose of any welfare-monitoring scheme is to identify and address specific problems." J Webster, 2008, The University of Melbourne Animal Welfare Science Centre Seminar.

Whether cow, citizen, or caretaker, most want the same things: improved quality of life, sustainable success, and products to enjoy. These shared values have the potential to align stakeholders on what can be an extremely emotive and polarising subject. If we can unite over our 'why' with clear and universal intent, we can figure out the 'how', together.

Most welfare assessment protocols focus on demonstrating the absence of indicators of poor welfare and potentially create a mismatch between the assurance of good welfare expected by society and the actual assurance of the absence of welfare problems current programs deliver (Keeling et al., 2021).A positive approach might also explore positive predictive factors to achieve desired welfare outcomes and determining ways to facilitate or enhance these. Overseas research indicates such factors include farmers having an agricultural education or off-farm training, future-oriented goals and behaviours, and fewer cows per labour unit (Lindena and Hess, 2022). Further work exploring the application of participatory frameworks assessing positive welfare opportunities is warranted (Stokes et al., 2022).

If industry requires assurance of the tripartite of good welfare (normal biological functioning, a healthy emotional state, and the ability to express normal behaviours), then the trilemma is achieving this quickly, with quality, and at minimal cost. As the project management saying goes, you can have it fast, you can have it good, you can have it cheap: pick two.

Figure 11: The trilemma of project management, and product or service delivery (Look Here Writing, 2018)**.**

3.4.1 Case study: Chris Falconer (NSch 2011), Pukerua Farm, NZ

“Do what you feel in your heart to be right, for you’ll be criticized anyway.” – Eleanor Roosevelt

Motivated by curiosity, a strong set of guiding principles and an opportunity to add value, Chris Falconer (NSch 2011) purchased land in 2016 and now operates a dairy business in Waeranga, North Waikato. Chris seems determined to challenge the status quo, and future-proof his dairy business in a country where society is beginning to expect a lot more from food producers than just food.

His 300-cow farm “Pukerua” backs onto a large wetland that is a UNESCO listed site of critical importance that contains more than one threated species, as well as having multiple sites of cultural significance for local Māori groups within his farm boundaries. These could have posed real and costly barriers to farming in the long term for Chris, but he has chosen to embrace and celebrate the features and adapt his farming system by adopting nutrient management and land conservation practices that respect and preserve these special aspects. Through strategic tree planting and fencing of wet zones and areas prone to flooding, Chris has not only improved his carbon credit profile, but reduced risk of runoff and minimized fertilizer requirements - which can now be met using chicken manure at a significantly lower cost than traditional urea. Similarly, through proactive engagement with local Māori groups, he now has an arrangement that respects their need for access and custodianship, and his farm requirements.

Chris’ dairy herd is milked once a day, and calves are kept on cows until weaning - a practice he has received much criticism for, despite seeing comparable production results. In a system based around offering cows as much autonomy as possible, Chris is not so wedded to the idea that he won’t adjust to ensure human and animal welfare isn’t compromised. If a cow becomes too aggressive or mismothers a calf, he will make the decision to rear it. Chris estimates 5-10% of calves require additional support using these principles. With a lower labour requirement and maintaining competitive production figures and comparable animal health outcomes compared to a conventional dairy, it’s certainly an attractive and profitable model.

Chris has found integrity at the intersection between people, profit and planet and built a business that is successful in every sense of the word. Whilst some farmers gravitate towards ‘alternative’ farming systems based on their ethics, or the potential to add value based on a point of difference, Chris is confident his numbers stack up against his commercial dairying peers. To the outside observer, a mindset shift is required here to understand that milk produced isn’t the only profit driver on a farm, and Chris is capitalizing while mitigating risk across his entire business. Revolutionary.

Figure 12: Simple modifications to Chris Falconer's NZ operation have enabled the successful implementation of new management practices

Figure 13: Chris Falconer's farm, 2022. Note similarity to Cardoso's "Ideal Dairy Farm" depiction in Chapter 1

Conclusion

“How wonderful it is that nobody need wait a single moment before starting to improve the world.” - Anne Frank

Whether national or private initiative, dairy welfare assessment programs offer market access advantages, benchmarking opportunities, and the potential for genuine welfare advancement in a currently suboptimal regulatory landscape. Key to program success is adequate financial resourcing, transparency, ongoing stakeholder collaboration and consultation, appropriate data utilization and a commitment to continuous improvement. Programs should aspire to remain open to incorporating new knowledge, scientific or policy advancements, and emerging citizen concerns.

It is crucial that successfully implementing a national dairy welfare assessment and assurance program requires financial resources, legislative support, and ongoing commitment from all stakeholders. Collaboration, transparency, and a shared vision for animal welfare are essential for application in Australia's dairy industry.

Critically, when it comes to the welfare of dairy cattle, more Australian research is needed with supporting data. The industry cannot mend or manage what we aren’t measuring, and it would be a catastrophic waste of resources to consider developing a program in Australia without first understanding the baseline. Much of this data already exists within herd recording software programs, so addressing accessibility and interoperability issues should be a priority.

Science is rarely the motivator for practice change. Decisions are shaped by values, preferences, and economics. By figuratively opening the farm gates, recognizing shortcomings, and sharing that which we already do well; the Australian dairy industry has everything to gain when it comes to animal welfare, and so do the cows.

Recommendations

- Further Australian research is required to establish relevant baseline prevalence data for common dairy welfare metrics.
- Farmer motivational studies should be utilised to understand barriers to, and opportunities for, achieving practice change in the dairy industry.
- Addressing farm-level data accessibility and interoperability issues should be an industry priority.
- Public participation models and farmer motivational studies should be applied when making animal welfare policy decisions or discussing industry solutions.
- For success, any Australian animal welfare assessment scheme requires strong stakeholder engagement, support, and ongoing commitment.
- To ensure credibility and consistency, welfare audits should be conducted by genuine third parties following clear and robust frameworks.
- Welfare assessments by experienced second-parties such as vets have the advantage of being able to help and encourage change, but conflicts of interest are inherent.
- Automated monitoring systems have noteworthy potential for conducting routine objective welfare measurements on farm
- Secure funding models are necessary for long-term program success, and shared costs create collective commitments.
- Failing to plan is planning to fail. The Australian dairy industry must understand future animal welfare or social licence issues and explore mitigation strategies early.
- Transparency builds trust. Australian dairy farmers should recognise their shortcomings and celebrate their strengths when it comes to caring for their cows.

References

2021 Sustainability Report. .

A2Milk. 2019. The a2 Milk Company Limited Annual Report 2018-19 56.

Ajzen, I. 1991. The theory of planned behavior. Organ Behav Hum Decis Process 50:179–211. doi:10.1016/0749-5978(91)90020-T.

[ARCHIVED CONTENT] Farm Animal Welfare Council - 5 Freedoms. . Accessed July 2, 2020. https://webarchive.nationalarchives.gov.uk/20121010012427/http://www.fawc.org.uk/freedoms.htm.

Arla supplier. 2022. Personal Communication.

Australian Alliance for Animals. 2023. Animal Welfare Policy Barometer. Accessed.

Australian Dairy Industry. 2020. Sustainability Report 2019: Towards Our 2030 Goals.

Australian Dairy Plan Achieving the Australian Dairy Plan: The first annual update. 2020.

Australian Government. 2023. A Renewed Australian Animal Welfare Strategy (AAWS). Accessed.

Australian Government. Australia-UK FTA Chapter 25 Animal Welfare and Antimicrobial Resistance. Accessed.

Barry Irving. 2023. Australian Dairy Conference.

Beausoleil, N.J. 2018. Extending the ' Five Domains ' model for animal welfare assessment to incorporate positive welfare states Extending the ' Five Domains ' model for animal welfare assessment to incorporate positive welfare states DJ Mellor * and NJ Beausoleil. doi:10.7120/09627286.24.3.241.

Beaver, A., K.L. Proudfoot, and M.A.G. von Keyserlingk. 2020. Symposium review: Considerations for the future of dairy cattle housing: An animal welfare perspective. J Dairy Sci 103:5746–5758. doi:10.3168/JDS.2019-17804.

Becker, J., M. Reist, K. Friedli, D. Strabel, M. Wüthrich, and A. Steiner. 2013. Current attitudes of bovine practitioners, claw-trimmers and farmers in Switzerland to pain and painful interventions in the feet in dairy cattle. The Veterinary Journal 196:467–476. doi:https://doi.org/10.1016/j.tvjl.2012.12.021.

Beggs, D.S., A.D. Fisher, E.C. Jongman, and P.E. Hemsworth. 2015. A survey of Australian dairy farmers to investigate animal welfare risks associated with increasing scale of production. J Dairy Sci 98:5330–5338. doi:10.3168/jds.2014-9239.

Beggs, D.S., E.C. Jongman, P.E. Hemsworth, and A.D. Fisher. 2019. Lame cows on Australian dairy farms: A comparison of farmer-identified lameness and formal lameness scoring, and the position of lame cows within the milking order. J Dairy Sci 102:1522–1529. doi:10.3168/jds.2018-14847.

Beter Leven. 2023.

Bicalho, R.C., V.S. Machado, and L.S. Caixeta. 2009. Lameness in dairy cattle: A debilitating disease or a disease of debilitated cattle? A cross-sectional study of

lameness prevalence and thickness of the digital cushion. J Dairy Sci 92:3175–3184. doi:10.3168/jds.2008-1827.

Bjørkdahl, K., and K.V.L. Syse. 2021. Welfare Washing: Disseminating Disinformation in Meat Marketing. Society & Animals 1–19. doi:10.1163/15685306-bja10032.

Bolton, S.E., and M.A.G. von Keyserlingk. 2021. The Dispensable Surplus Dairy Calf: Is This Issue a "Wicked Problem" and Where Do We Go From Here?. Front Vet Sci 8:347. doi:10.3389/FVETS.2021.660934.

Boogaard, B.K., B.B. Bock, S.J. Oosting, J.S.C. Wiskerke, • Akke, J. van der Zijpp, B.K. Boogaard, B.B. Bock, Á.J.S.C. Wiskerke, S.J. Oosting, and Á.A.J. van der Zijpp. 2011a. Social Acceptance of Dairy Farming: The Ambivalence Between the Two Faces of Modernity. J Agric Environ Ethics 24:259–282. doi:10.1007/s10806-010-9256-4.

Boogaard, B.K., S.J. Oosting, and B.B. Bock. 2008. Defining sustainability as a socio-cultural concept: Citizen panels visiting dairy farms in the Netherlands. Livest Sci 117:24–33. doi:10.1016/J.LIVSCI.2007.11.004.

Boogaard, B.K., S.J. Oosting, B.B. Bock, and J.S.C. Wiskerke. 2011b. The sociocultural sustainability of livestock farming: An inquiry into social perceptions of dairy farming. Animal 5:1458–1466. doi:10.1017/S1751731111000371.

Borges, J.A.R., C.H. de F. Domingues, F.R. Caldara, N.P. da Rosa, I. Senger, and D.G.F. Guidolin. 2019. Identifying the factors impacting on farmers' intention to adopt animal friendly practices. Prev Vet Med 170. doi:10.1016/j.prevetmed.2019.104718.

Bruijnis, M., H. Hogeveen, C. Garforth, and E. Stassen. 2013. Dairy farmers' attitudes and intentions towards improving dairy cow foot health. Livest Sci 155:103–113. doi:10.1016/J.LIVSCI.2013.04.005.

Cardoso, C.S., M.A.G. Von Keyserlingk, M.J. Hö Tzel, J. Robbins, and D.M. Wearyid. 2018. Hot and bothered: Public attitudes towards heat stress and outdoor access for dairy cows. doi:10.1371/journal.pone.0205352.

Cardoso, C.S., M.A.G. von Keyserlingk, and M.J. Hötzel. 2016. Trading off animal welfare and production goals: Brazilian dairy farmers' perspectives on calf dehorning. Livest Sci 187:102–108. doi:10.1016/j.livsci.2016.02.010.

Cardoso, C.S., M.A.G. Von Keyserlingk, and M.J. Hötzel. 2017. Brazilian citizens: Expectations regarding dairy cattle welfare and awareness of contentious practices. Animals 7. doi:10.3390/ani7120089.

Cardoso, C.S., M.A.G. von Keyserlingk, and M.J. Hötzel. 2019. Views of dairy farmers, agricultural advisors, and lay citizens on the ideal dairy farm. J Dairy Sci 102. doi:10.3168/jds.2018-14688.

Chen, P.J. 2016. Animal Welfare in Australia: Politics and Policy. Sydney University Press, Sydney.

Clark, B., G.B. Stewart, L.A. Panzone, I. Kyriazakis, and L.J. Frewer. 2016. A Systematic Review of Public Attitudes, Perceptions and Behaviours Towards Production Diseases Associated with Farm Animal Welfare. J Agric Environ Ethics 29:455–478. doi:10.1007/S10806-016-9615-X/TABLES/1.

Coleman, G.J. 2010. Educating the public: Information or persuasion?. J Vet Med Educ 37:74–82. doi:10.3138/jvme.37.1.74.

Di Concetto, A. 2023. Farm Animal Welfare and Food Information for European Union Consumers: Harmonising the Regulatory Framework for More Policy Coherence. European Journal of Risk Regulation. doi:10.1017/err.2022.46.

Dairy Australia. 2017. Australian Animal Welfare Standards and Guidelines for Cattle: A Guide for Dairy Farmers.

Dairy Australia. 2021. THE AUSTRALIAN DAIRY INDUSTRY IN FOCUS 2021.

Dairy Australia. 2023. Approach to Animal Welfare. Accessed.

Dairy Australia. Australian Dairy Industry Materiality Assessment Report 2019.

Dawkins, M. 2021. The Science of Animal Welfare: Understanding What Animals Want.

Doyle, R.E., A.J.D. Campbell, M. Dione, M. Woodruff, C. Munoz, G. Alemayehu, T. Berhe, and T. Knight-Jones. 2022. The role of animal welfare in improving the future of farming. Pages 937–943 in Animal Production Science. CSIRO.

Dr Antoni Dalmau. 2022. Dr Antoni Dalmau . World Association for Buiatrics Congress .

Dr Brandon Treichler. 2022. Personal Communication.

Dr Natarsha Williams. Personal communication.

Dutton-Regester, K.J., J.D. Wright, A.R. Rabiee, and T.S. Barnes. 2019. Understanding dairy farmer intentions to make improvements to their management practices of foot lesions causing lameness in dairy cows. Prev Vet Med 171:104767. doi:10.1016/j.prevetmed.2019.104767.

Egg farmers hit back at what they call myths about their industry - ABC News. . Accessed October 11, 2020. https://www.abc.net.au/news/rural/2016-12-16/caged-free-range-egg-industry/8126400.

Ellis, K.A., K. Billington, B. McNeil, and D.E.F. McKeegan. 2009. Public opinion on UK milk marketing and dairy cow welfare. Animal Welfare 18:267–282.

FAOLEX Database. Food and Agriculture Organization of the United Nations. Accessed.

Farm & Food Care Ontario. Farm Animal Care. Accessed.

Food Standards Code user guides. .

Francione, G. 2012. Animal welfare, happy meat, and veganism as the moral baseline.

Fraser, D., D.M. Weary, E.A. Pajor, and B.N. Milligan. 1997. A scientific conception of animal welfare that reflects ethical concerns. Animal Welfare 6:187–205.

Free Range Egg Farms fined $300,000 for misleading shoppers with false claims. . Accessed October 11, 2020. https://www.smh.com.au/business/consumer-affairs/free-range-egg-farms-fined-300000-for-misleading-shoppers-with-false-claims-20160415-go70cu.html.

Futureye. 2019. Australia's Shifting Mindset on Farm Animal Welfare.

Grandin, T. 2017. On-farm conditions that compromise animal welfare that can be monitored at the slaughter plant. Meat Sci 132:52–58. doi:10.1016/j.meatsci.2017.05.004.

Grandin, T. 2021. Improving Animal Welfare, 3rd Edition A Practical Approach.

Haas, R., A. Schnepps, A. Pichler, and O. Meixner. 2019. Cow Milk versus Plant-Based Milk Substitutes: A Comparison of Product Image and Motivational Structure of Consumption. doi:10.3390/su11185046.

Hendricks, J., K.E. Mills, L. V. Sirovica, L. Sundermann, S.E. Bolton, and M.A.G. von Keyserlingk. 2022. Public perceptions of potential adaptations for mitigating heat stress on Australian dairy farms. J Dairy Sci. doi:10.3168/JDS.2022-21813.

Home | DataGene. . Accessed July 23, 2023. https://datagene.com.au/.

Hötzel, M.J., C.S. Cardoso, A. Roslindo, and M.A.G. von Keyserlingk. 2017. Citizens' views on the practices of zero-grazing and cow-calf separation in the dairy industry: Does providing information increase acceptability?. J Dairy Sci. doi:10.3168/jds.2016-11933.

Hurnik, J.F., and H. Lehman. 1988. Ethics and farm animal welfare. J Agric Ethics 1:305–318. doi:10.1007/BF01826794.

International Market Overview. . Accessed October 11, 2020. https://www.dairyaustralia.com.au/manufacturing-resources-and-support/exports-and-trade/international-market-overview#.X4JGo2gzaXI.

Jackson, A., C. Doidge, M. Green, and J. Kaler. 2022. Understanding public preferences for different dairy farming systems using a mixed methods approach. J Dairy Sci. doi:10.3168/jds.2022-21829.

Jensen, P., and F.M. Toates. 1993. Who needs 'behavioural needs'? Motivational aspects of the needs of animals. Appl Anim Behav Sci 37:161–181. doi:https://doi.org/10.1016/0168-1591(93)90108-2.

Keeling, L.J., C. Winckler, S. Hintze, and B. Forkman. 2021. Towards a Positive Welfare Protocol for Cattle: A Critical Review of Indicators and Suggestion of How We Might Proceed. Frontiers in Animal Science 2:753080. doi:10.3389/FANIM.2021.753080.

Von Keyserlingk, M.A.G., A. Amorim Cestari, B. Franks, J.A. Fregonesi, and D.M. Weary. 2017. Dairy cows value access to pasture as highly as fresh feed. Sci Rep 7. doi:10.1038/srep44953.

von Keyserlingk, M.A.G., and D.M. Weary. 2017. A 100-Year Review: Animal welfare in the Journal of Dairy Science—The first 100 years. J Dairy Sci 100:10432–10444. doi:10.3168/JDS.2017-13298.

Keyserlingk, M.A.G. Von, and D.M. Weary. 2017. A 100-Year Review : Animal welfare in the Journal of Dairy Science — The first 100 years 1. J Dairy Sci 100:10432–10444. doi:10.3168/jds.2017-13298.

Laven, R.A., and J. Fabian. 2016. Applying animal-based welfare assessments on New Zealand dairy farms: feasibility and a comparison with United Kingdom data. N Z Vet J 64:212–217. doi:10.1080/00480169.2016.1149523.

Leach, K.A., H.R. Whay, C.M. Maggs, Z.E. Barker, E.S. Paul, A.K. Bell, and D.C.J. Main. 2010. Working towards a reduction in cattle lameness: 1. Understanding

barriers to lameness control on dairy farms. Res Vet Sci 89:311–317. doi:https://doi.org/10.1016/j.rvsc.2010.02.014.

Lean, I.J., S.J. LeBlanc, D.B. Sheedy, T. Duffield, J.E.P. Santos, and H.M. Golder. 2022. Associations of parity with health disorders and blood metabolite concentrations in Holstein cows in different production systems. J Dairy Sci 0. doi:10.3168/JDS.2021-21673.

Legrand, A.L., M.A.G. Von keyserlingk, and D.M. Weary. 2009. Preference and usage of pasture versus free-stall housing by lactating dairy cattle. J Dairy Sci 92:3651–3658. doi:10.3168/jds.2008-1733.

Levitt, T. 2018. Nuffield Report: Put a label on it: why the future of milk is a branded one.

Lindena, T., and S. Hess. 2022. Is animal welfare better on smaller dairy farms? Evidence from 3,085 dairy farms in Germany. J Dairy Sci 105:8924–8945. doi:10.3168/JDS.2022-21906.

Look Here Writing. 2018. The Fast-Great-Cheap Conundrum. Accessed.

Main, D.C.J., H.R. Whay, C. Leeb, and A.J.F. Webster. 2007. Formal animal-based welfare assessment in UK certification schemes. Animal Welfare 16:233–236. doi:10.1017/S0962728600031419.

Mellor, D.J. 2016a. Updating Animal Welfare Thinking : Moving beyond the " Five Freedoms " towards " A Life Worth Living ." doi:10.3390/ani6030021.

Mellor, D.J. 2016b. Moving beyond the "Five freedoms" by updating the "five provisions" and introducing aligned "animalwelfare aims". Animals 6. doi:10.3390/ani6100059.

Member Benefits - Red Tractor Assurance. . Accessed July 23, 2023. https://redtractorassurance.org.uk/reap-the-rewards-with-red-tractor/.

Mills, K.E., P.R. Payne, K. Saunders, and G. Zobel. 2023. "If you were a cow, what would you want?" Findings from participatory workshops with dairy farmers. animal 100779. doi:10.1016/j.animal.2023.100779.

Molfino, J., K. Kerrisk, and S.C. García. 2014. Investigation into the labour and lifestyle impacts of automatic milking systems (AMS) on commercial farms in Australia.

M&S. M&S DAIRY FARMS BECOME RSPCA ASSURED. Accessed.

O'Brien, S.L., and K.A. Cronin. 2023. Doing better for understudied species: Evaluation and improvement of a species-general animal welfare assessment tool for zoos. Appl Anim Behav Sci 264:105965. doi:10.1016/J.APPLANIM.2023.105965.

Of, R., and T.H.E. Dairy. 2019. ANIMAL CARE ON AUSTRALIAN DAIRY FARMS RESULTS OF THE DAIRY AUSTRALIA ANIMAL HUSBANDRY SURVEY 2019.

OIE GLOBAL ANIMAL WELFARE STRATEGY. 2017.

One Welfare. 2023. About One Welfare. Accessed.

Ortega, D.L., and C.A. Wolf. 2018. Demand for farm animal welfare and producer implications: Results from a field experiment in Michigan. Food Policy 74:74–81. doi:10.1016/j.foodpol.2017.11.006.

PAACO Standards for Certification of Animal Welfare Audits-Instrument & Guidelines. .

Parker, C., R. Carey, and G. Scrinis. 2018a. The meat in the sandwich: Welfare labelling and the governance of meat-chicken production in Australia. J Law Soc 45:341–369. doi:10.1111/jols.12119.

Parker, C., R. Carey, and G. Scrinis. 2018b. The consumer labelling turn in farmed animal welfare politics: From the margins of animal advocacy to mainstream supermarket shelves. Alternative Food Politics: From the Margins to the Mainstream 193–215.

Parker, C., H. Johnson, and J. Curll. 2019. Consumer Power to Change the Food System? A Critical Reading of Food Labels as Governance Spaces: The Case of Açaí Berry Superfoods.. Journal of Food Law & Policy 15:1–48.

Parker, C., G. Scrinis, R. Carey, and L. Boehm. 2018c. A public appetite for poultry welfare regulation reform: Why higher welfare labelling is not enough. Alternative Law Journal 43:238–243. doi:10.1177/1037969X18800398.

Ranjbar, S., A.R. Rabiee, L. Ingenhoff, and J.K. House. 2020. Farmers' perceptions and approaches to detection, treatment and prevention of lameness in pasture-based dairy herds in New South Wales, Australia. Aust Vet J 98:264–269. doi:10.1111/avj.12933.

Right to Farm Bill 2019 | Policy Commons. . Accessed July 23, 2023. https://policycommons.net/artifacts/4430200/right-to-farm-bill-2019/5226819/.

Robbins, J.A., B. Franks, D.M. Weary, and M.A.G. Von Keyserlingk. 2016. Awareness of ag-gag laws erodes trust in farmers and increases support for animal welfare regulations. Food Policy 61:121–125. doi:10.1016/j.foodpol.2016.02.008.

Saeri, A.K. 2023. 2023 Australian Animal Welfare Survey. doi:10.17605/OSF.IO/BF64U.

Smith, C., T. Farran, D. Armstrong, V. Staff, A. Michael, B. Kelsall, H. Chenoweth, M. Rose, M. O'keefe, M. Joliffe, N. Nelson, P. Wallace, R. Campbell, and S. Clack. 2022. Dairy Farm Monitor Project.

Statement on the use of animal-based measures to assess the welfare of animals. 2012. . EFSA Journal 10. doi:10.2903/J.EFSA.2012.2767.

Stokes, J.E., E. Rowe, S. Mullan, J.C. Pritchard, R. Horler, M.J. Haskell, C.M. Dwyer, and D.C.J. Main. 2022. A "Good Life" for Dairy Cattle: Developing and Piloting a Framework for Assessing Positive Welfare Opportunities Based on Scientific Evidence and Farmer Expertise. Animals 12:2540. doi:10.3390/ANI12192540/S1.

Strategic Priorities. . Accessed October 11, 2020. https://www.dairyaustralia.com.au/about/strategy-and-performance/strategic-priorities#.X4J4q2gza9J.

Sumner, C.L., M.A.G. von Keyserlingk, and D.M. Weary. 2018. How benchmarking motivates farmers to improve dairy calf management. J Dairy Sci 101:3323–3333. doi:10.3168/jds.2017-13596.

Svensson, C., N. Lind, K.K. Reyher, A.M. Bard, and U. Emanuelson. 2019. Trust, feasibility, and priorities influence Swedish dairy farmers' adherence and nonadherence to veterinary advice. J Dairy Sci 102:10360–10368. doi:10.3168/jds.2019-16470.

The New York Times. The Great New Zealand Egg Shortage. Accessed.

Ventura, B.A., M.A.G. Von Keyserlingk, H. Wittman, and D.M. Weary. 2016. What difference does a visit make? Changes in animal welfare perceptions after interested citizens tour a dairy farm. PLoS One 11:1–19. doi:10.1371/journal.pone.0154733.

VonKeyserlingk, M. 2022. Personal Communication.

Weary, D.M., and M.A.G. Von Keyserlingk. 2017a. Public concerns about dairy-cow welfare: How should the industry respond?. Anim Prod Sci 57:1201–1209. doi:10.1071/AN16680.

Weary, D.M., and M.A.G. Von Keyserlingk. 2017b. Public concerns about dairy-cow welfare: How should the industry respond?. Anim Prod Sci 57:1201–1209. doi:10.1071/AN16680.

Weary, D.M., B.A. Ventura, and M.A.G. Von Keyserlingk. 2015. Societal views and animal welfare science: Understanding why the modified cage may fail and other stories. Animal 10:309–317. doi:10.1017/S1751731115001160.

Webster, J. 2008. Dairy cow welfare : solutions for current problems. The University of Melbourne Animal Welfare Science Centre Seminar.

Welfare outcomes assessment in dairy farm assurance schemes. . Accessed July 23, 2023. https://www.researchgate.net/publication/286177536_Welfare_outcomes_assessment_in_dairy_farm_assurance_schemes.

Wolf, C.A., G.T. Tonsor, M.G.S. McKendree, D.U. Thomson, and J.C. Swanson. 2016. Public and farmer perceptions of dairy cattle welfare in the United States. J Dairy Sci. doi:10.3168/jds.2015-10619.

World Animal Protection. 2023. Animal Protection Index. Accessed.

World Organisation for Animal Health. 2022. Terrestrial Code for Animal Welfare.

Wynands, E.M., S.M. Roche, G. Cramer, and B.A. Ventura. 2021. Dairy farmer, hoof trimmer, and veterinarian perceptions of barriers and roles in lameness management. J Dairy Sci 104:11889–11903. doi:10.3168/jds.2021-20603.

Appendices

Appendix 1: Welfare outcomes and indicators for dairy cattle

Welfare outcome	Example resource-based indicators	Example animal-based indicators
Satiety – absence of prolonged thirst	Water provision Water access Water quality Water palatability	Hydration status
Satiety – absence of prolonged hunger	Feed provision Feed access Feed cleanliness Feed palatability Appropriateness of feed for nutritional requirements Feed choice/options	Milk yield and components Rumination time Body Condition Score Morbidity and mortality rates closely associated with nutrition (ie milk fever, retained placentas, displaced abomasums, acidosis (acute or subacute), ketosis, various toxicoses, etc) Lying/resting time Visual “fill” of the left paralumbar fossa Faecal consistency Milk yield and components
Comfort - resting	Time available Space available Appropriate substrate	Resting time Coat condition (faecal staining, mud coverage, pressure sores, hock lesions)
Comfort - thermal	Appropriate infrastructure available for all animals to achieve shelter without overcrowding Heat stress management infrastructure (shade, sprinklers)	Thermal stress incidence rates Body Condition Score
Comfort – unrestricted movement	Confined areas feature adequate space allowances for free movement	Injuries associated with overcrowding or confinement
Healthy – uninjured or impaired		Rumination time Lying time Mobility scoring. Leg and foot conformation Load sensors – measure weight distribution and indicate lameness Reproductive performance Assisted calving cases
Healthy - free from disease		Rumination time Lying time Temperature monitoring
Healthy – absence of pain		Rumination time Lying time Measure sound in barns – excessive mooing Facial expression

Behavioural expression - social	Access to herdmates Appropriate social groups	Incidence of antisocial behaviours or atypies Incidence of cohesive behaviours
Behavioural expression - gratification	Access to pasture Access to calf	Time spent grazing Accelerometers – grazing patterns Time spent suckling calf Lying time Calf – time spent sucking, incidence of cross-sucking Calf – other oral behaviour
Behavioural expression – general absence of fear	Livestock handlers receive appropriate training	Minimal handling associated injuries (ie broken tails) Approachability/flight distance

Appendix 2: Travel itinerary - Abridged

Table 2. Travel itinerary

Travel date	Location	Key visits/contacts
Pre-CSC: 2-7 March, 2022	United Kingdom: Bath, Cheddar, Bristol	Frogmary Farms, Thatchers Cidery
CSC: 8-15 March, 2022	United Kingdom: Norwich, London	
16-30 March, 2022	United Kingdom: London, Cotswolds, Dorset, Dorchester, Kingsclere, Wellington, London	Ft. COVID isolation Liz Cresswell – Vet Advisor MSD George Holmes – Arla Director Oli Chedgey – The Roaming Dairy PAACO online certification training
GFP: 5-7 June, 2022	Republic of Singapore: Singapore City	MLA International Markets ANZ Headquarters University of Singapore
GFP: 8-14 June, 2022	Netherlands: Zeewolde, Utrecht, Doetichem, Aalten, Giethoorn, Haarzuilens, Berlicum, Oirlo, Flevopolder, Monster	Rabobank Ruud Zanders, Kipster Poultry Suzanne Resink, Susies Farm Rick van Rijn, Geertje's Hoeve Johan Leenders – Oranjehoen Maud Tomesen, poultry
GFP: 15-21 June, 2022	Canada: Ontario Chatham, Blenheim, Essex, Merlin, Guelph	Blake Vince Karen Foster Casey Blair
GFP: 22-28 June, 2022	USA: Kansas – Wichita, Haysville, Montezuma, Garden City, Scott City, Kansas City, KSU	Russell Plashka Tori Laird Vulgamore Farms Dairy Farmers of America
GFP: 29 June – 2 July, 2022	USA: Washington DC	USDA Bayer International Congress Building
3- 23 July, 2022	USA: California, Nevada, Utah, Colorado, New Mexico, Texas,	Jim Reynolds, UC Davis Dr Cassandra Tucker, UC Davis FARM Conference Prof Marina vonKeyserlingk

	Kansas, Oklahoma, Missouri, Indiana, Michigan, New York	Dr Brandon Triechler Steven Roche Dr Warren Skippon, Saputo Chuck Stokke, Calftech Greg Bethard, High Plains Ponderosa Dairy Tom Jones, High Plains FeedYard Dr Grant Sardella, ABS Vulgamore Family Farms Ted Boersma, Forget-me-not Farms Tom Jones Cory Vanderham
24-31 July, 2022	Canada: Ontario Vasey	Dr Kelly Barratt Dr Charlotte Winder, Uni of Guelph Ron Maynard, DFO Prof Stephen LeBlanc, Uni of Guelph Karen Daynard NSch Bonnie denHaan, DFO Kevin Jones, Shadyglen Farms
1- 19 August, 2022	United Kingdom: England & Scotland London York Lancaster	Dr Luke Ramsden Peter Tompkins, NFU & RT Dr Jude Roberts – Map of Ag Angela Rhodes David Throup NSch Margi Hall NSch & Arla Director Roger & Nina Hildreth, Curlew Fields Rob Howe, NSch Ed Towers, NSch Robert Gray NSch John Banks Amy Eggleston Victoria Ballantyne, NSch Patrick Morris-Eyton Bryce Cunningham, Mossgiel Organic Farm Paddy Morris-Eyton, Beckside Farm David Findlay, The Ethical Dairy Philip Halhead, Norbrook Genetics
20 August – 1 September, 2022	Ireland:	Alex Eivers NSch Brian McCarthy NSc Laurence Sexton Lance Woods NSch Dr Tommy Heffernan NSch Pat Collins NSch Aoife Feeney, NSch
2-9 September, 2022	Spain: Barcelona, Madrid	World Buiatrics Congress
21-29 January, 2023	New Zealand: Nth Island Auckland, Hamilton, Waikato Region, Palmerston North Travelled with Anna Bowen NSch UK	Fonterra NZ Mandi McLeod NSch Chris Falconer NSch Tracy Brown NSch Prof Richard Laven & Dr Kat Littlewood, Massey University
13-17 February, 2023	Australia: Tasmania	Australian Dairy Conference