Towards Sustainable Surplus Dairy Calf Management

Sarah Ellen Bolton

ORCID ID: 0000-0003-2582-6370

Submitted in total fulfilment of the requirements of the degree of

Doctor of Philosophy

May 2024

Supervisors: David Beggs, Peter Mansell, Marina von Keyserlingk

Melbourne Veterinary School

Faculty of Science, The University of Melbourne

Abstract

Early life killing of healthy surplus dairy calves (all males and females not needed as future milking cows) poses a threat to the dairy industry's social license to operate. Implementing socially acceptable and economically viable surplus calf management practices is a complex challenge that fits many characteristics of a 'wicked problem'. Addressing these problems requires understanding the needs of all stakeholders, including farmers, their advisors, beef and dairy value chain stakeholders, the public and the animals. The overall objective of this thesis was to identify how the Australian Dairy Industry might implement sustainable approaches to managing surplus dairy calves and end the practice of early life killing. Chapter 1 introduces the conceptual background, methodology and theoretical framing, as well as the context for the research. Chapter 2 presents a narrative review of the current literature on surplus calf management and examines whether the issue fits the definition of a wicked problem. Chapters 3 through 6 collectively summarize the findings of applying a participatory approach to identifying sustainable approaches to surplus calf management, including the perspectives of the community (Chapters 3 and 4), beef and dairy value chain stakeholders (Chapter 5), and farmers and pre-farm gate advisors (Chapter 6). Chapter 6 also evaluates the impacts of exposing farmers and pre-farm gate advisors to the perspectives of the community, and beef and dairy value chain stakeholders. Chapter 7 presents a general discussion including an assessment of the strengths and limitations of the work and recommendations for future research. This thesis describes the complex social and economic factors that contribute to how surplus calves are managed in Australia and highlights opportunities for working towards sustainable management of surplus calves in the future.

***Keywords*:** animal welfare, beef, bobby calves, wicked problems, participatory processes

Declaration

This is to certify that:

- The thesis comprises only my original work towards the PhD,
- Due acknowledgement has been made in the text to all other material used,
- The thesis is fewer than 100 000 words in length, exclusive of tables, maps, bibliographies, and appendices.

_____

Signed: Sarah Bolton

Date: 29.4.2024

Preface

A version of Chapter 2 has been published: Bolton, S. E., von Keyserlingk, M. A. G., 2021. The Dispensable Surplus Dairy Calf: Is This Issue a "Wicked Problem" and Where Do We Go From Here? Frontiers in Veterinary Science, 8:660934. The refence style in the published version of this paper has been updated in the version that appears in this thesis for consistency with the other chapters. S. E. Bolton led the conceptualization, literature search and writing, editing, and review of the manuscript. M. A. G. von Keyserlingk acted in the typical role of supervisor, contributing to the conceptualization, literature search, writing, editing, and review of the manuscript.

A version of Chapter 5 has been published: Bolton, S. E., Vandresen, B., von Keyserlingk, M. A. G., 2024. Waste not, want not: value chain stakeholder attitudes to surplus dairy calf management in Australia. Animal Welfare, 33, e10, 1-10. The reference style in the published version of this paper has been updated in the version that appears in this thesis for consistency with the other chapters. S. E. Bolton designed the study, collected, and analysed the data, and wrote the manuscript. M. A. G. von Keyserlingk acted in the typical role of supervisor, having input into the study design, and contributing to the writing, editing, and revision of the manuscript. B. Vandresen contributed to the data analysis and the writing, editing, and revision of the manuscript.

A version of Chapter 4 has been submitted for publication: *"The advice? Think bigger"*: community perspectives on dairy, including surplus calves – an Australian focus group study. S. E. Bolton designed the study, collected, and analysed the data, and wrote the manuscript. M. A. G. von Keyserlingk acted in the typical role of supervisor, having input into the study design, and contributing to the writing, editing, and revision of the manuscript. B. Vandresen contributed to the data analysis and the writing, editing, and revision of the manuscript.

A version of Chapter 6 has been submitted for publication: Tackling a wicked problem: towards sustainable management of surplus dairy calves using a participatory framework. S. E. Bolton designed the study, collected, and analysed the data, and wrote the manuscript. M. A. G. von Keyserlingk acted in the typical role of supervisor, having input into the study design, and contributing to the writing, editing,

and revision of the manuscript. K. E. Koralesky contributed to the data analysis and the editing, and revision of the manuscript.

Acknowledgements

A very heartfelt thank you goes first and foremost to my research supervisor, Dr Marina (Nina) von Keyserlingk. The decision to send you an email out of the blue asking if you'd like to meet back in 2018 has changed my life in the best possible ways. You have turned me from someone with no interest in research to someone who just wants to ask all the questions and never stop. Thank you for being a valued mentor and a treasured friend. It's because of you that this thesis exists.

I also owe this thesis to Drs David Beggs and Peter Mansell. Thank you for giving me the opportunity to take on the PhD and facilitating this work at every step of the way.

To Bianca Vandresen and Dr Katie Koralesky – thank you for being such wonderful co-authors. I feel privileged to say that working with you both was never anything but a pleasure. I only hope I can repay the favour one day.

To Pip Band, Howard Parry-Husbands, Morgan Owen, and Ellie Holmes – thank you for helping make the idea for this work a reality. It would not have been possible without your energy, knowledge, and insights.

To the staff and students of The University of British Columbia Animal Welfare Program – thank you for accepting me into your community and for the countless inspiring conversations. It's safe to say that working with you all never really feels like work at all.

Thank you as well to my fellow Melbourne University Dairy residents for sharing the early parts of this journey. Your collegiality will always be appreciated.

To my former colleagues at Dairy Australia, in particular John Penry, Steph Bullen, Tenille Wilkinson, Beth Scott, Ee Cheng Ooi, and Louise Sundermann – thank you for always being a source of support, inspiration, and collaboration. Times spent working with you are some of the happiest memories of my career. A special mention must also go to the WCWA family.

To my current colleagues at Greenham – thank you for your constant support and for allowing me the time and space to complete this thesis. Thank you as well for your dedication to creating a sustainable

market pathway for surplus calves as premium beef animals. Your commitment to doing the right thing is genuine and honourable.

To Bonnie, Ret, Will, and Elli – thank you for being my constant source of love, support, fun, food, and comfort. You're the best 'chosen family' a person could ask for.

To the von Keyserlingk-Schmaling household – thank you for accepting me into your home and becoming my treasured 'Canadian family'. I am grateful for your generosity, kindness, and friendship. You have turned Vancouver into my second home.

Thank you as well to my actual family – you have never wavered in your support for my chosen career path, with all its twists and turns. For that I am extremely grateful.

Finally, thank you to all the participants that gave their time to the research that forms this thesis, and to the wider Australian beef and dairy industries for the countless questions and discussions that have helped inform and shape these pages.

For the millions of animals that have been born into systems that have failed them. In most cases, we humans are only doing our best, but this often falls short of what is needed. It is my hope that one day it can be better.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ABC = Australian Broadcasting Corporation

AHDB = Agriculture and Horticulture Development Board

AUS = Australian

AWP = Animal Welfare Program

DAFF = Australian Government Department of Agriculture, Fisheries, and Forestry

DFC = Dairy Farmers of Canada

EU = European Union

IDF = International Dairy Federation

MLA = Meat and Livestock Australia

NHIA = National Herd Improvement Association

NFACC = National Farm Animal Care Council

NMPF = National Milk Producers Federation

OED = Oxford English Dictionary

PETA = People for the Ethical Treatment of Animals

RIO = Reflexive Interactive Design

TX = Texas

UBC = The University of British Columbia

UK = United Kingdom

US = United States

USA = United States of America

USDA-FSIS = United States Department of Agriculture Food Safety and Inspection Service

WBCSD = World Business Council for Sustainable Development

Prologue

In undertaking qualitative research, my personal experiences and values have both influenced, and been affected by, my work in this field. I was raised on the traditional lands of the Gunaikurnai people in south Gippsland, Victoria. Growing up on beef and dairy farms, I was immersed in agriculture from my earliest memories and always had a strong affinity for animals. From a young age I wanted to be a veterinarian and envisioned a future where I could spend my days working with and helping improve the lives of animals.

I graduated with a veterinary degree from The University of Melbourne at the age of 23 and pursued my dream career as a large animal veterinarian. After six years working in private and government veterinary practice, along with time spent managing beef and dairy farms, I had become perturbed with what I had begun to see as a systemic issue. The management of surplus dairy calves was a source of both interest and frustration as I grappled with finding economically viable ways of directing healthy calves away from early life killing and preventing the welfare compromise suffered by these low value animals, an issue I was regularly seeing in my work as a vet.

In 2018, I was awarded a Nuffield Scholarship which afforded me the opportunity to spend four months travelling internationally, investigating global management of surplus calves. I reflect now on my initial approaches to my Nuffield travels as being very much through a traditional veterinary lens; that is, I was convinced I simply needed to find the right nutrition, genetics, and husbandry solutions, that must exist somewhere in the world, to ‘fix’ the problem. Early on in my Nuffield studies, I realised this silver bullet solution did not exist, forcing me to interrogate the question of whether the management of surplus calves really needed to shift from the status quo. This led me to believe that if asked purely from an economic perspective, the answer to this question is ‘no’. However, if asked from a social perspective, the answer is very clearly ‘yes’.

Following this key shift in my thinking, I took a new approach to the Nuffield Scholarship, moving away from the search for technical solutions and instead seeking out global experts in social license, public attitudes, and trust in food animal agriculture. This saw the scope of my Nuffield

Scholarship broaden, encompassing both surplus calves and cow-calf contact, and introduced me to a whole new world of fascinating research, being the social sciences.

My experiences as a Nuffield Scholar were life-changing, but there were two key outcomes that have stood out above all others. The first was that my Nuffield work led me to a new role at Dairy Australia, the peak research, development, and extension body for the Australian dairy industry, where I was given the opportunity to extend my work in addressing the surplus calf issue and broader dairy animal welfare at industry level. Later, this work evolved into a commercial role with Greenham, a beef packer operating in southeastern Australia, as the company's dairy beef and animal welfare manager.

The second key outcome of the Nuffield Scholarship was the chance to connect with Dr Marina (Nina) von Keyserlingk, a Professor of Animal Welfare at The University of British Columbia (UBC). This connection has since led to a wealth of life-changing opportunities, not the least of which has been the chance to work together on this thesis and for me to be integrated with the Animal Welfare Program at UBC, collectively leading to an exponential increase in my knowledge and seismic shifts in my thinking.

Throughout my post-Nuffield journey and in the writing of this thesis I have learned to be reflexive, and to question the assumptions and ingrained behaviours of myself and others. I have gained far more clarity in my own personal values and learned to reflect on past experiences through a clearer and more informed ethical lens. Above all, I have learned to see a society that has come so far but has so far to go if all living things are to be afforded a life worth living. In working towards this, I have come to believe that our biggest opportunity is to listen with the goal of understanding as many different perspectives as possible. This opportunity applies not just to our relationship with other humans, but to our relationship with animals, and the land, including its traditional custodians. I believe that it is only when we come to understand the perspectives of others that we can work towards building a future in which all living things have true quality of life.

Chapter 1. Introduction

1.1. Conceptual background

1.1.1 Defining animal welfare

The design of modern food production systems has placed emphasis on the values of food security and food safety but placed less importance on the values of animal welfare and respect for animal integrity (Bruijnis et al., 2015). During the past half century, intensification of farming has led to a marked increase in world production of animal products, accompanied by consolidation (more animals being raised on fewer and larger farms), and increased use of confinement systems such as feedlots and indoor housing (Fraser, 2008a; Robbins et al., 2016b). In 1964, amongst rising concerns about agricultural practices at the time, Ruth Harrison published her seminal text *Animal Machines*, placing 'factory farming' at the centre of moral concerns about animal welfare, as well as the environment, and human health (Kirchhelle, 2021).

Since the 1960s, debate has continued about what constitutes a good life for animals. In response to public concern following the publication of *Animal Machines*, the British Government commissioned The Brambell Report (1965), which led to the development of the Five Freedoms (Webster, 2001); a well-known framework for assessing animal welfare that has formed the basis of much animal welfare legislation but has also been criticized for its focus on freedom from negative welfare states alone (McCulloch, 2013). A more contemporary framework, the Five Domains, recognises that four domains (nutrition, physical environment, health, and behavioural interactions) can all give rise to positive or negative feelings and emotions experienced by animals (affective states), which constitute the fifth domain (Mellor et al., 2020). Fraser et al. (1997) put forward that animal welfare is a concept that can be studied scientifically but is also influenced by value-based ideas about what is important and desirable for animals to have a good life; this led to Fraser's three conceptions of animal welfare, being basic health and functioning, natural behaviour and natural living conditions, and affective states (Fraser, 2008b). More recently, this work has been furthered to acknowledge the impact of human factors on animal

welfare, including human attitudes and the quality of human-animal interactions, collectively referred to as the human dimension of animal welfare (Cole and Fraser, 2018).

Arguably, whilst failing to prioritize animal welfare, the design of modern food production systems also failed to prioritize social acceptability of practices amongst the public; a central component of sustainability alongside environmental impact and economic viability (von Keyserlingk et al., 2013). Weary et al., (2016) posit that this failure has led to innovations in animal agriculture that may offer scientific 'solutions' but ultimately fail. These authors describe one such example, being the modified cage for laying hens that addressed a narrow concept of animal welfare held by scientists, but failed to resonate with the concerns of others who were ultimately unwilling to support a 'cage' of any kind. Thus, social science methodologies are an integral component of animal welfare science as they can document the shared and divergent views of different stakeholders, including the public and those within the industry, to account for the human dimension of animal welfare and ensure that future food production systems are both viable and sustainable over the long-term. Within the cattle industries specifically, there is increasing pressure to address contentious practices, necessitating research into how problematic practices can be improved, and how these changes are best implemented on farms (von Keyserlingk and Weary, 2023).

1.1.2 Overview of the Australian beef and dairy industries

The Australian national cattle herd stands at 24.4 million head, of which 91% are beef cattle contributing to beef production, and the remainder are dairy cattle, contributing to the production of both milk and beef (MLA, 2023a). Of these dairy cattle, approximately 60% are Holstein-Friesians, while Jerseys, Holstein/Jersey crossbreds, and other dairy breeds make up the remainder of the national dairy herd (Dairy Australia, 2019).

In 2019, the average number of cows milked on a dairy farm in Australia was 369 with an average of 89 heifers expected to calve and replace culled older milking cows each year, representing a replacement

rate of 26% for the national dairy herd (Dairy Australia, 2019). The total volume of beef produced in Australia far outweighs what is required for domestic consumption, with approximately 70% of beef produced each year being exported (MLA, 2022a), while just 30% of dairy product is exported (DAFF, 2024).

Australian dairy herds operate in a wide range of climatic environments, from warm tropical and subtropical climates on the northeastern seaboard, to cool temperate regions in the southeast and southwest (Dairy Australia, 2023a). The majority of cows are located in the southeast of the country (Victoria and Tasmania), where most herds employ either seasonal or split calving systems (Dairy Australia, 2019). In these systems, cows are managed so that they calve either exclusively in the spring ('seasonal' calving pattern) or in the spring and autumn ('split' calving pattern). Seasonal calving systems aim for all cows to calve in a short period of time, prior to peak pasture growth, while split calving systems employ a similar system but with two (or three) calving seasons per year (Parkinson et al., 2019). Both calving systems result in the majority of calves being born over the course of just a few weeks, placing disproportionately higher demands on labour and logistical requirements at this time (Deming et al., 2019).

1.1.3 The production and fate of surplus dairy calves

In seasonal dairy calving systems, each cow must calve approximately once a year (Parkinson et al., 2019). Given that not all calves born each year will be raised as replacement heifers, the remaining calves (all of the males and some of the females) are 'surplus' to replacement requirements (Haskell, 2020). Whilst dairy breeds have been selected for their milk producing ability, they often perform poorly in terms of economically important traits such as carcase yield and conformation when slaughtered for meat (Clarke et al., 2009). As a result, surplus dairy calves, particularly male pure dairy breed calves, are often regarded as a waste product of the dairy system (Sumner and von Keyserlingk, 2018).

Depending on the country and the operating environment at the time, surplus dairy calves (sometimes referred to as 'non-replacement' calves (Vicic et al., 2022)) may either be killed at-birth on-farm, slaughtered in the first days of life (e.g., as five day-old 'bobby' calves (Animal Health Australia, 2012)), or sold and raised for beef or veal. In 2022, approximately 26% of calves born on Australian dairy farms were expected to be raised for beef, while 40% were expected to be killed in the first days of life (Dairy Australia, 2023b). Annual fluctuations in the number of calves killed at 5-30 days of age has a relationship with the beef commodity price, whereby more calves are killed in poor beef price environments, and less killed (and likely raised for beef instead) during higher beef commodity prices (Dairy Australia, 2023b). In recent years, annual numbers of calves slaughtered at 5-30 days have been as high 0.5 million calves per year in low beef commodity price environments, but still over 0.2 million per year during higher beef prices (Dairy Australia, 2023b). This persistence of early life killing in the face of higher beef commodity prices likely reflects the challenges associated with the operating environment; a country that already produces a net surplus of beef for export, the low genetic merit of dairy breeds for beef production, and the logistical challenges associated with managing large numbers of calves born in a short space of time.

Early life killing of surplus calves (killing at-birth on farm or slaughtering for meat in the first days of life) is widely regarded as a threat to the dairy industry's social license to operate. Derived from the mining industry, social license refers to the freedom granted to industries to self-regulate, on the basis that they do so in a way that aligns with public values, thereby maintaining trust (Rollin, 2011; Cooney, 2017). Whilst several studies have found low awareness of the surplus calf issue amongst the public (Cardoso et al., 2017; Ritter et al., 2022; Herrler et al., 2023; Schulze et al., 2023), when made aware of early life killing there is usually widespread rejection of the practice; indicating it is out of step with public values (Cardoso et al., 2017; Ritter et al., 2022). Given that the long-term sustainability of agricultural sectors is predicated on the sector being environmentally sustainable, socially acceptable, and

economically viable (von Keyserlingk et al., 2013), the lack of social acceptance of early life killing of surplus calves poses a threat to the sustainability of the dairy industry.

In addition to the ethical issues associated with early life killing (Ritter et al., 2022), surplus calves are often at risk of compromised welfare (Creutzinger et al., 2021). Regardless of whether they are slaughtered in the first days of life, or raised for beef or veal, surplus calves are likely to be fed less colostrum than replacement heifer calves (Renaud et al., 2017; Sumner and von Keyserlingk, 2018), placing them at greater risk of mortality on farm (Hyde et al., 2020), and at higher risk of morbidities including diarrhoea, dehydration, navel infections, and low body condition (Marquou et al., 2019; Wilson et al., 2020b). These animals are also subjected to stressors associated with handling and transport, which often occurs within days of birth (Wilson et al., 2020a).

Globally, efforts to implement strategies for managing surplus calves that are both socially acceptable and economically viable have largely focused on the use of 'responsible' breeding strategies (AHDB, 2020) to improve the economic viability of these animals when raised for beef; thereby, reducing the risks associated with early life killing and the low inherent value of the animals. These breeding strategies rely on the use of female sex-sorted dairy semen to breed the required number of pure dairy breed replacement females, while the remainder of the calves are bred using a beef sire cross bred with the dairy cow. These 'beef on dairy' calves have the potential to be more economically viable for beef production than pure dairy breed animals (Foraker et al., 2022).

However, such technical advancements do not necessarily offer a panacea for the problem of early life killing of surplus calves. The application of sexed semen can present challenges for dairy herds where reproductive performance is suboptimal (Holden and Butler, 2018; Balzani et al., 2021). Further, whilst sales of beef semen to Australian dairy herds are increasing (NHIA, 2022), the majority of Australian dairy farmers prioritize beef sire traits that facilitate their goal of maximising milk production (e.g., calving ease); and place little value on traits important to meat production such as growth rates or carcase

quality (Dairy Australia, 2023c). When taken together, it is perhaps unsurprising that in the 2021/2022 fiscal year, despite a record-high beef price environment in Australia, there will still in excess of 0.2 million calves slaughtered at 5-30 days of age (Dairy Australia, 2023b).

1.2 Methodology and theoretical framing

The persistence of the challenges associated with surplus calf management, despite the myriad of attempts to implement technical advancements, is likely attributable to the complexity of the challenge. The management of surplus calves is associated with complex social, economic, and environmental factors (Webb et al., 2023), attributes that are often associated with 'wicked problems' (Rittel and Webber, 1973). Participatory research offers an opportunity to tackle complex challenges in a way that goes beyond incremental technical advancements to instead facilitate cultural and institutional change (Bremmer and Bos, 2017). Carcasson (2016) posits that deliberative engagement, a form of participatory research in which citizens discuss ideas, exchange information, and develop their viewpoints over the course of discussions, offers a promising approach to tackling wicked problems. Thus, this thesis frames surplus dairy calf management as a wicked problem that requires understanding and accounting for the needs of all stakeholders (Croney and Anthony, 2011) through participatory research such as deliberative engagement, offering opportunities to identify and implement sustainable paths forward.

1.3 Context of this research

The context of my thesis research is the Australian dairy industry, Australia's third largest rural industry, consisting of over 4000 farms and employing an industry workforce of over 33,000 people (Dairy Australia, 2023a). The context of Chapter 6, specifically, is the dairy industry located in the state of New South Wales, home to 466 registered dairy farms collectively milking 140,000 cows (Dairy Australia, 2023a). At the time of data collection (2021-2022), the New South Wales dairy sector had recently emerged from severe drought only to be faced with significant flood events and challenges associated with COVID-19 (Dairy Australia, 2021a).

1.4 Thesis aim and objectives

My overall aim in writing this thesis was to identify how the Australian dairy industry might implement sustainable approaches to managing surplus dairy calves and ending early life killing. Given that the issue of early life killing of dairy calves is increasingly being scrutinized but is still a common management practice, the first objective of my thesis was to explore the complexity of the surplus calf challenge and, where possible, identify innovative approaches that may be used to identify sustainable paths forward. To address this objective, I undertook a narrative review of the current literature (Chapter 2) on surplus calf welfare where I examine whether the issue fits the definition of a wicked problem. The review concludes by suggesting that the issue indeed fits the definition of a wicked problem and that technical solutions to address the problem will likely fail. Instead, innovative approaches for addressing the issue are needed.

Chapters 3 through 6 collectively address my second objective: applying a participatory approach to understand the needs of a wide range of stakeholders and identify sustainable approaches to surplus calf management. Specifically, Chapter 3 contains an analysis of love and breakup letters written to 'dairy' by community members prior to their participation in focus groups exploring their attitudes to dairy, including surplus calves. Chapter 4 contains the results of public focus groups exploring community attitudes to dairy, including the management of surplus calves and possible alternatives to early life killing. Chapter 5 contains the results of interviews with beef and dairy value chain stakeholders, exploring their attitudes to the surplus calf issue. Finally, Chapter 6 summarizes the findings of a longitudinal focus group investigating how farmers and pre-farm gate advisors understand the surplus calf issue and how this understanding was impacted over the course of deliberation, with interventions involving exposure to the views of the public (Chapters 3 and 4) and value chain stakeholder perspectives (Chapter 5).

Chapter 2. The dispensable surplus dairy calf: Is this issue a 'Wicked Problem' and where do we go from here?

2.1 Introduction

The issue of surplus calves in dairy production has historically been limited to the fate of the male calf (Fisher et al., 2014; Pempek et al., 2017; Wilson et al., 2020a). However, the increasing use of sexed semen to strategically breed replacement females (McCullock et al., 2013) combined with the growing demand for beef crossbreeding on the remainder of the herd (Britt et al., 2018), has resulted in an increasing proportion of these surplus calves being female. The current fate of most of these dispensable surplus calves is fraught with criticisms due in large part to a history of poor management, such as inadequate colostrum provision (Shivley et al., 2019), transportation within a week of birth, young calves being sold through auction yards, and high rates of morbidity and mortality (see Wilson et al. (2020b)). Given the increased concerns raised by critics regarding contentious practices in animal agriculture (e.g. see example of early life killing of male chicks in Germany described by Brümmer et al. (2018)), we predict an increasing awareness of potentially contentious issues being circulated through news reports and social media posts.

Citizens are increasingly expressing concern for the quality of life of farm animals (Robbins et al., 2016b). Without understanding societal values, food animal industries may implement improvements that are intended to improve animal welfare but are viewed as unacceptable to the public. For example, as described by Weary et al. (2016), after years of public outcry over the use of confined housing for laying hens, millions of dollars and years of research were spent on developing new 'modified' cages that incorporated the latest collective scientific knowledge on social group size, space allowance and needs of the hens in these systems (Lay et al., 2011; Mench et al., 2011). However, these 'modified' systems failed to resonate with the key societal demand for cage-free systems. Had the egg industry done the necessary consultation and reflection on these public values, the industry investment and scientific effort may have been more wisely devoted to improving cage-free rearing systems. To avoid similar missteps by the dairy

industry, we suggest that future solutions must integrate the views of the public in developing approaches to address contentious practices, potentially contributing to the social license to farm.

The thoughts and ideas that are presented in this paper arose as a consequence of weekly online video discussions undertaken by the two authors who live on opposite sides of the world over a 10-month period, that began at the outset of the COVID-19 pandemic. In our weekly conversations, we discussed many unique challenges facing our respective dairy industries but quickly realised that regardless of where one lives, the fate of the surplus dairy calf is an ever-present challenge. Moreover, the majority of the available scientific literature suggests that most, if not all, research dedicated to surplus calves has focused on 'technical issues' such as whether male dairy calves receive sufficient colostrum (Shivley et al., 2019) or describing the status quo which includes most surplus calves either being transported off the farm at less than one to two weeks of age or euthanased at birth (Renaud, et al., 2018). Hence our discussions moved to focus on what alternative solutions could be found that would support a more socially sustainable dairy industry.

This paper summarizes these discussions into four parts beginning with a short description of the status quo of surplus dairy calf management and the case for change. In this section we have, given our respective locations, primarily used examples from Australia and Canada but, when possible, also included examples from other countries. We then argue that attempts to date to improve the welfare of surplus calves have been limited to technical solutions that have focused on refinement of existing practices and discuss why this approach may fail in the long run. We then explore whether the challenge of surplus dairy calf management may fit the definition of a wicked problem, before finally moving to describe how the use of participatory methodologies may assist with developing sustainable paths forward. We have also included real-world examples where these types of approaches have been used to effectively tackle wicked problems and discuss how research is needed on adapting these approaches so that they may be applied to the fate of the surplus dairy calf (and arguably other contentious issues).

2.2 The status quo

In order to produce milk, cows must give birth to a calf (Tucker, 1981) that, under natural circumstances, would suckle the cow until weaning occurs when calves are seven to nine months of age (Reinhardt and Reinhardt, 1981). In contrast, the majority of conventional dairy farms separate calves from the dam within 24 hours of birth (Vasseur et al., 2010; Vogels et al., 2013). For the dairy industry to produce milk efficiently, farmers strive to achieve a yearly calving cycle; namely, every cow produces one calf every year. Considering replacement rates of lactating dairy herds (Edwards-Callaway et al., 2019), approximately 30 to 50% of the calves born on farms will be reared as replacement milking females while the remaining surplus female calves and all male calves must be managed through alternative pathways. In a study of calves sold at auction for veal operations in Quebec, Canada, 13% of calves sold were female (Marquou et al., 2019), indicating that the issue of surplus dairy calves can no longer be confined to a focus on male calves alone.

Since the 1940s, genetic selection has seen the modern dairy cow become highly specialized, producing more milk from less inputs and improving overall efficiency (Capper et al., 2009). However, it appears that this selection for high milk production has been largely at the expense of beef production traits. In comparison to specialized beef breeds, many dairy breed offspring exhibit reduced average daily gains, lower dressing percentages and less desirable carcase conformation (Muir et al., 2000; Albertí et al., 2008), impacting their suitability for, and use in, profitable meat production systems.

As a result of their perceived lack of suitability for beef production, the majority of surplus dairy calves in Quebec and Ontario, Canada's major dairy provinces, enter the veal industry (see Renaud et al., (2017)) and are slaughtered when they are 16 – 18 weeks old (USDA-FSIS, 2013), a management practice that has not changed dramatically in decades despite consumption rates of veal declining in North America; as of 2016 the annual veal consumption within Canada has dropped below 1 kg per person and to less than 100 g per person in the United States (Agriculture and Agri-Food Canada, 2020; Alberta

Government, 2020). The continued reliance on the veal industry as a viable and sustainable market by the Canadian dairy industry and elsewhere must be questioned, particularly given that animal welfare and ethical concerns are the most commonly cited reasons for not consuming veal (Skelhorn et al., 2020).

Concerns regarding the welfare of young surplus calves are not limited to North America. In Great Britain, the 0 to 3 months death rate at slaughterhouses for male pure dairy breed calves has increased from 17.4% in 2011 to 26.16% in 2018, in contrast to that of female dairy calves and beef calves (including beef cross dairy) of both sexes which has remained low (<0.5%) (Hyde et al., 2020). In Australia, there is little in the way of established veal or dairy beef markets resulting in most surplus dairy calves entering the bobby calf market (Dairy Australia, 2019) where they are slaughtered within the first weeks of life (Jongman and Butler, 2014).

The reduced suitability of dairy breed calves for beef production is also reflected in the value attributed to them, with Brown Swiss and Jersey calves attracting the lowest prices in a recent Canadian study, followed by calves with Holstein genetics, while crossbred calves with beef genetics sold for higher prices (Wilson et al., 2020b). Similarly, Buczinski et al., (2021) found that beef crossbred calves sold through auction markets of Quebec had better sale prices than Holstein, whereas coloured dairy calves had lower sale characteristics than both Holstein and beef crossbred calves. We speculate that the low inherent value of surplus calves motivates, at least in part, their sale at a young age. Wilson et al., (2020b) also report that Holstein dairy calves sold at auction were similar in body weight (~47kg) to those of newborn female Holstein calves born in the same region in Canada (Rosenberger et al., 2017) and elsewhere (Curtis et al., 2018), suggesting that the majority of the Holstein calves in these studies were less than a week old when sold. It should be noted that in Canada, as of February 20, 2020, new federal regulations prohibit transporting calves with unhealed navels, and require that calves under nine days of age be transported directly from farm to farm without going through an auction or assembly yard. The maximum trip length must be no longer than 12 hours – shorter than typical trips for many surplus calves being transported in Canada which often exceeds 12 hours and may be up to 48 hours in duration (Wilson

et al., 2020a). Unweaned calves aged nine days or older can be sold at auction, but the total trip from dairy farm to calf grower cannot exceed 12 hours except in specially equipped transport trailers (Government of Canada, 2020). Similar regulations exist in Australia where, amongst other requirements, calves must not be transported before five days of age (unless consigned directly to a calf rearing facility), must be fit and healthy and fed within six hours of transport with a maximum journey of 12 hours (see Animal Health Australia, (2012)).

Given that the core business focus of most dairy farmers is on milk production, and that surplus calves are often of low value and in some cases are viewed as a 'waste product' (Sumner and von Keyserlingk, 2018), it is not surprising that the standard of care provided to these calves is often lower than that afforded to arguably higher value replacement female calves. In a recent Canadian survey, 9% of farmers indicated that they did not always feed colostrum to male calves (a practice essential for managing the incidence of disease), and 17% did not provide the same quantity of feed to male calves as they did to heifer calves (Renaud et al., 2017). This was further supported by the views of Canadian veterinarians in one study, where participants noted that if bull calves are "…*worth twenty bucks, they get fed, sort of"* and that "*they might not even really get colostrum"* (Sumner and von Keyserlingk, 2018). In the UK, male dairy calves were also found to have the highest on-farm mortality rates in the first three months of life when compared to female dairy and beef (including beef cross dairy) calves (Hyde et al., 2020). High rates of health abnormalities including diarrhoea, dehydration, navel inflammation and low body condition have also been reported in calves sold at auction in Canada (Marquou et al., 2019; Wilson et al., 2020b) and upon arrival at milk-fed veal calf facilities (Wilson et al., 2000; Pempek et al., 2017; Renaud et al., 2018a). The most recent data from the US National Animal Health Monitoring System indicates the majority of the 42 operations surveyed sold their bull calves before weaning, with most doing so when the calves were less than one week old and about half of these were sold via an auction yard (Shivley et al., 2019).

The transportation required to relocate surplus calves from the farm on which they are born to either a rearing facility or to slaughter also impacts their welfare. Calves are often transported within a week of life (Dairy Australia, 2019), including within a day of birth (Wilson et al., 2020a), with mortality of calves less than a week old increasing exponentially with distance travelled (Cave et al., 2005). Particularly worrisome is that the time spent during transport usually equates to time that they do not have access to milk; a fact that has been shown to directly impact their welfare (Fisher et al., 2014). This notion that time off feed is a risk factor for mortality was acknowledged by a group of Canadian dairy industry experts who noted that young calves have limited body reserves to meet the demands of transport, which can have a duration of up to 48 hours including a rest stop (Wilson et al., 2020a). These experts also noted that stress caused by handling can suppress immunity to disease (see also Burdick et al. (2011)), that commingling of calves from different farms exposes them to new pathogens (see also Damiaans et al. (2019)) and that calves do not always receive appropriate quantity and quality of feed and water while in the transport continuum (Wilson et al., 2020a).

Given the economic challenges associated with surplus calves, it is not surprising that in some instances they are euthanased on-farm shortly after birth (Renaud et al., 2017; Dairy Australia, 2019); a decision that in some cases likely arises as the farmers are forced to make the trade-off that the value attributed to a calf is less than the cost of rearing it, a fact likely exacerbated when there are minimum age requirements for transport. Decisions regarding euthanasing healthy calves shortly after birth is likely compounded in situations where farmers face a lack of access to housing facilities for these surplus calves (Renaud et al., 2017). While the majority of Australian farmers euthanasing calves do so with firearms (Dairy Australia, 2019), the use of blunt force trauma (euthanasia via a sharp blow from a solid object to the head) continues to be used by some, posing a significant risk of poor welfare outcomes resulting from issues with operator training and error (Beggs et al., 2015). In one survey of Canadian farmers, an average of 19% of calves were euthanased at birth and of those respondents that euthanased calves, 34% reported using blunt force trauma, a practice that is not deemed acceptable by either the Canadian Code on the

Care and Handling of Dairy Cattle (Renaud et al., 2017) or the American Veterinary Medical Association (see American Veterinary Medical Association, (2020)), and is also against Australian Dairy Farmers policy (see Australian Dairy Farmers, (2020a)). Objectively, immediate and effective euthanasia following birth may be a preferable welfare option than experiencing standards of care that are common to surplus calves, such as long periods off feed, transportation or other known stressful conditions (e.g. cold) that can increase the risk of disease. Despite this, the killing of a newborn will not be accepted easily by the public due to ethical concerns; a point that will likely increase reputational risk to the industry. For example, the publishing of an undercover video taken on a dairy farm operating in Chile, with links to the New Zealand dairy industry, reporting that over 6000 calves had been killed using blunt force trauma resulted in public outcry in New Zealand (described by Weary and von Keyserlingk, (2017)). The voices of criticism following publication of the video were sufficient to enact changes in the New Zealand Animal Welfare Act making it *"illegal to kill a calf by blunt force to the head, except in emergency circumstances"* (New Zealand Ministry of Primary Industries, 2016). Clearly, the fact that the surplus calf is viewed as dispensable and killed immediately following birth in some regions of the world or allowed to live but given substandard care (at least relative to the female replacement heifers) is not socially sustainable and so alternative options must be explored.

2.3 The case for change

The status quo of how surplus calves are cared for has, as argued above, primarily been brought about in part because these animals have an inherent low economic value and in part because the dairy industry is focused on the milk production aspects of their industry. However, the rising value attributed to the maintenance of public trust in the dairy industry has initiated discussions about the need to improve the way surplus calves are managed (Weary and von Keyserlingk, 2017; Beaver et al., 2020). Commonly recognised challenges facing agriculture more broadly include a general public that is becoming increasingly disconnected from food production (Futureye, 2018), combined with an increase in concern about how food is produced (Coleman and Toukhsati, 2006; Croney and Anthony, 2011).

When it comes to dairy farming, concerns about the welfare of animals are amongst the most commonly cited by the public (Cardoso et al., 2016). Indeed, the management of bobby calves has been rated as one of the most significant issues facing the Australian Dairy Industry and is recognised as a key barrier hindering the long-term sustainability of the industry (Dairy Australia, 2020). There is a growing sensitivity globally that this issue must be addressed, exemplified by the views of a Canadian veterinarian who noted that "*if the public was more aware of what was going on there, it's not probably going to make good press"* (Sumner and von Keyserlingk, 2018). Unsurprisingly, when Australian study participants having little knowledge of the dairy industry were informed about the reason for the slaughtering of bobby calves, they responded with a high level of outrage and farm animal welfare standards were perceived as being inadequate (Futureye, 2018). There is also some evidence in the media that the issue of surplus calves will likely be tied to cow-calf separation (Levitt, 2019; Jacobs, 2020) which we predict will add additional complexity to this issue.

The increasing force of the social push-back by members of society regarding the management of surplus dairy calves has potential economic consequences, particularly in light of the rising interest in socially responsible finance (Climent, 2018), with some banks now promoting lending positions that exclude systems and processes that have negative impacts on animal welfare (see Bank Australia, (2020)). It may also contribute to difficulties in attracting and retaining new entrants to the dairy sector, exemplified by the comment from a Canadian veterinarian: "*we see a lot of the younger generation that's coming on to the farm that seem to really want to push the calf welfare issue"* (Sumner and von Keyserlingk, 2018). Whether future economic pressures play a role in facilitating improved surplus calf management, particularly when considering the opportunities for increased revenue from beef, remains to be seen. Regardless, change is not easy as stated by some Canadian farmers who participated in a focus group study where they emphasised that money is necessary to make on-farm changes and meet the must-haves of farms in 20 years (Ritter et al., 2020).

The case for shifting away from regarding the surplus calf as a waste product of dairy systems is not confined to social and economic pressures. Multiple studies have reported that beef from the dairy herd has a lower carbon footprint compared to beef from traditional beef herds (Nguyen et al., 2010; Mogensen et al., 2015; Tichenor et al., 2017; van Selm et al., 2021), making this form of beef production potentially very attractive, particularly in the context of climate change. This potential advantage of dairy beef is attributed to emissions from the breeder cow being allocated between the various products. In the case of dairy beef production, the dairy cow produces milk, meat, and calves, with emissions allocated among all three products compared to the beef from suckler cows which only produce meat and calves (Tichenor et al., 2017; van Selm et al., 2021). This explanation suggests that improving the uptake of beef from the dairy herd could lead to improved land use efficiency, which will be required in order to meet future increases in food production (Herrero et al., 2018).

2.4 Current approaches to achieving change

There is little doubt that the dairy industry has some appetite for change, one only has to look at the structural changes that have occurred over the last 50 years (Barkema et al., 2015). However, these changes have for the most part been driven by the pursuit for improved production efficiencies, such as increased milk production per cow through the adoption of improved genetics (Windig et al., 2006), scientific advances in ruminant nutrition (i.e. Meale et al., (2014); Sun et al., (2019)) and adoption of technologies to aid in health monitoring (see Rutten et al., (2013)). When it comes to surplus calves, approaches to achieving change have largely focused on improving practices such as colostrum management (Sumner et al., 2018), euthanasia practices (Turner and Doonan, 2010) and transport standards (Cave et al., 2005), and increasing the adoption of technologies such as sex-sorted semen (McCullock et al., 2013; Holden and Butler, 2018).

Increased adoption of sex-sorted semen, which allows predetermination of calf sex with approximately 90% reliability (Holden and Butler, 2018), will affect surplus calf management as it

provides for more targeted breeding of replacement females. Advantages of sexed semen can include accelerated rates of genetic gain in the female herd (Murphy et al., 2016) and reduced dystocia rates due to smaller female calves, although potential reductions in fertility can reduce the financial benefits associated with implementation (Holden and Butler, 2018). Most notably, the combined use of sexed semen to produce the required number of replacement females with beef crossbreeding over the remainder of the herd has the potential to improve the value of surplus calves (Hohenboken, 1999; Hietala et al., 2014). Indeed, recent evidence suggests that the feedlot performance, carcase quality, and yield of crossbred Jersey calves sired by beef breeds was improved compared to purebred Jersey calves (Jaborek et al., 2019). Undeniably, a focus on improving the technical feasibility of more sustainable surplus calf management practices is a fundamental requirement to achieving change. However, despite the widespread availability of these technical advancements, the problem of surplus calf management persists, suggesting that this approach alone may be insufficient.

Unique marketing angles have also been suggested as an approach to improving surplus calf management by increasing the financial returns of beef from the dairy herd. This may provide gains in niche markets, however Appleby (2004) notes that *"it is not reasonable to expect consumers to take day-by-day responsibility for animal welfare at the point of sale, any more than they are expected to do so for other issues of concern to society, such as pollution"*. Whilst niche markets may offer a partial solution, it is unrealistic to expect this approach to act as a panacea.

Approaches to preserving trust in the dairy sector also face a lack of consensus amongst stakeholders. The fact that many communities are increasingly disconnected from agriculture has caused many within the industry to dismiss the general public as simply not knowledgeable (Benard and de Cock Buning, 2013). However, restricting the flow of information (often referred to as 'ag-gag' laws) has been shown to be counterproductive, decreasing trust in farmers and leading to more negative perceptions of farm animal welfare standards (Robbins et al., 2016a).

Educating the public as a means to gain acceptance is another approach commonly argued by those within agriculture as a way of preserving trust (discussed by Sumner and von Keyserlingk, (2018); Ritter et al., (2020)). However, proponents of the education approach often fail to recognise that it will likely also highlight aspects that fail to resonate with societal values (e.g. zero grazing, cow calf separation (reviewed by Ventura et al., (2016); Weary et al., (2016); Hötzel et al., (2017)). This is compounded by the fact that animal welfare is often assessed by citizens not just in light of biological functioning, but also through the lenses of 'naturalness' and affective states (i.e. the way the animals feel) (Fraser et al., 1997).

Given that closing the doors or educating the public into understanding is unlikely to adequately address the threat of diminishing public trust in dairy production (Weary and Von Keyserlingk, 2017), how then should the industry proceed? Whilst technical solutions for improving surplus calf management are available and utilised to some extent, the persistence of the issue at a global level brings into question whether the problem must be viewed differently to those that are tackled solely through traditional scientific approaches targeted at refinement of existing practices.

2.5 Why the status quo may be a wicked problem?

Despite the refinement efforts made to date, there remain few, if any, dairying countries that do not experience some form of challenge when it comes to managing surplus calves. In short, the issue is yet to be completely 'solved', despite our best efforts in research, development, and extension.

The inherent division between the separate beef and dairy sectors present in many countries may play a role, at least to some degree, in hindering the development of sustainable solutions to the surplus dairy calf issue. Other challenges hindering progress may include commodity price volatility and inherent aversion to financial risk by many dairy producers (Ritter et al., 2020), arguably resulting in current management practices continuing to place most emphasis on the path with least economic resistance. Possible differences in cultural attitudes to the perceived quality of dairy beef or veal both within the

agricultural sector as well as amongst consumers may also play a role. Further, the concept of 'barn blindness' – a lack of perception of problems on one's own farm where the abnormal is viewed as normal because it is seen every day (Croyle et al., 2019) – may also contribute to a lack of widescale change. This barn blindness can occur at both a farm level, as well as an industry level; indeed, some practices become normalised by those working within the industry but are found abhorrent by others outside of the industry.

In further exploring the reasons for the persistence of the surplus calf challenge, framing the issue as a 'wicked problem' may provide some insights. The term wicked problem was first coined by urban planners Rittel and Webber (1973) as a way of describing problems which, in contrast to 'tame problems', present a unique set of challenges as a result of their inherently complex and incendiary nature. In Table 2.1 we show how common features of wicked problems can be related to the management of surplus dairy calves.

Table 2.1. Key features of a wicked problem and how aspects of current surplus dairy calf management systems could be argued to meet each of the individual features that when taken together meet the criteria for a wicked problem.

Features assigned to wicked problems	**Relation to surplus calf management**
They are **difficult to clearly define** (Rittel and Webber, 1973) and **different stakeholders have different versions of what the problem is** (Australian Public Service Commission, 2007).	The challenge of surplus calf management is difficult to distil into a clear problem definition, primarily because the components of the problem are many and varied. The problem could be defined as surplus calves being slaughtered early in life (as is the case in Australia) and treated differently to replacement females because they are of lower economic value (as is the case in most dairy regions). But why are they of low value? Is the problem one of genetics, nutrition, husbandry, market access and demands, human perceptions of value, industry attitudes or cultural norms? Additionally, different stakeholders will place different emphases on each of the potential components of the problem.

They are often **not stable**; the problem, constraints, and evidence involved in understanding the problem (e.g. legislation, scientific evidence, resources, political alliances) are frequently evolving. They also have many **interdependencies** and are often multi-causal (Australian Public Service Commission, 2007).	Evolving and interdependent influences on the management of surplus calves include market incentives/disincentives, policy, legislation, commodity price fluctuations, land availability, scientific knowledge, and evolving community attitudes/values.
They often include **internally conflicting goals** or objectives (Australian Public Service Commission, 2007).	Internally conflicting goals include the desire to achieve financially viable growth rates through accelerated/lot feeding of dairy breed calves vs. rising public opposition to concentrated animal feeding operations (Thompson, 2010); the advantages offered by increasing use of sexed semen (Holden and Butler, 2018) vs. the value placed by the public on the concept of 'naturalness' (Fraser, 2008b; Román et al., 2017); the welfare impacts of transporting calves to rearing facilities vs at-birth euthanasia which may not compromise welfare if performed effectively but is likely to be at odds with public values.
They have **no immediate and no ultimate test of a solution**; the full consequences of a potential solution cannot be appraised until all the waves of repercussions have completely run out (Rittel and Webber, 1973), **and measures introduced to address the problem may lead to unforeseen consequences elsewhere** (Australian Public Service Commission, 2007).	The social, environmental, and economic consequences of any changes to surplus calf management will take time to become evident. For example, increasing the number of surplus calves reared for beef or used for veal production may fail to resonate with societal values for reasons associated with production methods (e.g. cow-calf separation); proposed solutions may have a detrimental financial impact on farmers in the short term; management changes may have unforeseen impacts on the environment, land use, food security etc.
They have **no stopping rule**, as the perfect solution will likely never be achieved (Rittel and Webber, 1973).	Given that the socio-cultural evolution of humans is ongoing (Klüver, 2008), the question will likely not be whether the management of surplus calves becomes 'good enough' to the point that it is 'solved' but rather that practices will likely require continual review in order to ensure that they align with public values in perpetuity.
They are **socially complex**, and it is social complexity rather than the technical complexity that overwhelms most current problem-solving	The management of surplus calves involves a diverse range of stakeholders with varying frames of reference including dairy and beef farmers, calf growers/veal

and project management approaches (Australian Public Service Commission, 2007).	producers, transporters, feedlot operators, meat processors, milk processors, wholesale, retail, food service, exporters, policy makers, compliance etc. This level of social complexity is increased again by the addition of the general public as a credible stakeholder.
They involve **changing the behaviour** and/or gaining the commitment of individual citizens (Australian Public Service Commission, 2007).	Changing the status quo of surplus calf management will not only involve changing the behaviour of farmers, but of all stakeholders involved along the whole supply chain (i.e. from farm to plate).

Developing a dairy industry where practices are more aligned with public values will likely be more socially sustainable (Weary et al., 2016); the question is what do these practices look like, are they economically viable, and who should be involved when discussing them?

2.6 Addressing wicked problems (the inclusion of voice)

Given the complex nature of surplus calf management, gaining an understanding of, and accounting for the interests of, all stakeholders and reasons that motivate conflicts of interest between them is vital (Croney and Anthony, 2011). This will require more interactive methods of communication that can provide for democratic, interactive, and multidirectional discussion sessions (Boone and Snowden, 2007) that stretch across different disciplines and even across public, private, and civic sector organisations (Fung, 2015).

When addressing wicked problems, it is widely recognised that relying solely on experts and advocates is not only insufficient but can actually make tackling the issues more difficult (Carcasson, 2016). As pointed out by Weary et al., (2016), some solutions (see above discussion on the modified cage for hens) developed by scientists fail to gain traction with the public because a) they do not adequately address the societal concerns that motivated the original research and, b) they do not adequately address the perceived constraints within the industry. According to Fung (2006), non-professionals may be able to contribute to the development of innovative approaches and strategies precisely because they are free

from the received but obsolete wisdom of professionals and the techniques that are embedded in their organisations and their procedures.

The importance of ensuring that surplus calf management practices are not only socially acceptable but also financially viable, means that it is vital that discussions include industry, including the farmers, their trusted advisors (e.g. veterinarians, nutritionists) and other stakeholders along the supply chain (e.g. milk processors), and the general public, in their role as both citizens and consumers, as credible stakeholders. Weary and von Keyserlingk (2017) emphasise the importance of two-way conversations with the public that include not just consumers who purchase dairy products but all citizens that provide a social license for the dairy industry to operate, including those that do not consume animal products but are interested in the issues and who influence corporate and government responses. Similarly in the mining sector, it has been recognised that genuine community engagement, participation, and collaborative approaches to the development of strategies to mitigate negative impacts will likely create greater community trust and acceptance in the longer term (Moffat and Zhang, 2014).

Indeed, it is becoming increasingly clear that exclusion of certain voices (i.e. the lay public), despite their lack of connection to the industry, may not be sustainable in the long term; particularly given that the younger generations are predicted to contribute significantly to the debate on choices towards new food production practices and consumption patterns (Bollani et al., 2019). In contrast, the inclusion of voice from both industry as well as citizens through public participation can act as a source of 'trust' and 'legitimacy' (i.e. that all those involved in the conversation trust those developing potential solutions and therefore see them as legitimate) and thus can act as a means of affecting change (Jackson, 2019).

However, the inclusion of the voice of the citizen must not be merely tokenistic; Schuppli and Fraser (2007) examined factors influencing the efficacy of animal ethics review committees and found that the inclusion of community members, usually as a single or pair among a panel of several experts, often led to them feeling outnumbered or intimidated by the expert members and their voice was often not

heard. This emphasises the importance of attempting to ensure that the inclusion of voices from various stakeholders is at least in some way representative. Despite this, Fung (2006) describes the challenges associated with achieving adequate representation amongst participating voices, including: whether important interests or perspectives are excluded; whether they possess the information and competence to make good judgements and decisions; and whether participants are responsive and accountable to those who do not participate. Whilst these challenges must be acknowledged, moving to include the voice of the lay stakeholder in at least some form is an as-yet underexplored frontier when it comes to addressing wicked problems in agriculture. Using these approaches to guide and build upon traditional approaches to research, development, and extension offers a promising domain in which to break new ground.

Driving ownership of the problem and buy-in for new approaches from farmers and wider industry is also vital as any initiatives are more likely to be successful when led by producers (Fraser, 2014) and the associated allied industries who support the agriculture industry. This buy-in for new approaches must circumvent the traditional attitudes of industry-based stakeholders who have often characterized public concerns about farm animal welfare as symptomatic of a lack of knowledge about farming and have used one-way information vehicles to educate the public (Benard and de Cock Buning, 2013). The challenge is to help the dairy sector as a whole to see the opportunities that change may bring as opposed to supporting a way of doing business that may become an intractable problem.

In the case of surplus calves, 'fixing' the problem must go beyond refining existing practices and improving profit margins. As Bos and Koerkamp (2009) state, "*the old-fashioned idea that pure technological magic will do the job, no longer applies".* Instead, these authors argue that in order to make modern animal production systems more sustainable, it is necessary to design systems that address multiple challenges at one time. It is not only profitability of alternative surplus calf systems that must be considered, but these types of approaches may also aid in identifying solutions for other complex issues such as animal welfare, farmer welfare, environmental impacts, and other aspects of social sustainability.

Ideally, solving these issues is not done in isolation of one another as individual solutions may conflict with, or even negatively influence, the performance of other aspects of the system.

Further, when considering that human social evolution is a constant process (Klüver, 2008), it is vital that systems for tackling complex issues such as surplus calf management are designed to accommodate and move with evolving societal values. Almost 15 years ago the Australian Public Service Commission (2007) reported that any approach to tackling wicked problems will require: *"holistic, not partial or linear thinking; innovative and flexible approaches; the ability to work across agency boundaries; increasing understanding and stimulating debate on the application of the accountability framework; effectively engaging stakeholders and citizens in understanding the problem and identifying possible solutions; additional core skills such as communication and tolerating uncertainty and accepting the need for a long term focus".* We argue that identifying a sustainable path forward regarding the issue of surplus calves produced by the dairy industry will require approaches that embrace all of these attributes. Below we discuss the use of participatory methodologies that could be used as a starting point to engage in dialogue that includes representation from industry stakeholders as well as the public.

2.7 Examples of participatory methodologies

Whilst participatory methodologies vary based on who participates, they are all based on the concept that those involved co-create knowledge and make decisions together and it is their collective voice that is then linked with policy or public action (Fung, 2006). When it comes to the inclusion of the voice of the community, Gregory et al. (2008) define community engagement as the process of involving the community in the planning and development of policies and services by which they themselves are likely to be impacted. The three methods described in Table 2.2 are examples that could be used to tackle the complex surplus calf management problem and were specifically chosen since they all provide for the inclusion of voice from all sides of the issue, including the lay public, with the overall aim of identifying more meaningful, sustainable outcomes.

Table 2.2. Brief descriptions of three participatory methodologies and examples where they have been used to tackle complex problems.

Participatory methodology	Description	Examples of methodology in use
Deliberative forums	Deliberation is defined as the action of thinking carefully about something, especially in order to reach a decision (OED Online, 2020). According to Gregory et al. (2008), deliberative approaches to community engagement centre on involving the community in discussion and deliberation about issues, ideally leading to concrete proposals that can be adopted by policy makers. The process involves ordinary citizens being willing to tackle difficult, often value-laden problems. A key part of these types of forums is the recognition that participants will absorb educational background materials and engage in exchanges with others, who may have different perspectives, experiences, and reasons, and in doing so will develop their views and discover their interests (Fung, 2006). In contrast to the commonly-utilised focus group, Carcasson (2016) emphasises that deliberative engagement focuses on developing mutual understanding and genuine interaction across perspectives, which then provides a base to support the constant adjustment, negotiation, and creativity required to tackle wicked problems. These types of interactions do however require extensive community capacity and are indeed a cultural shift away from an over-reliance on either expert or adversarial processes.	The Irish Citizens' Assembly is an example of a deliberative forum (see Farrell et al. (2019) for full description) where members of the assembly were regular citizens selected from the wider population and participated in facilitated roundtable discussions on a monthly basis. Presentations by advocacy groups and on occasions (notably when discussing abortion) personal testimonials by a number of women were also included. Together, the creation of two deliberative mini-publics in quick succession (The Irish Citizens' Assembly (2016-2018) and the early Convention on the Constitution (2012-2014)) played a significant role in supporting key referendums for constitutional change that followed (marriage equality in 2015 (Elkink et al., 2015), and abortion in 2018 (Field, 2018)). In a dairy-specific example, participatory policy making was recently employed in the United Kingdom to enable groups of dairy producers to deliberate and develop an antimicrobial stewardship policy (see van Dijk et al. (2017) for full description). The authors noted that *"the participatory process provided comprehensive learning for all involved and allowed for the integration of science and the producers' own knowledge and experience.*

		The process led to the development of credible and practical recommendations designed to deliver real on-farm changes" (van Dijk et al., 2017).
Reflexive Interactive Design (RIO)	According to Bos and Koerkamp (2009), the RIO approach (a Dutch acronym for Reflexive Interactive Design) was first proposed to aid the discussions surrounding agricultural issues that are viewed to be complex and value laden. The approach recognises that livestock production's historical focus on volume and cost-efficiency has increasingly been confronted with a series of self-generated risks and unwanted side effects (see also von Keyserlingk et al. (2013) for discussion on risks to sustainability arising from current dairy management practices in the US). The RIO framework places equal focus on both technical and social challenges and seeks to redesign agricultural systems in ways that can overcome these constraints to be truly sustainable (Bos and Koerkamp, 2009). According to the same authors, determining the fundamental needs of all actors that are involved in a system (including farmers, the general public and consumers as well as the animals themselves) and formulating them into a 'Brief of Requirements' is a key starting point of this approach. Their aim is to then redesign systems that simultaneously speak to the needs of all the different actors, instead of weighing the pros and cons of the	An example where RIO methodology was used is the Pork Opportunities project in the Netherlands (2008-2010) (see Bremmer and Bos (2017)). Briefly, the aim was to redesign the pig husbandry system to *"produce pork in a way that is good for People, Planet, Profit and Pigs"*. This project began with a system analysis that identified and assessed the needs of the pig, pig farmers, the environment, and the consumer/citizen. Key challenges in the current pig production system were then identified as were possibilities for change. Design goals were formulated, key functions were identified and solutions to these functions were generated to fulfill the needs of all actors. A selection of these solutions was then combined to render new designs of pig husbandry systems. The RIO approach was also used by Romera et al. (2020) to re-design sustainable dairy systems in New Zealand. The authors argued that this approach offered an opportunity for more profound reflexion within the dairy industry and is tailored to wicked problems and situations with apparent value conflicts. It first set out to develop desirable 'ideal' systems; participants were actively encouraged to not

	various interests against each other (Bos and Koerkamp, 2009).	focus on technical or economic feasibility. Only after completion of this phase were the participants then encouraged to focus on the feasibility of the concepts. Animals were considered as key actors alongside farmers, as were the consumers and the New Zealand citizens; this latter aspect of the process was driven in large part by the recognition and acceptance by all involved that animals are sentient beings, whose lives could be profoundly affected by the designs if they were to be implemented.
Human Centred Design	Human Centred Design is rooted in fields such as ergonomics, computer science and artificial intelligence (Giacomin, 2014). This approach also places priority on deeply respecting all views, recognising that in order to develop creative, innovative solutions that are rooted in people's actual needs, the voices of all stakeholders must be included (see IDEO.org, (2015)). The process involves three main phases: Inspiration, ideation, and implementation, and is designed to help participants learn directly from each other, open themselves up to a breadth of creative possibilities, and then zero in on what is most desirable, feasible, and viable for all actors involved (see IDEO.org, (2015)).	Human Centred Design has been used to address complex issues such as healthcare, and was utilised by The Best Babies Zone initiative, a multi-year project aimed at reducing inequities in infant mortality rates and enhancing overall population health in Oakland California (Vechakul et al., 2015). As the authors describe, this approach was used to design solutions that addressed the deeply rooted, complex social and economic conditions that are important drivers of health inequities in this region. A diverse team representing organisations from multiple sectors were invited to attend; stakeholders represented government, design, community and economic development and individuals who worked in the neighbourhood. Collectively the goal was for all stakeholders to become familiar with the complexity of the

	situation in a context that deepened their understanding and empathy. Based on insights from working in the community, the team brainstormed over 100 concepts to address the design challenge and integrated community members' feedback at an early stage of the planning process.

In all three examples (see Table 2.2), the values and ideals of those not directly connected to an issue, but who are either affected by the issue or downstream recipients such as community members or consumers, are recognised as being of equal importance as the needs of experts or industry stakeholders in developing sustainable solutions to complex problems. It should be noted that this is in contrast to the relatively minor changes that normally follow the traditional process of getting feedback after a fundamental design had been completed by experts (that may include a representative of the humane movement (NFACC, 2021), but not always (i.e. NMPF, (2019)), and then put forward for public comment (see process described by Canada's National Farm Animal Care Council (NFACC, 2017)). As Raman and Mohr (2014) point out, it is not enough to simply measure social acceptance of a practice, but instead industries should aim to include all stakeholders in the co-construction of social license. Thus, engaging with all stakeholders, including the public, is a key step to ensuring that practices remain in step with evolving societal values.

In addition to maintaining a focus on technical advancements, we strongly encourage research that focuses on identifying solutions for the surplus dairy calf that pro-actively incorporate societal values (i.e. the public) into industry-led multi-stakeholder discussions on this complex issue. Additionally, as in the case for laying hens, if the dairy industry implements solutions that fail to resonate with societal values, there is a great risk that any proposed changes may result in public disapproval as awareness of this issue grows, wasting immense resources by both the dairy industry as well as the research community. By engaging in social science research using some form of participatory methodology (see Table 2.2) that includes the public, we believe that the industry can minimize this risk.

2.8 Conclusion: The ever-distant horizon

Achieving widespread adoption of socially acceptable, financially viable, and environmentally sustainable alternatives to surplus calf management is an immediate requirement to ensure the continued viability of the dairy industry. However, as complex as this specific issue is, we also recognise (as have

others (von Keyserlingk et al., 2013)) that it is unrealistic to expect that the challenge of ensuring dairy animal management practices meet the needs of people, planet, profit, and animals will be solved immediately and that issues hindering the sustainability of the dairy industry will be confined to the issue of surplus calves alone. There is little doubt that public scrutiny of dairy production practices will continue to increase, and that this scrutiny will increasingly include challenges based on ethical grounds, including the current practice of managing surplus calves as an associated 'dispensable' product of the dairy industry.

Short term measures of progress on surplus calf management will likely include improved beef market access by the dairy sector and a move away from early life slaughter. However, in addition to working on short term solutions, we encourage the industry to simultaneously begin working towards longer term solutions that will meet the future needs of the animals, the farmers who care for them, the wider agricultural sector, consumers as well as the citizens in the broader community. In doing so, related 'contentious' issues such as cow-calf separation, confinement feeding (concentrated animal feeding operations), involuntary culling due to disease and lameness, and the welfare of cull cows will also need to be addressed.

The current challenge facing the global dairy industry regarding the fate of surplus calves demonstrates a clear and pressing need to engage in research that expands on the traditional focus on technical solutions by developing and evaluating participatory methodologies, enabling the dairy industry to address these ever-evolving, complex, wicked problems. This novel approach could potentially aid the dairy industry to clearly position itself as a leader in sustainable food production, rather than simply being reactive to issues as they arise, thereby assisting the industry in retaining its' social license to practice.

Chapter 3. *"Dear Dairy, it's not me, it's you"*: Australian public attitudes to dairy expressed through love and breakup letters

3.1 Introduction

A sustainable food production system recognises the importance of environmental sustainability, the need to be economically viable, and assures that the system is socially acceptable (von Keyserlingk et al., 2013). The economic viability of the dairy industry has been, and continues to be, a focus of research (Santarossa et al., 2004; Bórawski et al., 2020), and questions concerning the impact of livestock production on global warming have led to a dramatic increase in our understanding of the environmental impact of dairy production (see Holden, 2020). However, to be sustainable in the long term, farming practices must also be socially acceptable. Thus, research centred on understanding evolving public views on food production methods must not be overlooked (Weary et al., 2016).

The concept of a 'social license to operate' originated in the mining industry (Cooney, 2017) and relates to an industry being seen as having the broad acceptance of society to conduct its activities (Gehman et al., 2017). It follows that if the maintenance of social license depends on broad acceptance or conformance with societal norms (Gavrilets et al., 2024), then as societal values evolve and societal norms shift, social license may be gradually eroded. That is unless, as in the case of animal agriculture, livestock industries ensure their practices evolve in line with changing public values.

Western society has long emphasised the production of large amounts of good-quality food at low cost. This has been achieved through specialization and scaling up of production, largely driven by values associated with food safety and food security (Bruijnis et al., 2015). However, what was not central to the discussions that led to the design of most modern food production systems were the moral values of citizens. Arguably, this has led to many common agricultural production practices falling out of step with public values, including issues relating to the environment (Ammann et al., 2023) and the care of food production animals (Weary et al., 2016).

There is some evidence that public attitudes do not always lead to consumer purchasing behaviours that align with beliefs (environmental issues, Pickett-Baker & Ozaki, 2008; Rokka & Uusitalo, 2008; animal welfare issues, Hyland et al., 2022). It is also recognised that purchasing decisions are confounded by a myriad of other attributes such as price, perceived brand quality, past experiences, functionality, ease of acquisition, and environmental impact, amongst others (Jones et al., 2017). Failure to show strong alignment between consumer purchasing behaviours and public values has resulted in some farmers arguing that they do not need to be concerned about public attitudes towards farming practices (Burton et al., 2008). However, failure to engage in discussions about how dairy products are produced may partially explain the trend for increased sales in alternative milk products (Janssen et al., 2016b). Key reasons cited for this change in purchasing behaviour are increased sensitives around the environmental impact of dairy production and the quality of life led by dairy cattle (Haas et al., 2019).

Citizens have the power to impact the economic viability of an animal industry through the decisions they make when buying food. It is therefore imperative to understand public views if the animal industries are to remain viable in the long term (Weary and von Keyserlingk, 2017). Whilst representative surveys provide valuable information, they are not designed to gain an in-depth picture of the public's respective beliefs, values, and attitudes towards dairy production. As a first step in understanding this in-depth picture, we asked members of the public to write their choice of either a 'love letter' or a 'breakup letter' to dairy. The present study summarizes the qualitative analysis undertaken on the letters written by participants.

3.1.1 Positionality statement

When conducting qualitative research, the researchers' collective life experiences and thus their individual frames of reference affect their approach to study design, data collection, and analysis (Holmes, 2020). To contextualize our research, below we provide a positionality statement for each author in relation to the topic being studied.

Bolton is a female PhD student at The University of Melbourne and a visiting scholar with The University of British Columbia Animal Welfare Program (UBC AWP). She has worked as a veterinarian and has lived experience in dairy farm management. She was employed as the National Animal Welfare Lead at Dairy Australia, at the time of this research was undertaken. Currently she holds the role of Dairy Beef and Animal Welfare Manager with Greenham, a beef packer operating packing plants in Tasmania and Victoria (Australia).

Vandresen is a female PhD student at UBC AWP. She is Brazilian and obtained her Bachelor of Science degree in veterinary medicine and her Master of Science degree in Animal Welfare in Brazil before moving to The University of British Columbia (UBC) where she is completing her PhD. She did not grow up in a farming community but has lived experience living and working with dairy cattle at the UBC Dairy Education and Research Centre located in Agassiz BC. She has also investigated multiple topics related to farm animal production systems using qualitative methodologies.

von Keyserlingk grew up on a beef cattle ranch in British Columbia, Canada, and also worked in the agribusiness sector for seven years before joining the university as a faculty member in UBC, where she has co-led the UBC AWP since 2002. She is now a full Professor and has held a Natural Sciences and Engineering Research Council of Canada Industrial Research Chair in Animal Welfare since 2008. She has published extensively in both the natural and social sciences on a broad range of topics in animal welfare, with most of this work focused on farm animals.

3.2 Methods

This study was approved by the University of Melbourne Human Research Ethics Board (protocol no 20750). and The University of British Columbia (UBC) Behavioural Research Ethics Board (protocol no H18-02880-A012). All participants provided written consent to participate.

Our participants were recruited via a commercial market research company (Pollinate, Sydney, Australia) for a public focus group session, intended to explore their attitudes towards the dairy industry per se but also specifically about the care of surplus calves (see Chapter 4). Recruitment of participants aimed to achieve a broad spread of demographics (age, gender identity, income), variation in attitudes towards the dairy industry, the environment, social and economic issues, and in frequency of consumption of dairy products. A total of 24 participants were recruited, including four that identified as vegan, three as vegetarian and three having a self-described connection to the dairy industry.

At the time of recruitment, participants were informed that the purpose of the focus group (Chapter 4) was to explore their attitudes towards dairy. To stimulate their thoughts, participants were each given 'homework' to complete before participating in the focus group sessions where they were asked to write their choice of either a 'love letter' or a 'breakup letter' to dairy. No further instructions were provided, allowing participants to have freedom to decide on the content of the letters, their interpretation of the term 'dairy', their word count, and writing style. The letters were designed to act as stimuli during the focus group conversations (see Chapter 4 for full description of the focus group discussions), specifically as 'provokers' (Törrönen, 2002); 19 of the 24 participants emailed their letters to the marketing company before the start of the focus group sessions.

Analysis of the letters began by removing all identifying information, including participant names. Individual letters were then assigned a randomly generated participant number. These data were then submitted to inductive thematic analysis. This form of analysis is particularly useful when utilizing a relatively novel approach to data collection in an area of work with little pre-existing research (Clarke and Braun, 2017). This approach to analysis was also selected because we did not have any pre-existing questions and instead allowed the collected data to drive the analysis.

SB and BV undertook extensive reading of the letters and individually drafted the initial themes and codes. After a first screening of the letters, they were categorized as either love letters or breakup letters.

Love letters were characterized by clear compliments that conveyed a positive attitude to dairy, while breakup letters were characterized by clear criticisms and negative attitudes towards dairy. The authors identified that some letters could not be classified as either love or breakup letters, and a new category named ‘distance letters’ was created for those describing a conflicted stance towards dairy with some positive and negative views communicated in the same letter. Randomly generated participant numbers assigned to letters were then updated to reflect their categorization as a love (‘L1’, ‘L2’, etc.), breakup (‘B1’, ‘B2’, etc.), or distance (‘D1’, ‘D2’, etc.) letter.

Both coders then discussed, reviewed, and refined the initial codes and themes until codebook agreement was reached. SB and BV then performed intercoder reliability by each analysing the data independently using the draft codebook, before meeting to resolve any coding discrepancies and refining the codebook accordingly. The final codebook was applied to all 19 letters, irrespective of the stance taken by the participant. All three authors then discussed and agreed upon the final codebook (Figure 3.1 and Appendix A). BV then used the final codebook to code all the data (letters) using NVivo (version 12; QSR International Pty Ltd., https://www.qsrinternational .com/nvivo-qualitative-data-analysis-software/home). Below, we outline each of the themes and provide example quotes from each of the sub-themes.

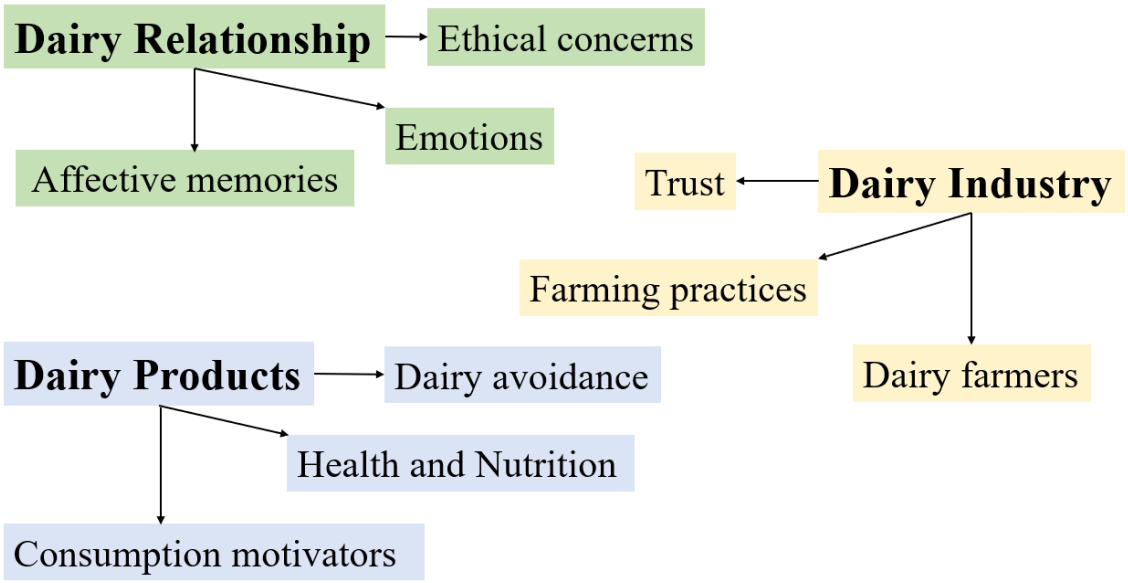

Figure 3.1. Description of the primary themes and codes identified following thematic analyses of letters written by participants (n=19) who were asked to write a love letter or a breakup letter addressed to dairy.

3.2 Results and Discussion

The 19 letters were an average of 144 words long (range: 48-285), and comprised of eight love letters, six breakup letters and five distance letters that conveyed a conflicted stance. Analysis of the letters revealed three main themes, including participants' relationship with dairy (Dairy Relationship), their attitudes towards dairy products (Dairy Products), and their views about dairy as an industry (Dairy Industry). Each main theme included three underlying sub-themes (Figure 3.1).

Although all themes were identified in each of the letters, some codes were more prevalent in love letters, while other codes were more prevalent in breakup letters (Figure 3.2). Not surprising, codes related to positive views towards dairy, like "affective memories" and "dairy farmers" were mostly present in love letters. Codes related to negative views towards dairy, like "ethical concerns", "trust", "farming practices", and "dairy avoidance" were mostly present in breakup letters. Three codes (consumption motivators, health and nutrition, and emotions) were composed of both positive and

negative views towards dairy, and were shared among love, breakup, and distance letters. The distance letters also shared codes with the breakup letters (“ethical concerns”, “trust”, and “dairy avoidance”) and love letters (“affective memories”).

Love letter

Dear Dairy

I'm writing to tell you all the ways in which I love you!

Since you've come into my life you've made me so happy. You make everything better. There is no such thing as too much cheese, and sour cream completes every dish. I wish I could put it on absolutely everything. The addition of cream is also a show stopper, you complete me.

When cheese and dip turn up to a party with their friend crackers they always bring people together. Any gathering just wouldn't be the same without them.

And let's not forget that you make my bones stronger, my teeth healthier and my nails longer and harder. You help to prevent muscle cramps and dental cavities and even help to lower high blood pressure. You can also help me get to sleep at night.

I can't make calcium on my own so I would be useless without you. Don't ever leave me.

All my love,

Anonymous xo (L1)

Distance letter

Dear Dairy,

I am writing this letter to pay gratitude for all that you have provided me. It is a sad time at the same time as I must say goodbye too. You were my first love as a child and I loved all the flavoured milks at school. I loved my childhood memories of stringy cheese, ice creams and yummy desserts. I loved the idea of happy cows and country farms. There was something homely about it. I never really thought of it as a commercial enterprise.

As I grew up I realised that the cows weren't happy. I was forced to acknowledge the truth that the world population could not sustain cattle farming – the dairy industry being a contributor to it. Mother nature needed to heal and food security is a problem for our generation. I also found that calcium can be found in other foods. There were alternatives to create similar foods from my childhood memory. I still want us to be friends but I definitely can't have a love affair with you. I have also found I am making better choices and feel more healthy focusing more on fresh fruit and vegetables to sustain me. I hope you understand. It's for the best.

Love,

Anonymous (D4)

Breakup letter

Dear Dairy,

I'd like to say it not you, it's me… but, it's you. Now that the image you presented me of contented cows grazing in green fields in the sunshine has worn off and I have got to know the real you, I can't stay in this relationship. It took me a while to realize that the male calves you never spoke about were being taken away and slaughtered – and that their young mothers would be slaughtered a few years later when their bodies had stopped being useful to you. I have seen the real grief that these mothers experience when you take their children away and I want no part of it.

You say you care about these animals but I know that is only as far as you can make a profit from them. I guess it's a lie just like that time you said you cared about the environment.

Sorry Dairy, I've already started seeing Soy and Almond and we are really hitting it off.

Don't call me again,

Anonymous (B3)

Figure 3.2. Examples of love, distance and breakup letters written by participants (n=19) when asked to write their choice of either a love or breakup letter to dairy.

3.2.1 Dairy Relationship

The 'Dairy Relationship' theme covered the multiple aspects of participants' personal relationship with dairy. A key factor identified in our participants' relationship with dairy was the affective memories they associated with dairy products: "*Oh and let's not forget the nights we've had together enjoying vanilla ice cream (a signature dish of my grandma).*" [L6]. These included positive associations with dairy products in their childhood: "*When I was a kid, you and I were inseparable."* [D1], sharing dairy products during quality time with their loved ones: "*cheese just makes for a perfect night with my wife as we drink wine together.*" [L2], and at social events: "*When cheese and dip turn up to a party with their friend, crackers, they always bring people together. Any gathering just wouldn't be the same without them.*" [L1].

Many of the affective memories described by participants were associated with positive emotions, such as comfort: *"*[You] *make me feel comfortable and safe* [when you're] *in my hot chocolate."* [L5], happiness: "*Since you've come into my life you've made me so happy.*" [L1], and love: "*Oh, Dairy how I love you. You fulfil me every day. Thank you.*" [L4]. Statements about participants' love for dairy were frequently directed towards dairy products and their qualities: "*From my love of your sweet yoghurts to the zing your sour cheeses; I'm just mad about you.*" [L5], and their need for dairy in their lives: "*I don't know what I'd ever do without you dairy! So, thank you & please never leave me.*" [L3]. However, some participants also described negative emotions towards dairy, including anger: "*For a while I was angry with you. I'd watched* [the film] '*Dominion' and afterwards I came home to throw any dairy out into the bin. Then I got upset with myself that I should have known what you did to baby calves if they were born male.... or how you treated cows."* [B1], and guilt: "*I only really see you on special occasions now, when I'm seeking out a guilty pleasure or occasionally in my tea."* [D1].

Negative emotions towards dairy were frequently attributed to participants' ethical concerns about dairy farming: "*So the reason I'm breaking up with you, Dairy, is in the hope that by doing so*, [animals] *may get a chance to […] not have to experience such a torturous life. I hope one day things turn for the better* and [they] *can live naturally again."* [B1]. Ethical concerns also contributed to participants struggling with mixed feelings towards dairy: "*I am writing this letter to pay gratitude for all that you have provided me. It is a sad time at the same time as I must say goodbye too. You were my first love as a child and I loved all the flavored milks at school. I loved my childhood memories of stringy cheese, icecreams and yummy desserts. I loved the idea of happy cows and country farms. There was something homely about it. I never really thought of it as a commercial enterprise.*" [D4].

Participants described positive relational associations almost exclusively with dairy products, while negative descriptions of participants' relationship with dairy centred on industry practices. Remembered positive and pleasurable food-related experiences have been linked to childhood memories and eating experiences shared with family and friends (i.e., social events) and are aspects of food experiences that consumers perceive as meaningful and remain in memory (Kauppinen-Räisänen et al., 2013). Food value has been linked to aspects such as taste and texture, the setting in which food is purchased or consumed and emotional value, including experience, entertainment, and indulgence (Dagevos & van Ophem, 2013). Food consumption can therefore influence people's mood and feelings, and vice versa (Köster & Mojet, 2015), likely explaining the positive emotions described by our participants when consuming dairy products. Conversely, food value is also linked to the practices and process of food production, as well as ethical considerations (Dagevos and van Ophem, 2013); aspects on which our participants centred their descriptions of negative emotions. Negative emotional reactions from the public towards common dairy farm practices such as treatment of male calves (Ritter et al., 2022), and care of cows (Wolf et al., 2016) have been found by others, underpinning concerns that standards of animal care in modern production systems are falling out of step with public values (Weary and von Keyserlingk, 2017).

3.2.2 Dairy industry

The 'Dairy industry' theme covered participants' views about dairy farming practices, producers, and their trust towards dairy production. Participants expressed negative attitudes towards many practices they perceived to be common in dairy farming: "*It took me a while to realise that the male calves you never spoke about were being taken away and slaughtered, and that their young mothers would be slaughtered a few years later when their bodies had stopped being useful to you. I have seen the real grief that these mothers experience when you take their children away and I want no part of it."* [B3], and the impact of dairy farming on the environment: "*I was forced to acknowledge the truth that the world population could not sustain cattle farming […]. Mother nature needs to heal and food security is a problem for our generation.*" [D4].

Participants shared their feelings of trust, or lack thereof, towards the dairy industry, often caused by a perceived lack of transparency and failure to meet expectations: "*I used to think it was all blue skies, sunshine, and lush green pastures. It seemed so perfect and natural. […] I soon discovered that this was not the case. I learnt that those colorful images on the packets of your tastiest foods and drinks were not the reality of your world. The reality was harsh, cruel and violent, and I very quickly wanted nothing to do with it.*" [B1]. Some participants believed that the reality of dairy farming is not aligned with what is shown to the public: "I*'d like to say it's not you, it's me… but, it's you. Now that the image you presented me of contented cows grazing in green fields in the sunshine has worn off and I have got to know the real you, I can't stay in this relationship. […] You say you care about these animals but I know that is only as far as you can make a profit from them. I guess it's a lie just like that time you said you cared about the environment."* [B3]. One participant specifically felt that the dairy industry makes efforts to hide some practices from the public: "*I got upset with myself that I should have known what you did to baby calves if they were born male.... or how you treated cows. But how could I know? It was all hidden, wasn't it? You made a great effort of that.*" [B2].

Despite participants' concerns towards dairy farming practices, their attitudes towards dairy farmers as people were positive: "*Thank you for standing strong amidst drought, fires, floods, COVID & all those alternative milk drinkers. Thanks to all the farmers dedicating themselves to this industry and working long hours to make ends meet*" [L3]. Indeed, some participants praised the industry's resilience and the importance of farmers' work to society: "*I also appreciate the fact that you provide local farmers with a job and support the local community.*" [L2].

Some of our participants included references in their letters (primarily in the breakup letters) to some of the contentious issues plaguing the dairy industry, such as early life killing of surplus calves, cow-calf separation, and cull cow welfare, indicating previous knowledge of, and negative attitudes towards, these practices. To produce milk, dairy cows generally give birth to a calf once a year that is separated from the cow within the first few days of life and raised artificially by the farmer (Cook and von Keyserlingk, 2024). Whilst some of the female calves are used as future 'replacement' milking cows, the male and some female calves are surplus to milking herd replacement requirements. In some parts of the world, including Australia, many of these 'surplus' dairy calves are managed through early life killing, a practice that involves either at-birth euthanasia on farm, or being slaughtered within the first few days of life (Bolton et al., 2024). Once the lactating cows are no longer needed, they are referred to as 'cull cows' and are sold for meat and replaced by younger female animals.

The management of cull cows, surplus calves and the practice of separating cows and calves within the first few hours of life present significant animal welfare challenges for the global dairy industry (Meagher et al., 2019; Creutzinger et al., 2021; Cockram, 2021) and have been cited by the public as being out of step with their values, once made aware (Cardoso et al., 2016; Sirovica et al., 2022; Ritter et al., 2022). Concerns expressed by our participants towards these practices were generally grounded in ethical theories of abolitionism (Sandøe et al., 2008); a perspective that was clearly communicated in the breakup letters. That some participants had previous knowledge of these practices is of interest, given that previous work has found that despite the general public's level of concern for farm animal welfare being

high, their understanding and knowledge of animal production systems is poor (Cornish et al., 2016; Boogaard et al., 2011). However, that awareness can contribute to increased levels of concern underpins reasons for other authors to suggest that educating the public into understanding why farmers undertake contentious practices is unlikely to be successful in maintaining public trust (Ventura et al., 2016). The interplay between knowledge (awareness) of specific agricultural practices and values associated with acceptance of the food produced is worthy of future study.

Participants also described concerns about the impact of dairy farming on the environment (Wolf et al., 2017), and a lack of trust based on the perception that the realities of farming practices may be hidden from the public (Broad, 2016). This sentiment is supported by Robbins et al. (2016a), who found that even the intention to restrict access to information about farming practices can undermine trust. Despite this, some participants expressed positive attitudes towards farmers as people, and there was an absence of any blame placed on farmers in the letters. This may be attributed to the historical role agriculture has played in Australia's economy (Berry et al., 2016), and the virtues associated with farmers as being self-sufficient and having a strong commitment to community (Cockfield and Courtenay Botterill, 2012).

3.2.3 Dairy Products

Participants' views about the consumption of dairy products, as well as their impact on human health and nutrition, were covered under the theme 'Dairy Products'. Participants shared that they consume dairy products for many reasons, such as their taste: "*I love the textures and flavors of your richest cheeses. I love the bite of your best Greek yoghurt."* [D2], their ability to enhance meals: "*You make everything better. There is no such thing as too much cheese, and sour cream completes every dish. I wish I could put it on absolutely everything. […] you complete me.*" [L1], and that they form part of everyday routines: "*You're always talked about, you are added to our every meal, […], you are the sweetest & sour of desserts, that finalizes the plates and cups of our children, family and friends.*" [L5].

Some participants praised dairy products for their benefits to human health and nutrition: "*And let's not forget that you make my bones stronger, my teeth healthier and my nails longer and harder. You help to prevent muscle cramps and dental cavities and even help to lower high blood pressure. You can also help me get to sleep at night. I can't make calcium on my own so I would be useless without you. Don't ever leave me.*" [L1], while others expressed desires to reduce dairy consumption due to health concerns: "*We are not breaking up but you are making my tummy too big and cholesterol too high. I have found your rice milk is yummy, sweet but not as bad for me*." [D2].

Avoiding or giving up dairy consumption was described as a difficult task by some, despite feeling they should: "*I was seriously considering breaking up with you. But breaking up with you is just too hard! I love your cheese!!! I can't eat my cereal without you! So, instead of a breakup, let's have a make-up. […] I love you too much to break up with you.*" [D5], and a challenge to maintain in the face of their love for dairy products: "*So for nearly 3 years I consumed no dairy till recently. I tried goat feta and got the taste again.... so, I kept eating other cheeses... telling myself 'It's not that bad' and convincing myself that 'I' wasn't the problem. That the dairy industry was."* [B2]. Participants also described their reluctance to be an inconvenience in social settings: "*The only time I ate dairy after that would be when I was eating out and didn't want to be a pain, either to my friends and family or to the chefs. If cheese or dairy was in something I would just eat it.*" [B5]. Plant-based alternatives to dairy products were seen by some participants as having a role a gradual transition away from dairy: "*So the first way I say goodbye to dairy was by changing to alternative milk and yoghurt wherever I could – coffee, breakfast, baking, cooking. I think this is generally the first way most people go.*" [B5], while others were less positive towards alternatives: "*My breakfast would be very bland if I did not have this real milk. Powdered milk or fake milk made from almonds or soy is just not the same.*" [L2]. Proponents of alternative dairy products praised them for being healthier and more ethical than dairy: "*Your vegan counterparts surpass you in taste, are suited for humans, and are more ethical and free of the cruelty of animal industry. I only wish that they were cheaper, more readily available, and convenient. All this will change though, and you will*

be left in the dustbin of history where your cruelty belongs." [B4] and appeared less conflicted in their decision once their relationship with dairy products had ended: "*Sorry Dairy, I've already started seeing Soy and Almond and we are really hitting it off. Don't call me again.*" [B3].

Motivations for consuming dairy products have been categorized as 'the 4Ns', being Natural, Necessary, Normal and Nice, with taste playing a strong hedonic role in consumption decisions (Collier et al., 2023). In line with our participants' sentiments, previous work has also shown that consumers see dairy products playing an important role in their daily diet (McCarthy et al., 2017), and will also cite reasons to both consume (Haas et al., 2019) and avoid (Silva et al., 2020) dairy consumption on the basis of health.

That our participants described struggling to cease dairy consumption, despite feeling that they should, is a paradox explored by Adamczyk et al. (2022). These authors suggest that when people are made aware of the problems resulting from dairy consumption, they may be pushed aside by hedonistic motives such as the desirable taste of dairy products. Participants also described experiences of cognitive dissonance related to consuming dairy products; an unpleasant state of moral conflict that provokes associated coping strategies (van der Weele, 2013). Our participants described using denial as a coping mechanism; a dissonance reduction strategy also identified by Ioannidou et al. (2024) amongst some dairy consumers made aware of animal harms arising from routine management in the dairy industry. Other dissonance reduction strategies used by consumers of dairy products include attributing less sentience and intelligence to dairy cows and expressing lower moral concern for the cow (Ioannidou et al., 2024). Further barriers to ceasing dairy consumption described by participants included dairy consumption being a social norm (Gavrilets et al., 2024), with avoidance causing potential inconvenience in social settings and disruption to group behaviour (Kish Bar-On and Lamm, 2023).

While Milfont et al. (2021) describe the probability of a sudden shift away from an omnivore diet to a vegan diet as low, some of our participants described a potential role for plant-based alternatives in a

gradual transition away from dairy consumption. In contrast, some participants described resistance to plant-based alternatives, which has been attributed by Collier et al., (2023) to either cognitive rationalization of their continued dairy consumption, and/or reservations about the sensory properties of these products, including taste. That participants who were proponents of alternative milks cited health and ethical advantages is in line with the work of others (Haas et al., 2019; Hölker et al., 2019; Janssen et al., 2016). Of particular interest, however, is that participants who eschewed dairy products in favour of alternatives described this with little to no conflict in their views, suggesting that their decision was firm, once made. Aschemann-Witzel & Schulze (2023) describe a similar phenomenon at a cohort level: grounded in social network theory, societal 'tipping points' are described as sudden, widespread changes in social norms that spread amongst socially connected peers. Whilst these authors acknowledge that a tipping point is unlikely to be triggered by one single event, actor, or intervention, they do describe the ability for tipping points to occur as a result of numerous interrelated societal processes. It could be argued that the finality described by our participants in their decision to cease consumption of dairy products may be due to them reaching an internal 'tipping point'; where exposure to multiple pieces of negative information about the dairy industry have an incremental effect over time, with the cumulative effect eventually changing their views (Rice et al., 2020). Herein lies the pressing risks, yet simultaneous opportunities for the dairy industry; by working to ensure production practices align with consumer values and thereby reducing citizens' exposure to reasons to avoid dairy consumption over time, the industry may work to preserve social acceptability, and thus the sustainability of the overall industry (von Keyserlingk et al., 2013).

3.3 Strengths, Limitations and Future research

The strength of our approach is that by asking our participants to write their choice of either a love letter or a breakup letter, we captured their top-of-mind thoughts on the concept. The decision of what type of letter to write was likely impacted by the framing effects imposed upon our participants by the myriad of information streams impacting their daily lives (i.e., Schuldt et al. (2015)); a phenomenon that

arguably every member of society is subjected to when having to make decisions about what they choose to eat. That the framing of information can affect decision making has long been known (Tversky and Kahneman, 1981).

Australia as a country is geographically and culturally diverse, and the data arising from the letters submitted by our participants are not generalizable to the wider Australian public. However, the present study does provide an insight into participants' attitudes towards the dairy industry and dairy products, and alignment or otherwise with their values. We encourage further work exploring public attitudes to the dairy industry and the products it yields, including further qualitative and quantitative research to broaden and deepen our understanding of a socially sustainable future for the dairy industry.

3.4 Conclusion

Reasons cited by some of our participants to love dairy centred on dairy products and their support for farmers; whereas reasons to break up with or distance themselves from dairy centred on specifics associated with farming practices, most notably on the care provided to the animals. Evident within the letters was a tension between desires to continue consuming dairy products and a desire to perform behaviours that align with participants' individual values. Participants' attitudes towards dairy in our study existed on a spectrum between clear love, and clear dissent, with those in the middle of the spectrum exhibiting mixed feelings and conflicted attitudes. The findings of this qualitative paper should not be viewed as representative of the Australian public but rather offer an insight into the alignment or otherwise of the dairy industry with participants' core values and the impact this has on their relationship with dairy. Working to identify and correct where industry practices fall out of step with community values will be key to maintaining social sustainability of the dairy industry.

Chapter 4. *"The advice? Think bigger"*: Community perspectives on dairy, including surplus calves – an Australian focus group study

4.1. Introduction

Citizens living in urbanized centres in the developed world are increasingly disconnected from the specifics associated with the production of the foods they consume (Gibson et al., 2020). This phenomenon has been driven in part by urbanization but also intensification of agriculture resulting, at least in the western world, in a situation where a minority of the population now produces the food for the majority (i.e., Foley et al., 2011; Sumner, 2014). Intensification has resulted in numerous changes in the food production system (Thompson, 2008), including specialization, increased use of technologies that improve efficiency (and reduce labour), consolidation of ownership (fewer but larger farms) and in the case of food animal production systems, changes in how the animals are cared for (Robbins et al., 2016b).

The sustainability of food animal production systems is increasingly being questioned. For example, cattle are a key source of greenhouse gases emissions, particularly methane (CH_4) (Wolf et al., 2017) and thus the role these animals play in climate change is gaining increased attention. However, for a food animal production system to be sustainable it must also be economically viable and socially acceptable (von Keyserlingk et al., 2013). It is the social pillar of sustainability that is often the most difficult for the food animal industries, largely because it requires broad stakeholder input if we are to set future directions and goals for research, policy, and producer innovation that coalesce into a sustainable dairy industry that also resonates with societal values (Swanson et al., 2011; von Keyserlingk et al., 2013).

Intensification has also resulted in changes in animal management practices resulting in some livestock offspring being deemed as having little economic value and consequently killed shortly after birth (i.e., male chicks in the laying industry (de Haas et al., 2021) and surplus calves in some dairy production systems (Bolton et al., 2024)). Killing of these animals raises ethical questions such as what

kind of life we owe these animals (Phillips and Molento, 2020) and whether an industry is sustainable if it requires the production of a life only to be killed shortly thereafter. Not surprising, these and many other routine management practices are increasingly being questioned by society (Weary et al., 2016), thus increasing the risk that the industry will lose its social license to operate (Rollin, 2011).

Whilst many farm animal industries rely on practices that may not resonate broadly with societal values, we have chosen to focus on a common calf management practice in the Australian dairy industry. This industry is largely pasture-based and comprises just over 4000 farms, collectively milking just over 1.2 million cows (Dairy Australia, 2023a). Most cows will give birth to one calf per year, with the majority of calves born in the spring months. The majority of calves are separated from the cow within hours of birth and raised artificially by the farmer (Dairy Australia, 2023c). Although many of the female calves are used as replacements for the lactating herd, approximately 30% of the calves are managed through early life killing, including being euthanased at birth on farm or slaughtered in the first few days of life (Bolton et al., 2024; Dairy Australia, 2023b).

Despite many people having little to no connection with agriculture (as described above), many people still hold strong values about *how* food is produced (Dagevos and van Ophem, 2013). Herein lies one of the great challenges in modern agriculture: ensuring that food animal production practices maintain alignment with the evolving core values of an increasingly disconnected public. Achieving this will require broad stakeholder engagement, including understanding public attitudes to food production practices, identifying what aspects are out of step with public values, and working towards alignment into the future.

This study is part of a series of studies that addressed our overall aim of investigating the perspectives of different stakeholders along the entire Australian dairy value chain, including dairy farmers (Chapter 6), the allied industries (including milk processors, retailers, and other associated stakeholders (Chapter 5)), and the public, on the common practice of early life killing of surplus calves.

This study specifically focuses on providing an in depth understanding of Australian public attitudes towards this issue. Given that we assumed that our participants had little knowledge of this issue we took a step-by-step approach, firstly asking them to provide their perspectives on sustainability and animal welfare more broadly, before seeking their specific views on early life killing of surplus dairy calves.

4.1.1. Positionality statement

In qualitative research, it is recognised that the researchers' life experiences and frame of reference can influence the research process (Holmes, 2020). Here we provide a positionality statement describing the position of each author in relation to the topic being studied.

Bolton is a female PhD student at The University of Melbourne and a visiting scholar with The University of British Columbia Animal Welfare Program (UBC AWP). She has worked as a veterinarian in Australia and has experience in dairy farm management and calf rearing. At the time of data collection for the present study, she was the National Animal Welfare Lead at Dairy Australia, the research, development and extension body for the Australian Dairy Industry. She currently holds the role of Dairy Beef and Animal Welfare Manager with Greenham, a beef packer operating three export accredited beef packing plants in Victoria and Tasmania.

Vandresen is a female PhD student at UBC AWP. She was born and raised in Brazil, where she obtained her Bachelor of Science degree in veterinary medicine and her Master of Science degree in Animal Welfare. She did not grow up in a farming community but has experience living and working with dairy cattle at The UBC Dairy Education and Research Centre. Vandresen has also investigated multiple topics related to animal production systems using qualitative methodologies, including pig and dairy farming practices.

von Keyserlingk is a female Professor at The University of British Columbia where she has co-led the UBC AWP since 2002. She has also held a Natural Sciences and Engineering Research Council of

Canada Industrial Research Chair in Animal Welfare since 2008. She grew up on a beef cattle ranch in British Columbia, Canada, and also worked in the agribusiness sector for seven years before joining the university as a professor in 2002. Together with her students she has published extensively in both the natural and social sciences on a broad range of topics in animal welfare, with most of this work focused on farm animals.

4.2. Methods

This study was approved by The University of British Columbia (UBC) Behavioral Research Ethics Board (protocol no H18-02880-A012) and the University of Melbourne Human Research Ethics Board (protocol no 20750). All participants provided written consent to participate.

4.2.1. Participant recruitment

Participants were recruited through a commercial market research company (Pollinate, Sydney, Australia). Recruitment of participants aimed to achieve a broad spread of demographics (age, gender identity, income), variation in attitudes towards the dairy industry, the environment, social and economic issues, and in frequency of consumption of dairy products. A convenience sample with a total of 24 participants was recruited, including four that identified as vegan, three as vegetarian, and three having a self-described connection to the dairy industry. Each participant was paid $300 AUS dollars to compensate them for their time spent contributing to this study. The authors had no previous interactions with participants.

Upon being recruited, participants were informed that the purpose of the focus group was to explore their attitudes towards dairy. As ‘homework’ before attending the focus group, participants were asked to write their choice of either a ‘love letter’ or a ‘breakup letter’ to dairy and email their letters to the facilitators (for a full description of the themes raised in the letters please see Chapter 3).

4.2.2. Focus group facilitation

Upon attending the focus group session, the 24 participants were divided into three separate focus groups of eight participants each. They then signed consent forms detailing measures taken to maintain participants' anonymity and that the results of the study would be prepared for submission to a peer-reviewed publication. All participants were informed that the session would be audio recorded; they were free to leave if they were not comfortable with this, but no one chose this option, and all elected to stay. Focus group sessions were based upon a semi-structured discussion guide (see Appendix B) developed by SB and MvK in conjunction with three trained facilitators who moderated the focus groups; all three had extensive experience facilitating focus groups on a variety of topics. The focus groups were approximately 180 min long and included two short breaks at the 80- and 130-min marks.

When conducting focus groups, it has been shown that more in-depth data is collected when a respectful environment that provides opportunities for everyone to voice their thoughts is created (Dicicco-Bloom and Crabtree, 2006). Thus, to give each participant an initial opportunity to speak, they were asked to introduce themselves and share a brief description of their 'story', including their connection to the local region and whether they had any connection to the dairy industry.

The focus groups then continued by asking the participants to convey their views on sustainability, including what it meant to them and how important it was. This was followed with similar questions relating to animal welfare as a high-level concept. Participants were then asked about their understanding of, and attitudes towards, the dairy industry, including farmers, using frame reflection (Benard and de Cock Buning, 2013) and systems mapping (Sedlacko et al., 2014) to stimulate discussions. Next, participants were asked if they would volunteer to read the 'love' and 'breakup' letters they had previously written to dairy (see Chapter 3) aloud to the group. All participants voluntarily read their letter; this served as a stimulus, specifically as a 'provoker' (Törrönen, 2002) for the focus group

discussions in that each participant conveyed their individual reflections on dairy products and the dairy industry.

In the second half of the focus group sessions, participants were read brief descriptions of cow-calf separation and surplus dairy calves, including the status of the issue in Australia and the different pathways used by farmers to manage the calves. After discussing these practices, participants were asked for their thoughts on the causes of these issues, as well as for their feedback on five broad-ranging hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia (Table 4.1). These scenarios were used to elicit discussion with participants about approaches to sustainable surplus calf management and future directions for the dairy industry. To conclude the session, participants were asked to provide advice to the dairy industry on future directions in surplus calf management, including what the industry could learn and what should be considered going forward.

Table 4.1. Descriptions of five broad-ranging hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia used to elicit discussion with participants about approaches to sustainable surplus calf management.

Scenario description
All surplus calves are grown to adulthood and eventually used for meat. This comes at an extra cost to dairy farmers but they are able to do it because the cost of milk is increased.
All surplus calves are grown to adulthood and eventually used for meat. This comes at an extra cost to dairy farmers but they are able to do it because the beef and dairy industries work together to create supply chain networks that allow farmers to be paid more for the animals.
Cows are given hormones so they produce milk without having to become pregnant, meaning these calves are never born in first place.
All surplus calves are grown to adulthood and eventually used for meat. The dairy industry does this by transforming into a network of small eco-farms that work together in a ‘circular economy’. People consume less meat and dairy and pay more for what they buy.
All surplus calves are grown to adulthood and eventually used for meat. Farmers do this by using technology that is currently available (breeding cows to give milk for longer between having

calves, breeding calves that are better fit for purpose via female sexed semen for replacement and beef crossbreeding for non-replacements, improving herd reproductive management).

4.2.3. Data analysis

Audio recordings of the focus groups sessions were transcribed verbatim by a professional transcription service (Rev.com Inc, Austin, TX, USA) and transcripts were checked for accuracy by SB and BV. To our knowledge, this is the first study to employ focus group discussions in exploring public perceptions regarding the early life killing of surplus dairy calves in Australia. Given the innovative nature of our approach and our aim to uncover public values concerning this practice, we utilized inductive thematic analysis to examine the data. This method involves analysing the data without preconceived notions about themes and codes, thus facilitating the development of a data-driven codebook (Clarke and Braun, 2017).

The transcripts were anonymized by removing all identifying information. The transcriptions were then identified by focus group number (i.e., Focus Group 1 (FG1), Focus Group 2 (FG3), Focus Group 3 (FG3)). SB and BV began by individually reading each of the transcripts and assigning descriptors to phrases (data) that were relevant to answering our research question. Descriptors were grouped by similarity to create a list of codes and sub-codes, and then codes were clustered into themes and sub-themes, resulting in an organised codebook. SB and BV then met to compare and discuss their individual codebooks, resolving any discrepancies until they reached an agreement. The codebook was validated through one round of inter-coder reliability assessment between SB and BV who each independently coded the three transcripts using the codebook. SB and BV then met to discuss differences in coding and codebook interpretation, and adjustments to the codebook were made accordingly. All authors reviewed and approved the final codebook (see Appendix C), and SB then re-coded all the transcripts using the finalized codebook (Figure 4.1). All coding was done using NVivo (QSR International Pty Ltd., version 12; https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home). In the following

section we provide an overview of each of the themes and subthemes derived from the analysis and provide example quotes from each, some of which have been modified for clarity.

4.3. Results and Discussion

Thematic analysis of the data resulted in two central themes, each with underlying sub-themes. The themes were 1) Animal agriculture as an industry, including sustainability, farmers, and farming practices and animal welfare; and 2) Personal impacts and reflections as citizens, including ethical considerations, and consumer behaviours (see Figure 4.1 for a description of the themes and sub-themes).

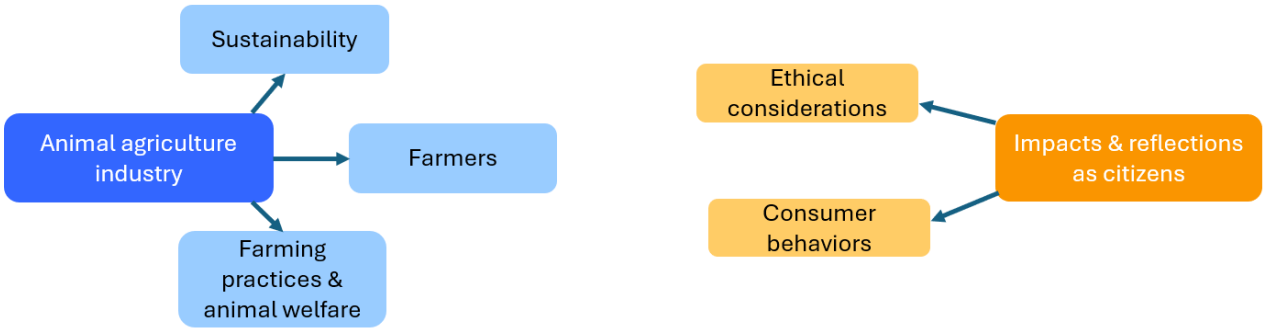

Figure 4.1. Thematic map of themes and subthemes from focus groups with 24 participants on their attitudes towards the management of surplus dairy calves and proposed alternatives to early life killing, as well as to dairy, animal welfare, and sustainability more broadly. Boxes in blue represent subthemes under the theme of 'animal agriculture as an industry', boxes in orange represent subthemes under the broader theme of 'impacts and reflections as citizens'.

4.3.1. Animal agriculture as an industry

Participants spent considerable time discussing the animal agriculture industry, with discussions largely centring on the dairy industry's sustainability (or lack thereof), their views on farmers, and their views on specific farming practices and animal welfare impacts, including early life killing of surplus calves and cow-calf separation.

4.3.1.1. Sustainability

When discussing sustainability and how it relates to the dairy industry (and agriculture in general), many participants felt that *"Sustainability is a very big, important issue."* [FG3]. Participants explored multiple aspects of sustainability and saw environmental sustainability and animal welfare as "*... go*[ing] *together."* [FG2]. Some of the discussions also centred on the impacts of agriculture on the environment: *"I think every step of the way, animal agriculture is against any kind of definition of sustainability. The biggest cause of deforestation in the Amazon is growing soy to feed the beef."* [FG2].

Climate change was frequently referenced during conversations about sustainability. For example, one participant took the stance that agriculture contributed to the climate crisis stating that *"Cows make lots of emissions."* [FG2] but another cited their concerns for the farmers stating, *"what is really important is not the effects that farming has on climate change but how climate affects farming"* [FG1]. That animal agriculture is a major contributor to greenhouse gas emissions (Wolf et al., 2017), and deforestation (Skidmore et al., 2021) has been highlighted by others, but the negative impact of climate change on farming has also been pointed out (Malhi et al., 2021). Indeed, the role of cattle farming in discussions on climate change is complex (Statham et al., 2017).

Some participants emphasised that an important component of sustainability was minimizing waste and when consuming meat, being sure to utilize as much of the animal as possible: *"I think* [we should be] *using more of that animal that we have killed and […] being more respectful to that animal by eating more of* [it] *rather than* [just] *picking three prime cuts."* [FG2]. Others linked the wasting of animal products to animal welfare issues. For instance, prior to the facilitator informing the group about the management of surplus calves, one participant stated:

"For me where sustainability and animal welfare combine is if you think about the male calves in the dairy industry, you think about old cows that aren't useful and you think about hens that aren't laying anymore, you think about greyhounds that aren't winning races anymore, animals that aren't useful anymore are slaughtered. So that is the animal welfare issue." [FG2].

Concerns for the welfare of animals deemed 'waste products' are not unfounded. Previous work has identified these dispensable animals as potential risks to the respective industries, including surplus dairy calves (Creutzinger et al., 2021); cull dairy cows (Cockram, 2021); cull laying hens (Nielsen et al., 2023); ex-racing greyhounds (Stevens et al., 2021)); male chicks (Bruijnis et al., 2015); retired race horses (Crawford et al., 2021); and surplus goat kids (Meijer et al., 2021)). These animals are often unwanted due to their low economic value, a morally problematic outcome (Bruijnis et al., 2015) arising from increased specialization of the animal production industries and contributing to ethical and animal welfare concerns (Webb et al., 2023).

4.3.1.2. Farmers

When reflecting on the role of dairy farmers in society, our community participants frequently referenced the challenges farmers face, providing statements such as *"[…] dairy farmers…they work extremely hard for what they get […] and* [there is] *a lot of risk […]. All of that time and all of that money that they put into* [the farm] *… is for nothing sometimes"* [FG1]. This led some participants to acknowledge that *"the dairy farmer [...] is so misunderstood […]. The criticism that they* [deal with] *when it comes to […] activism […] is so harsh."* [FG1]. One participant went onto question whether *"there* [is] *a space for dairy farmers in today's world at all?"* [FG2], in essence questioning whether the contributions made by the dairy industry were sufficient to overcome the challenges. This line of discussion led one participant to ask whether *"it would be prudent for society to help train the next generation of farmers to* [do] *something else?"* [FG2]. The acknowledgement by the public that farming is a hard life was also found in focus groups discussing pig farming (Benard and de Cock Buning, 2013), and is reflected in industry statistics, with less than half of those working in Australian dairy businesses reporting an effective work-life balance (Dairy Australia, 2021b). That some Australian citizens empathise with the plight of the dairy farmer has been found by others (Hendricks et al., 2022a); however, it is interesting that our participants, when discussing the numerous and mounting challenges faced by

dairy farmers (Phillips, 2024), began to question the future of a vocation long associated with romanticized tradition and sentimentality (Phillipov and Loyer, 2019).

In discussing the dairy farmers' character, our participants were divided when it came to their perspectives on farmer attitudes towards animal care. Some participants were adamant that caring for the land and animals was core to farmers' values, firmly believing that farmers were not simply about profit. For example, one participant stated that *"I think there is a very big emotional element from the farmer's point of view. I don't think we can* [say that they] *only see a dollar sign and a milk vending machine walking up and down the paddock. I do believe they see them as animals."* [FG2]. However, other participants disagreed, stating that *"I don't think dairy farmers particularly care about cows […]."* [FG2], arguing that this lack of care was driven by their need to be *"emotionally turned off"* [FG2] to undertake their work. Yet another participant took a more moderate stance, arguing that farmers are able to prioritise both the economic viability of their farm, and their duty of care to their animals: *"I do think it is absolutely business and they are looking to earn as much money as they possibly can, but I also think that farmers do have the welfare of their animals in mind."* [FG2]. Whilst economic viability is prioritized by agricultural businesses (von Keyserlingk et al., 2013), to be socially sustainable, livestock farmers must balance this with their duty of care towards animals, a responsibility that is expected by the public (Weary and Robbins, 2019). Although farmers often emphasise the importance of maintaining animal welfare (Kauppinen et al., 2010), routine duties of caring for the animals often include husbandry practices that inflict pain such as castration and disbudding. Peden et al., (2020) suggest that this paradox between caring for animals, while also running a production system that necessitates subjecting animals to pain or other compromised welfare states, may leave farmers susceptible to high levels of cognitive dissonance. Cognitive dissonance produces an unpleasant emotional state (Rothgerber, 2020), and can be met with 'convenient' beliefs about the (lack of) harm caused by one's actions, or one's (lack of) responsibility (Bastian and Loughnan, 2016). This trade-off that farmers must grapple with on a daily basis likely contributed to our participants' complex views on the role of farmers as caregivers.

4.3.1.3. Farming practices and animal welfare

The role of farm size and how this impacted the environment and the standard of care provided to animals were salient topics discussed by the focus groups. Large scale, corporate farming operations were often seen in a negative light, with references to how they affected *"the animals and the environment and* [that they were] *not sustainable."* [FG3] and participants felt it was the *"mega farms"* [FG2] that were often the subject of undercover video exposés. In contrast, smaller family operations were discussed favourably using phrases such as *"farmer Joe who literally loves his cows and probably has a name for every one of them"* [FG2]. That farm size matters to the public was also reported by Cardoso et al., (2016) who asked US citizens their views on the characteristics associated with an ideal dairy farm. Some of their respondents connected mistreatment of cows with management on "factory farms"; a metaphor that is believed to have been founded in American 20th Century culture in response to the industrialisation of farming (Lavin, 2009). Interestingly, Beggs et al., (2015) found no evidence for a relationship between herd size and adverse welfare outcomes on Australian dairy farms and Chapinal et al., (2014) reported that the prevalence of clinical lameness and severe lameness decreased with increasing herd size on Chinese dairy farms.

Participants often referenced the benefits of pasture access to animal welfare in comparison to intensive production systems. One participant felt that *"[…] a free-range style environment for the animal* [allows for] *a reasonable existence […]* [compared to] *having a feedlot of 10,000 cows per acre all coming in and just being fed grain."* [FG2]. The desire to see cows on pasture was echoed by another participant who felt *"animals* [should] *live how they were evolved to live […], not in pens."* [FG3]. Although the majority of dairy cattle in Australia are on pasture year-round (Dairy Australia, 2023a), feedlot finished cattle account for approximately half of Australia's total cattle slaughter (MLA, 2023b). In a recent survey, Hendricks, et al. (2022) reported that Australians valued outdoor access for cows and were more willing to accept strategies for heat stress mitigation that incorporated pasture, than strategies that confined dairy cows to an indoor system.

Most of our participants were initially unaware of the common dairy farm practice of at-birth separation of dairy cows and calves, but almost all reacted negatively once it was explained to them. One individual stated that *"I hadn't honestly ever thought about it, never thought about that aspect of tearing calves away from mothers […]."* [FG2]. Some anthropomorphized, relating to their own experiences as parents: *"I couldn't imagine being separated from one of my children in the first 24 hours. […] even though they are an animal, they are still a mum, and I don't agree that they would forget because I don't believe we forget who we are connected with."* [FG1]. One participant who stated that they were aware of the practice, having learnt about it from an online video, conveyed their dismay by describing how they saw *"[…] the mum cow chasing after baby cow in a truck. It is horrific."* [FG2]. A few participants also described their personal experience with the practice, for example, one participant offered: *"I actually have relatives that are dairy farmers and I have seen those cows crying and it is awful."* [FG2]. The general public's level of concern for animal welfare in food production is high, despite their poor understanding and knowledge of production systems (Cornish et al., 2016). It is therefore unsurprising that many of our participants disapproved of cow calf separation; a finding that has been reported by others (Busch et al., 2017; Hötzel et al., 2017; Sirovica et al., 2022; Ritter et al., 2022).

Participants from all three focus groups questioned whether the practice of cow-calf separation was necessary, raising questions such as *"how is it better for* [the animals] *or is it just […] better because once they take* [the calf] *away, the cow is producing more milk and it makes the dairy more productive?"* [FG1]. Others however, justified the practice, describing it simply part of dairy farming and the effects of humans domesticating animals for their own use. As one individual stated: *"We have bred an animal that produces a lot of milk so therefore we need to do all this stuff. Now in the wild, would a bovine just produce as much as milk as their calf drinks? I am guessing* [it] *probably* [would]*"* [FG2]. Most dairy industry extension programs have advocated for the immediate separation of calves from cows on the basis of improved health (Dairy Australia, 2022). However, there is a growing body of evidence that prolonged cow-calf contact may come with benefits to animal welfare (Flower and Weary, 2001; Beaver

et al., 2019; Meagher et al., 2019). Despite these benefits, the practice of immediately separating dairy cows from their calves remains common practice. Interestingly, one participant put forward the notion of simply not separating dairy cows and calves, stating:

"On my grandfather's farm, […] they had the baby with the cow and then early in the morning when they go to milk it they'll take the calf, [and] *separate them for half the day and the cow produces a certain amount of milk that the farmer gets and the rest of the milk goes back to the calf and the farmer makes sure that there's enough milk in the cow for the calf's upbringing" [FG3].*

Dairy systems that allow prolonged contact between cows and calves are gaining traction, particularly in Europe (Eriksson et al., 2022; Hansen et al., 2023). However, widespread adoption will require both acceptance of the need to find alternatives to husbandry practices that are out of step with public values, and continued research into optimal implementation strategies (Cook and von Keyserlingk, 2024).

As in the case of cow-calf separation, most participants were unaware of the common practice in Australia of early life killing of surplus calves. Again, many participants were surprised when learning about the issue: *"I'm just oblivious in my own little world […] the male, the little calves. I didn't realise that they killed them." [FG3].* However, despite their lack of awareness, some participants were unsurprised. *"It's new to me but it's not surprising. To be honest I was kind of expecting people to […] just* [show] *shock* [and] *outrage, I guess.* [But] *it feels like there's not shock and outrage."* [FG3]. Participants that were already aware of this practice believed that *"It's the biggest problem in the dairy Industry and it has been for a long time."* [FG3]. Regardless of whether they were previously aware or not, most expressed general negativity towards the practice, using phrases such as *"I was absolutely horrified about that."* [FG2]. The management of surplus dairy calves (males and females not needed as future milking cows) is a complex challenge in Australia and much of the world (Bolton and von Keyserlingk, 2021). Despite the associated social license risks, most surplus calves are managed according to the path of least economic resistance (Bolton et al., 2024), with hundreds of thousands of

calves slaughtered in the first few days of life each year (Dairy Australia, 2023b), and many others killed at birth on-farm (Dairy Australia, 2023c). Previous work has also found low awareness of the surplus calf challenge amongst the public (Cardoso et al., 2017; Herrler et al., 2023; Schulze et al., 2023), and widespread rejection of the practice of early life killing once made aware (Cardoso et al., 2017; Ritter et al., 2022). However, the lack of shock expressed by participants once they learned of the practice is of interest. Rice et al., (2020) described a similar lack of impact when the public were exposed to information about a single incident of animal mistreatment, suggesting that people are becoming desensitized to livestock animal welfare issues. It is also possible that participants may have an underlying expectation that morally questionable practices occur in animal agriculture; as was discussed in a survey of the Belgian public by Bruers (2022), where the majority of respondents believed farm animals did not have a life worth living.

When discussing the reasons for early life killing of surplus calves, many participants believed that farmers had little control over economic forces and thus had no other choice but to undertake the practice. Some defended the farmer's duty of care using language such as *"a farmer does care about his or her animals, I truly believe that, and I think that could they raise the male cows in the background if they only had the money"* [FG2]. In the words of one participant who spoke in defence of the farmer: *"*[The farmers] *are not* [saying]*, 'oh I can't be bothered, I am just going to kill all the calves'. They would love to do it the other way but […] they have been forced to enter this situation. […] If there is no money* [in raising the calves]*, they can't just go broke."* [FG3]. The sentiment from some participants that farmers only undertake early life killing of surplus calves because they have no alternative may reflect a high level of trust in Australian dairy farmers, a finding that has been described by others (Hendricks et al., 2022a). Interestingly, trust appeared to persist despite the public's negative reactions to the practice, possibly suggesting that participants viewed the issue as a symptom of 'the system' rather than the fault of the farmer. That economic viability is at the heart of the surplus calf challenge was emphasised by

Australian beef and dairy value chain stakeholders, who acknowledged that early life killing was an undesirable, but often unavoidable, task for farmers (see Chapter 5).

When participants were presented with the hypothetical future scenarios (Table 4.1) involving different approaches to addressing the surplus calf issue, the scenario that involved cows being given hormones to facilitate milk production caused much discussion. Many participants reacted using terms such as *"Horrible"* [FG2], *"Doesn't sit well with me; Frankenstein."* [FG2], and *"I would literally lie naked in a field with a sign on my head* [that says], *'that is not happening'."* [FG3]. Some described the approach as unnatural and risky with the potential for unintended consequences: *"This is how the zombie apocalypse has happened, messing around with that kind of stuff."* [FG2]. Despite this, others contemplated the trade-off between hormone use and early life killing of surplus calves. In the words of one participant: *"[…] it might be a better idea than the calves being taken away and killed and the cows being sad."* [FG3], a view that was echoed by another individual in the same group who said, *"I don't know what is the better of two evils; the calves being killed, the mother being injected with hormones - what is worse? I am not sure."* [FG3]. The strength of some participants' moral opposition to early life killing of surplus calves is reflected in the fact that they were willing to consider that hormonal induction of lactation, whilst unappealing, may still be a better option. Widespread rejection of the use of hormones in dairy cattle has been found by others, with citizens' concerns linked to potential impacts on naturalness, milk quality, and human and animal health (Millar et al., 2002; Cardoso et al., 2016, 2017). Chakraborty (2005) also found evidence of a consumer preference for mandatory labelling of milk produced with the use of the hormone bovine somatotropin (bST).

When confronted with the other hypothetical alternatives to early life killing of surplus calves (Table 4.1), some participants conveyed their desire for a future that was more than simply a *"bare minimum"* [FG2] and were willing to pay *"the extra cost of the milk."* [FG2] to achieve this. While some participants conveyed scepticism towards the concept of raising surplus calves for beef, describing it as *"wishful thinking."* [FG1], and *'unrealistic'* [FG3], others felt that *"Killing adult cows [was] only slightly*

better than babies, not revolutionary" [FG2]. Some participants were also sceptical about the merit of the scenarios put forward. In the voice of one participant: *"They all sound like the dying gasps of the desperate pleas of a business that sees itself losing ground, trying to market itself* [as] *ethical but completely missing the point."* [FG2]. One individual went further, calling for the industry to do far more to address the issue:

"None of those were particularly groundbreaking for me. I think they just rested on their laurels a bit by the sound of it. […] I only just learned about the problem and [I came] *up with one of the top 5* [solutions], *so if people are coming up with ideas like this, how is that the best they have got for me?"* [FG2].

The lack of enthusiasm shown by some of our participants towards proposed alternatives to early life killing likely reflects a level of pessimism towards the industry's ability to 'solve' the issue. Indeed, similar challenges have been described by others as a form of moral 'lock-in'; an economic system locked into ways of operating that are morally inferior (Bruijnis et al., 2015). Despite this, an online survey of the North American public found that only 16% of respondents felt that surplus calves should not be slaughtered at all, with acceptance of killing the animal often being specifically linked to the fact that the calves' lives had a purpose (i.e. contributing meaningfully to the beef supply) (Ritter et al., 2022).

Despite exploring possible solutions to the surplus calf issue, participants acknowledged the issue was complex and unlikely to have a simple solution. As one individual stated *"I don't think there is going to be* [an outcome of] *'We fixed this. Tick'."* [FG3]. Interestingly, some participants also felt that the risks to the dairy industry's social license were not limited to surplus calves. One participant stated that *"It sounds a bit flaky that they are focusing just on the bobby cow issues. That is not even half of it."* [FG2]. This caused some participants to highlight that even if the surplus calf issue was addressed, they were still unlikely to support the industry: *"For me, I am not suddenly* [going to] *turn around and support dairy because there aren't male calves."* [FG2]. Ultimately, participants encouraged the dairy industry to be

more proactive and work harder in its approach to dealing with the issue *"The advice? Think bigger. So* [come up with] *ideas* [that are] *bigger,* [take a] *holistic approach"* [FG2]. That the surplus calf challenge is highly complex and inherently linked to the additional challenge of cow-calf separation has been explored by others (Bolton and von Keyserlingk, 2021). Whilst the economic viability of alternative practices that eliminate the surplus calf issue remains a challenge (Wilson et al., 2021; Vicic et al., 2022; Creutzinger et al., 2022; Bolton et al., 2024), Webb et al. (2023) questioned the implications of small incremental changes in calf welfare and called for system-level changes that move outside the box of conventional farming systems. Other authors have called for transformative change in the management of surplus calves and cow-calf contact to address the sustainability of the dairy industry (Bolton and von Keyserlingk, 2021; Cook and von Keyserlingk, 2024), while Bruijnis et al. (2015) described the need for innovation and radical changes to morally 'un-lock' inferior practices.

4.3.2. Personal impacts and reflections as citizens

Participants also spent time reflecting from a personal perspective on the dairy industry and animal agriculture more broadly, including how it impacted them as people and impacted their behaviours. These reflections included an exploration of the ethical considerations of raising and killing animals for food, as well as their roles as consumers and their ability to impact, and be impacted by, food production systems.

4.3.2.1. Ethical considerations

Participants engaged in broad discussions regarding the ethics of raising and killing animals for food. Some participants reflected on the fact that they consume meat, but maintained strong values about how farm animals are treated. *"I eat animals, and […] have no problems with it* [but] *I do think we can be […] a little bit more conscious of how we treat* [animals]. *If we are going to […] kill* [a food] *animal then we need to make it quick, fast,* [and the] *least pain possible […]."* [FG2]. Others viewed the issue through a different ethical lens:

"For me, […] the idea of animal welfare is you don't grow animals and domesticate them to [use] *them as a source of food when you can sustain yourself on things that can just grow on the land. […]* [it means] *that animals are allowed to […] live their full life, not* [have that] *taken away from them prematurely by us […]. So, if it's a cow it stays there right to the end, till it dies of its own causes."* [FG3].

Participants also questioned different attitudes around what animals should and shouldn't be used as a protein source: *"A cow is the same as a dog,* [it] *still has a personality and a life. Why would you eat a cow versus not your dog? What is the difference?"* [FG2]. When it came to livestock, participants further questioned the ethics of killing animals at different ages *"so we are bothered by the fact that it is a baby calf but not bothered by the fact that we would be killing the cow when it is older?"* [FG3]. The perspectives communicated by participants on raising and killing animals for food were grounded in ethical theories ranging from relationism (the morality of eating animals is determined by their relationship to humans, explaining why it is common to eat cows, but not dogs) (Hölker et al., 2019), to utilitarianism (eating animals is justifiable if outweighed by the benefits), and abolitionism (humans should not use animals for their own purposes) (Sandøe et al., 2008). Indeed, eating animals is facing increased scrutiny for ethical, health, and environmental reasons (Rothgerber and Rosenfeld, 2021) and species that people consider more intelligent by the public tend to be afforded more concern (Cornish et al., 2016).

4.3.2.2. Consumer behaviours

Many of our participants reflected on their purchasing decisions and the power they hold as consumers to influence the way food is produced and its associated impacts. For instance, one participant told the group that they *"try and eat less beef just because of the carbon emissions […], not that I'm ruling out* [consuming] *beef altogether […]." (FG3.)* However, some participants were conflicted, acknowledging that making sustainable choices in terms of the food they consume is complex:

"If we go, okay we don't eat meat, […] and only eat plants and vegetables, that is fine […] [but] *there is another ethical question going on there: […] is my corn grown sustainably? Has my wheat, soy, my whatever* [been] *grown sustainably? So [..] no matter what we […] put in our mouths it will still be a* [question of whether it is] *sustainable"* [FG2].

Other participants stated they would like to stop consuming animal products but were not ready to make the change: *"For me,* [I am] *someone who is not prepared to give up beef or dairy. I am not prepared to do that just yet. […] I would like to think I have got a conscience, and I would head that way […] but I love* [lamb] *cutlets. I don't* [eat them] *often but when I do, I appreciate them."* [FG1]. Some described an ability to simply block out any knowledge of certain animal production practices as a way of continuing eating meat: *"We know a lot of what goes on behind the scenes and I know for me, I do block it out and I just buy the product."* [FG1]. Commonly cited reasons for reducing or avoiding consumption of animal products are environmental and animal welfare concerns (Haas et al., 2019; Hölker et al., 2019; Janssen, et al., 2016). Despite this, many of our participants described an internal conflict when it came to consuming animal products. Most people across the globe eat meat, yet a vast majority of meat-eaters also find animal suffering emotionally disturbing (Bastian and Loughnan, 2016). This form of cognitive dissonance has been referred to as the 'meat paradox'; a term used to describe the tension between human desire to care for animals and to not wish them harm, yet simultaneously consuming them (Loughnan et al., 2010). Available evidence suggests that some citizens are deeply conflicted when it comes to eating animals due to the misaligned nature of their simultaneous moral concern for animals (and arguably their impact on the environment) and the overwhelming norm of animal consumption (Rothgerber and Rosenfeld, 2021). This ambivalence necessitates various forms of 'coping mechanisms', including the 'strategic ignorance' described by our participants, amongst other strategies (van der Weele, 2013). Dissonance reduction strategies in individuals consuming dairy products have also been investigated. Ioannidou et al., (2024) found that awareness of animal harm in the dairy industry induced feelings of guilt about dairy consumption and associated dissonance reduction reactions similar to the meat paradox,

including attributing less sentience and intelligence to dairy cows, and expressing lower moral concern for the animal.

In further discussing their attitudes towards animal care and how it affected their purchasing and consumption behaviours, participants highlighted that being time- and energy-poor impacted their ability to engage with *"the deeper decision-making process"* [FG2] when they are grocery shopping. They also noted that animal welfare was just one of many issues vying for a place on their list of priorities. For instance, one participant stated that *"I still have bigger fish to fry than* [the dairy industry] [FG2]. Participants noted that many purchasing decisions they make have multiple ethical aspects to consider: *"There is a fatigue, I suppose you could get paralysis by* [making] *decisions in the sense of […]* [when] *you buy your clothing; is that fair trade cotton? Is it something* [else]*?"* [FG2]. That consumers are faced with multiple considerations that confound purchasing decisions has been found by others, including price, perceived brand quality, past experiences, functionality, ease of acquisition, and environmental impact (Jones et al., 2017), no doubt contributing to the fatigue and overwhelm described by our participants. This is likely further impacted by lifestyle factors, with Tanner et al., (2021) describing the ability of work experiences during the day to affect responsible consumption behaviour in the evening.

The weight of the cumulative issues to be considered when making responsible consumption decisions was suggested by some as leading to disengagement: *"we're desensitised, everything is bad, everyone is out for money, the dairy industry is just one of many doing bad things. […] to me it's just another thing that is so complicated in life […] and sometimes you just want to […] ignore it which is a terrible thing."* [FG3]. The compassion fatigue they experienced was attributed by some to over-exposure to information:

"We're desensitised and I feel like there has been a lot of vegan activism that's gone on and the activism in some ways has had a counterintuitive effect where it's trying to guilt people and say 'you're

murderers' […] and you've been made to feel like such a bad person that [you think] *'oh that's just another person telling us* [the same thing]*'."* [FG3].

Some participants acknowledged that the new knowledge about the surplus calf issue *"definitely* [changes what I think] *about the industry but would I stop eating dairy because of what I just heard? Probably not."* [FG2]. Despite this, participants suggested that as they learn more about the dairy industry, there are more reasons to stop consuming dairy products:

"I'm sort of rethinking why do I consume so much dairy? […] It might be easier to go 'oh well I like the taste of oat milk, I'll just do that' because now I hear more bad things about the dairy industry, […] [learning about early life killing of surplus calves] *might be the final push to not consume it anymore or consume a lot less of it."* [FG3].

Another individual in this focus group conveyed: *"[…] it's like a journey, so there's these little chinks in the armour along the way and then you get a tiny bit of impact here and there and then over time it brings you to that threshold where you go 'I don't need this anymore, I don't need the dairy anymore'."* [FG3]. The self-description of participants as 'desensitised' to vegan campaigns aligns with the findings of others (Tiplady et al., 2013; Rice et al., 2020). Rothgerber (2020) describes how the provision of information that appeals to reducing meat (and arguably dairy) consumption may have a 'counterintuitive' effect in some individuals, serving to instead bolster consumption through increased justification. However, Rice et al. (2020) posit that whilst exposure to individual pieces of information about animal agriculture (e.g. a media campaign) may not have a significant immediate impact on public attitudes, there may be an incremental effect over time, with the cumulative impact eventually changing public views, and associated social norms (Gavrilets et al., 2024). How this will affect humans' consumption of animal products over time remains to be seen; however, as described by Heidemann et al. (2020), emerging food production technologies and evolving cultural values may see a significant change in our relationship with non-human animals in the future.

4.4. Strengths, Limitations and Future Research

Whilst the present study provides a deep insight into the perspectives of our participants, being a focus group study, it is not representative of the views of the broader public. Despite this, well-facilitated focus group discussions provide an opportunity for participants to explore and communicate deeper perspectives including the personal values and ethical considerations that influence their day-to-day thoughts, feelings, and behaviours. A particular strength of this study was the inclusion of participants who varied widely in their attitudes to the dairy industry, such as vegans and vegetarians who participated in discussions with those connected to the industry, as well less polarized participants. Despite the potential for conflict, the discussions were respectful and insightful, with the sharing of widely different perspectives prompting participants to explore and question their own values and behaviours and contributing to a richer dialogue. We encourage more research exploring public attitudes towards food production practices, including qualitative and quantitative work that aims to identify practices that may be out of step with public values, and the viability of potential alternatives.

4.5. Conclusion

From the perspective of our participants, sustainability was an important but complex subject. When reflecting on the agricultural sector, many participants acknowledged that farmers have a hard life and care about their animals but must prioritize economics as well. Most participants were unaware of the common dairy industry practices of early life killing of surplus calves and cow-calf separation, but once made aware, there was widespread rejection of the practices. Participants were sceptical towards a range of alternatives to early life killing, seeing them as undesirable in some cases, and unrealistic or unambitious in others. Participants also explored the ethics of raising and killing animals for food, offering a range of different perspectives. This range was also reflected in their self-described roles as consumers and their attitudes towards purchasing animal products. Ultimately, our participants described their relationship with dairy and animal agriculture more broadly as a journey where a love of product and empathy for farmers was often at odds with feelings of guilt, fatigue, and dissonance related to the

impacts on animals and the environment. From a dairy industry perspective, identifying and addressing the sources of this conflict, such as cow-calf separation and early life killing of surplus calves, offers opportunities to improve the social sustainability of the industry into the future.

Chapter 5. Waste not, want not: Value chain stakeholder attitudes to surplus dairy calf management in Australia

5.1. Introduction

The primary business focus of most dairy farms is producing milk, with fluctuations in milk price usually being the greatest factor impacting farm revenue (Wolf et al., 2009). To ensure high levels of milk production, most dairy cows are managed such that they give birth annually, initiating the onset of a fresh lactation. Although many female calves remain on the farm as replacements for the lactating herd, some female and all male calves born are surplus to herd replacement requirements. Depending on the region and operating environment, these 'surplus' (sometimes termed 'non-replacement') dairy calves are managed through different pathways including being raised for veal or dairy beef, or through early life killing. In Australia, early life killing includes at-birth euthanasia of healthy calves on-farm (Haskell 2020), followed by disposal, as well as calves that are transported to slaughter as 5–30 day old 'bobby calves', a term used in legislation to describe calves under 30 days of age that are transported without their mother (Animal Health Australia, 2012) (Figure 5.1).

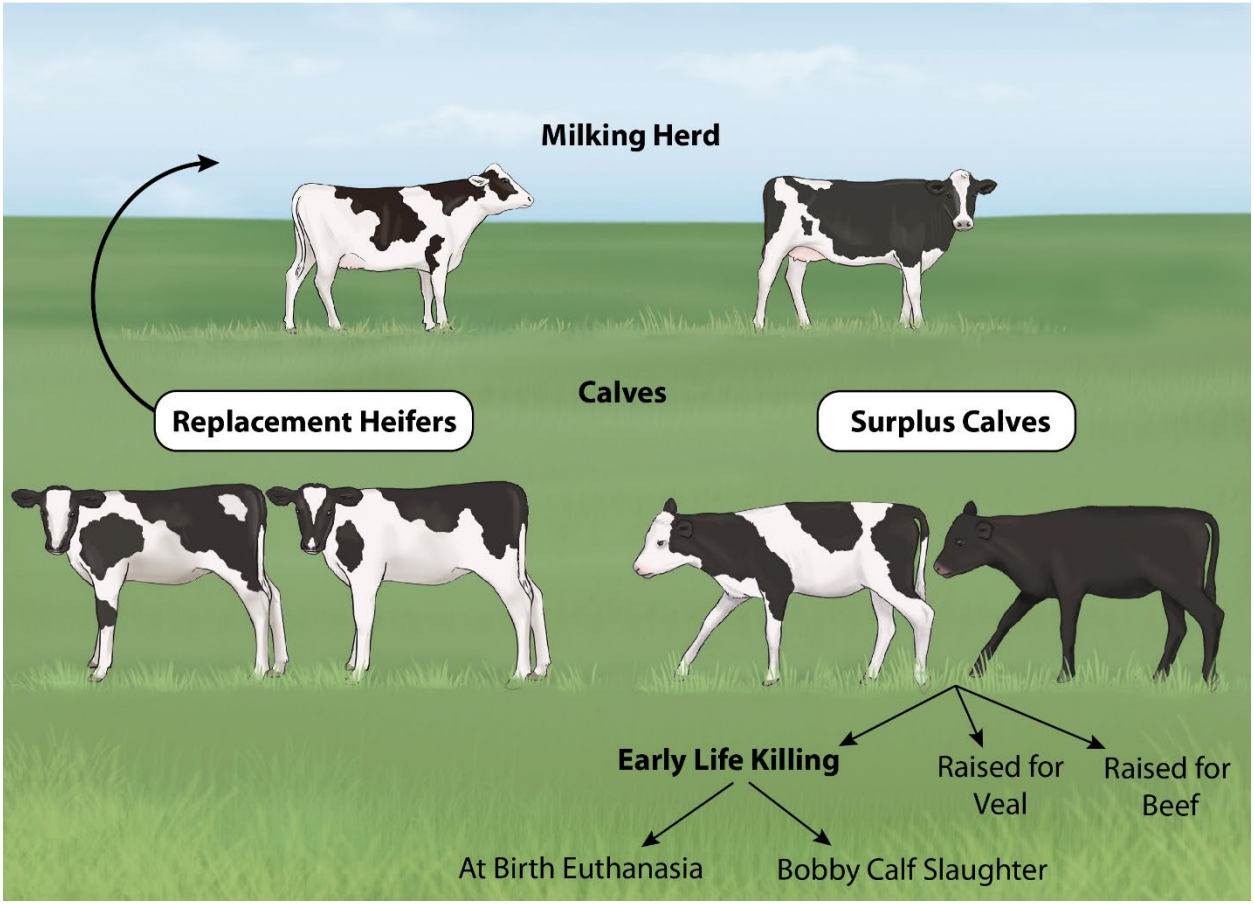

Figure 5.1. Management pathways for surplus dairy calves. (Illustration by Ann Sanderson, independent illustrator, Canada).

Given that many surplus calves and most cows culled from the dairy herd are eventually slaughtered for meat, dairy farmers are also contributors to the beef value chain (von Keyserlingk et al., 2013); 'value chain' defined as *"the full life cycle of a product or process, including material sourcing, production, consumption and disposal"* (WBCSD 2011). The contribution of beef from the dairy herd (either from cull cows or surplus calves slaughtered for meat) to a country's overall beef production varies regionally. In Australia and Canada about 10% and 22% of the beef produced, respectively, originates from dairy farms (CANFAX 2022; MLA 2022). This is much higher in the European Union (EU), given that about 65% of cattle in the EU are dairy breed animals, the majority of which will eventually contribute to the beef supply (Greenwood, 2021; Vinci, 2022).

Whether surplus calves are destined for early life killing or enter the beef value chain as veal or dairy beef is dependent in large part upon the type of dairy production system and demand for beef. Historically, predominantly pasture-based, seasonal calving dairy regions that are net exporters of beef, such as Australia and New Zealand, have been more likely to employ early life killing of surplus calves (Boulton et al., 2020; Dairy Australia, 2023b). In contrast, regions that rely more on year-round calving dairy systems and have stronger demand for domestic beef production, such as North America and Europe, are less likely to employ early life killing of surplus calves (Boyle & Mee 2021). In Australia, annual fluctuations in the numbers of calves killed in the first few days of life are influenced by commodity prices. When beef prices are low, more calves are slaughtered in the first week of life (as high as > 500,000 head in the 2014/2015 fiscal year) (Dairy Australia, 2023b), demonstrating that calves are managed according to the path of least economic risk. However, even in times of relatively high beef prices, such as the 2021/2022 fiscal year, over 200,000 calves were slaughtered at 5–30 days of age (Dairy Australia, 2023b), while farmers reported that in 2022, they expected to kill 5% of their calves at birth, on-farm (Dairy Australia, 2023c). Calves destined for early life slaughter are vulnerable to compromised welfare on farms, during transport and at abattoirs. Stressors include food and water deprivation, disease, injury, stress from handling, social mixing, and new environments (for a review, see Creutzinger et al. 2021; Roadknight et al. 2021). Moreover, the practice of early life killing of a healthy calf presents an ethical dilemma that is separate to scientific animal welfare implications (Haskell, 2020).

Early life killing of surplus calves has been argued by some to be out of step with public values (Ritter et al., 2022), bringing into question the industry's ability to retain its social license to operate (Bolton & von Keyserlingk 2021). Originating out of the mining industry, the concept of a social license was introduced to encompass the non-regulatory political and social risks presented to an industry or business outside of any formal licensing or permits required (Cooney, 2017). The loss of a 'social license' refers to the withdrawal of societal support for an industry or practice, often resulting from outrage and

associated loss of trust when the broader community learns of a practice or event that is out of step with their expectations (Hampton et al., 2020).

Livestock production systems are fraught with issues that many stakeholders find contentious (Weary et al., 2016), giving rise to moral dilemmas: situations that arise when societal values conflict with livestock production practices, often resulting from unintended consequences (Gremmen, 2020). Some of the most challenging moral dilemmas in animal agriculture include the killing of day-old chicks (de Haas et al., 2021) and early life killing of surplus calves (Haskell, 2020). Routine highly contentious agricultural practices that are entrenched within the system have been referred to as a type of moral "lock in" (Bruijnis et al., 2015). These "locked in" practices are difficult and costly to change, often involve choosing the least of several possible evils (Gremmen, 2020), and in some specific cases are argued to meet the criteria of 'wicked problems' (Bolton & von Keyserlingk 2021). The challenge for the global dairy industry going forward is to implement sustainable management strategies for surplus calves that are both economically viable and socially acceptable. In practice, this means prioritising pathways for surplus calves that provide them a reasonable length, quality, and purpose of life (Ritter et al., 2022).

The implementation of economically viable alternatives to early life killing of surplus calves, such as raising them for beef, is a persistent challenge. For example, over 200,000 bobby calves were slaughtered at 5–30 days of age in the 2021–2022 fiscal year despite record high beef prices (Dairy Australia, 2023b), and continued growth in the sales of sexed semen and beef semen to dairy farms employing beef on dairy breeding strategies (NHIA 2022). Implementing sustainable beef pathways for surplus dairy calves is made even more challenging by a lack of clarity regarding the needs of multiple beef and dairy value chain stakeholders. These stakeholders include, but are not limited to, genetics companies, calf growers/rearers, beef finishers, dairy processors, beef packers and retailers. Given the diversity of stakeholders, the complexity of the value chain and little knowledge of their different perspectives, it is not surprising that technical solutions attempting to solve this issue (e.g. sexed semen and beef on dairy breeding strategies) have failed to create widespread, sustained change. Moreover, as

Bolton and von Keyserlingk (2021) argue, issues that meet the criteria for a wicked problem require transformational change. In essence, the problem of early life killing of surplus calves must become an "unlocked" moral issue (Bruijnis et al., 2015), as only then will sustainable solutions be identified and implemented.

Many different approaches have been suggested for tackling wicked problems. One element that most approaches have in common involves identifying and working with the needs of all stakeholders (see Chapter 2). As such, the aim of this study was to describe the views of post-farm gate beef and dairy value chain stakeholders regarding surplus calf management practices in Australia and how the industry might implement alternatives that are socially acceptable and economically viable into the future.

5.2. Materials and methods

5.2.1. Ethical approval

This study was approved by The University of British Columbia (UBC) Behavioral Research Ethics Board (protocol no H18-02880-A012) and the University of Melbourne Human Research Ethics Board (protocol no 20750). All participants provided written consent to participate.

5.2.2. Positionality statement

In qualitative research, the researchers' experiences can also influence the research process, as researchers act as instruments for collecting qualitative data (Holmes, 2020). SB is a female PhD student at The University of Melbourne and a visiting scholar with the UBC Animal Welfare Program (AWP). She grew up on beef and dairy farms in Australia before obtaining her Bachelor of Veterinary Science degree. She has since worked in veterinary practice and has experience in dairy farm management and calf rearing. At the time of data collection for the present study, she was the National Animal Welfare Lead at Dairy Australia. BV is a female PhD student at UBC AWP. She was born and raised in Brazil, where she obtained her Bachelor of Science degree in veterinary medicine and her MSc degree in Animal Welfare. She did not grow up in a farming community but has lived experience working at The UBC

Dairy Education and Research Centre. MvK is a female Professor at UBC where she has co-led the UBC AWP since 2002. She grew up on a beef cattle ranch in Canada and worked in the agribusiness sector for seven years before joining the UBC AWP as a Professor in 2002.

5.2.3. Participant recruitment

Participants selected for this study were individuals who worked in management roles for organisations known to play a key role in either the Australian beef and/or dairy value chains. Participants were initially identified via email or phone through existing networks held by SB. Those that agreed to participate were informed of the study details and asked to sign the consent form (via email). Initially, ten companies were contacted but two stated that they were not interested in participating and one elected to participate but did not sign the consent form (and was thus not included in the study). The seven organisations that participated comprised one genetics company, one beef finisher, two beef packers, two milk processors, and one retailer, forming a convenience sample.

The first version of the semi-structured interview guide was prepared by SB and revised by MvK. The interview guide was then circulated for comment to three individuals, all of whom had previous experience with undertaking interviews but were not subject experts. All comments received were discussed and the interview guide revised accordingly (see Appendix D).

In total, 12 representatives from seven organisations (ranging from one to four participants) were interviewed via Zoom (Zoom Video Communications Inc 2021) by SB in partnership with an external consultant experienced in market research interviews. Each interview lasted between 60 and 90 min. After initial introductions, the participants were asked for consent for the meeting to be recorded. The interview started by asking the participants about their understanding of the surplus calf issue and whether their company had ever held discussions on how to address it. This was followed by a brief overview of a wider participatory framework project exploring the surplus calf challenge involving farmers, pre-farm gate advisors and community members. Interview participants were informed that the results of their

interviews would be de-identified and shared with the participants of the participatory framework project and prepared for publication.

To elicit further discussion, participants were asked to provide feedback on four possible future scenarios involving different approaches to addressing the surplus calf issue in Australia (Table 5.1). The scenarios were created to reflect a broad range of different high-level approaches, based on common themes in industry-level discussions held by SB during the three years she worked for Dairy Australia. Participants were then asked about their views on responsibility, co-operation, and collaboration along the value chain to address the surplus dairy calf issue. Lastly, participants were asked whether they would like to provide any additional input at the end of the interview.

Table 5.1. Descriptions of four broad ranging hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia used to elicit discussion with study participants on approaches to sustainable surplus calf management.

Scenario description
All surplus calves are grown to adulthood for the beef supply chain. This is able to be done because the costs are covered either through milk price increase or supply chain cooperation.
Hormones are introduced to enable cows to continue to produce milk without having to repeatedly become pregnant, meaning surplus calves are never born in first place.
The local dairy industry transforms into a connected network of farms that work together on a solution. The solution differentiates the region's milk and/or dairy beef and attracts a premium.
Farmers use technology that is currently available including sexed semen to reduce male calves being born. The remaining calves either enter the dairy industry or are grown to adulthood with optimized nutrition and production for the beef supply chain.

5.2.4. Data analysis

Audio recordings of seven interviews were transcribed by a professional transcription service (Rev.com Inc, Austin, TX, USA). All identifying information was removed from the transcribed data,

including the names of participants, the organisations they represented, and any quotes that made themselves or their organisations identifiable. Where there was more than one participant in an interview, efforts were made to separate the quotes by individual participants. The transcriptions were identified by the interview number only (i.e. Interview 1).

All transcribed data were submitted to thematic analysis using an inductive approach (Braun & Clarke 2006). Inductive thematic analysis is based upon the creation of codes without a pre-existing coding frame, where the collected data drives the analysis, rather than the analysis being driven by pre-existing theory or questions defined in the interview guide, as is used for deductive analysis (Clarke & Braun 2017). Inductive analysis was selected to understand how participants viewed the broad-ranging complexities of surplus calf issue (Bolton & von Keyserlingk 2021). That value chain stakeholder attitudes to this issue have been relatively under-studied was further reason to select inductive analysis over deductive.

The development of the codes began with the extensive reading of the transcripts and familiarisation with the data until patterns were identified. Both SB and BV independently developed the initial codes, then discussed their findings. During this process, the codes were reviewed and refined throughout the data analysis (i.e. specific codes were merged into broader codes and *vice versa* until clusters of similar codes were developed). The code clusters were merged into sub-themes, which were connected into broader themes. Intercoder reliability (between BV and SB) was established, wherein both authors coded the data independently using the draft codebook followed by discussions where they compared results and refined the codes and themes. The codebook was further reviewed through in-depth discussions with all authors to address any remaining discrepancies before the final codebook was agreed upon (see Appendix E). BV then used the final codebook to code all the transcripts using NVivo (version 12, QSR International Pty Ltd, USA). In the following section we describe each of the themes and provide quotes, some which were modified for clarity, to exemplify ideas from each of the sub-themes.

5.3. Results and Discussion

Participants discussed three main themes regarding the management of surplus calves in Australia, each with three underlying sub-themes (Figure 5.2). The themes were: 1) Ethics of surplus calf management, including concerns about societal views, personal views of industry stakeholders, and animal welfare, ethical and public perception implications of different practices; 2) Economics of surplus calf management, including disunity amongst beef and dairy industry stakeholders, opportunities to improve the quality and profitability of dairy beef, and logistical and practical challenges of alternatives to early life killing; and 3) Moving towards solutions including affecting practice change, the role of leadership and collaboration, and downstream benefits of dairy beef production.

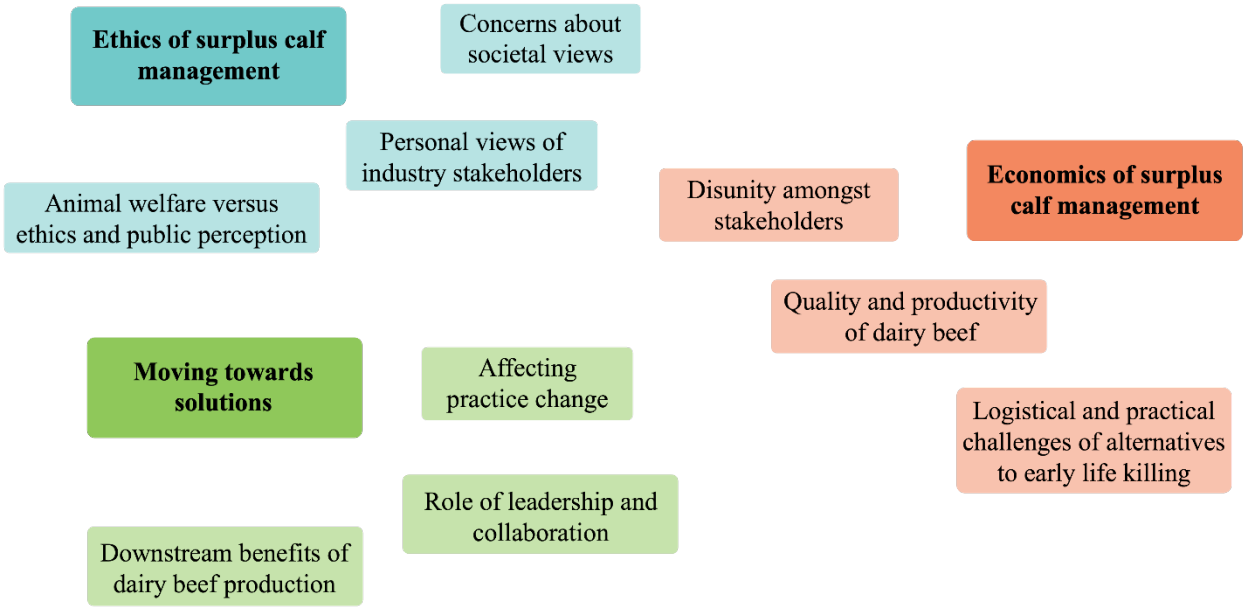

Figure 5.2. Thematic map of themes and subthemes from interviews with seven beef and dairy value chain stakeholders on their attitudes towards surplus dairy calf management. Boxes in blue represent topics within the broader theme of ethics of surplus calf management. Boxes in orange represent topics within the broader theme of economics of surplus calf management. Boxes in green represent topics within the broader theme of moving towards solutions.

5.3.1. Ethics of surplus calf management

Participants frequently defined early life killing of surplus dairy calves as an ethical issue with societal views being their primary concern, but also provided their personal ethical concerns regarding the issue. Participants also explored the complex relationship between animal welfare and ethics regarding the practice of early life killing.

5.3.1.1. Concerns about societal views

Many participants believed that early life killing of surplus dairy calves poses a risk to the dairy industry's social license. In the words of one individual *"...* [the bobby calf issue] *cuts to the heart of the social license to continue to dairy"* [Interview 2]. In terms of a business risk, one participant was concerned that *"if there was poor welfare practice, such as treatment of bobby calves in some way it would definitely be a risk to us"* [Interview 5]. Some organisations also conveyed that: "*We no longer do that* [slaughter bobby calves] *as* [it is] *a risk to our business and from our customers' perspective […] and there was certainly pressure from the companies that we deal with for us to drop the bobby calf kill*" [Interview 4].

The concerns expressed by the participants regarding risk are not unfounded, given that once aware, the public will likely not support early life killing of calves. In an online survey, only 3% (of 998 participants) stated that they regarded slaughtering calves less than one month of age as appropriate (Ritter et al., 2022). Whilst some countries have already worked towards halting the practice of at-birth euthanasia of healthy calves on-farm (e.g. Great Britain; (AHDB 2020)), to our knowledge, no country to-date has banned early life slaughter of surplus dairy calves for meat.

Participants commented on the contribution of social media and undercover exposés to the vulnerability of the dairy industry. In the voice of one participant "*I think the consumer is more aware that you can't simply tell a story about the management of female calves anymore and I think the rise of social media again makes everyone clear what the vulnerability is*" [Interview 2], particularly, if

"*someone happens to get pictures [...] and it hits the front page"* [Interview 7]. The fear of undercover media exposés is not surprising nor unwarranted. Exposés have increased the discussion of farm animal welfare in other regions (e.g. the United States (Shields et al. 2017)) and in Australia (e.g. the ban on live cattle export to Indonesia (Schoenmaker & Alexander 2012)). Interestingly, some participants acknowledged the importance of working to avoid this risk altogether by *"make*[ing] *sure that we're ahead of the game or otherwise* [it's] *just another reason for a bad news story to hit mainstream media"* [Interview 1].

Concerted efforts to implement minimum standards on some aspects of animal care have been made, such as prohibiting the use of blunt force trauma as a method of euthanasia (e.g. Australia (Animal Health Australia 2016; Australian Dairy Farmers 2020); New Zealand (New Zealand Ministry of Primary Industries 2016); Canada (DFC-NFACC 2023)). However, compliance with these types of minimum standards will likely not be sufficient to maintain public trust if the practice fails to resonate with societal values (Weary & von Keyserlingk 2017). For instance, a New Zealand milk processor recently announced that effective from June 30, 2023, they would no longer purchase milk from farms that euthanase healthy calves on-farm (Fonterra, 2022).

Participants also mentioned the possible risk of compromising the good image of the Australian agriculture: *"Really as a country […] we are seen to be really good on the animal welfare status and we are seen as that clean green* [image] *and that's not just from the dairy industry, that's from the beef industry, that's Australia's agricultural industry as a whole"* [Interview 1]. The use of pastoral images to promote dairy farming have long been used by the Australian dairy industry (Phillipov & Loyer 2019), where the majority of a cow's diet comes from grazed pastures (Dairy Australia 2023c). Promotion of the pastoral image by the agricultural industry has been linked to the long-standing support given to this sector by its citizens (Cockfield & Botterill 2012).

Potential links between surplus calf management practices and cow-calf separation (for a description, see Meagher et al. 2019) were also raised by our participants. In the words of one participant: "*I think if you're a* [member of the] *general public and you see these baby cows being transported, lots of people will see them, baby calves without their mums being taken on this scary journey*" [Interview 7]. Although awareness of cow-calf separation is generally low amongst the public (Ventura et al., 2016), once aware, there is little to no support for this practice (i.e. Hötzel et al. 2017; Sirovica et al. 2022). Although the public generally exhibit negative attitudes towards both practices, attitudes towards early life killing have been shown to be more negative than cow-calf separation (Ritter et al., 2022).

5.3.1.2. Personal views of industry stakeholders

That individual participants grappled with the ethics of early life killing was evident as they conveyed their own personal views and experiences. One participant, who entered the dairy industry in adulthood, described being shocked when learning about early life killing of surplus calves:

> *"I'd drank milk my whole life and I never actually even considered* [where] *it comes from, except for all those children's books you read where it's all about a happy mum cow making the milk […]. It really was a shock to the system when I entered the food industry and realised where my food came from and I thought that I was educated coming into it that, having gone to university and studied the food industry and all these things, that it never even actually came up in my curriculum while I was studying" [Interview 7].*

Another participant who had grown up in the industry stated that "*I increasingly can't come to terms with the early age euthanasia of calves just because they're not going to be reared. That's something that we've put in place and we're saying it's okay, […] well I personally just keep reconsidering that and I just don't find it acceptable in the long term*" [Interview 5].

Participants also acknowledged that early life killing of calves was a matter of concern for farmers. However, despite the practice being commonplace, participants believed that farmers found the task undesirable: *"I have never seen anyone enjoy euthanasing an animal […], people want to do the right thing.*" Indeed, as another participant said, *"I think a lot of farmers […] think that what they are doing is best practice and I do not think anybody intends to do the wrong thing or something that is not humane or economical or socially acceptable"* [Interview 7]. Others have highlighted cognitive dissonance as the reason explaining the disconnect between farmer beliefs or values and what they do in practice (Neave et al., 2022).

The role of farmers' mental health was also acknowledged: *"The mental health and well-being of a farmer is fundamental to the level of assurance you're going to get about how they manage the well-being of their animals"* [Interview 2]. Looking at the Australian dairy industry, 92% of dairy farms are family owned with only 45% of those working in the business reporting the dairy industry provides them an effective work-life balance (Dairy Australia 2021). A lack of work-life balance and associated fatigue for people working in and on the business may contribute to reduced mental health which has been linked to poor animal welfare outcomes (King et al. 2021), underpinning this as a key area of focus for addressing the long-term sustainability of the industry (Kato et al., 2022).

Social sustainability is often discussed in the context of society's views about farming (von Keyserlingk et al., 2013). However, our results emphasise that industry stakeholders also have their own ethical concerns about early life killing of calves, forming an additional dimension that should not be overlooked (Segerkvist et al., 2020).

5.3.1.3. Animal welfare versus ethics and public perception

When managing surplus calves through early life killing, participants voiced that the interplay between animal welfare impacts and ethical views of different stakeholders was complex. "*Some people may have the view that actually humanely euthanasing on-farm is actually kinder to the calf if you can't*

take it onto somewhere else [while] *other people may say actually we're completely against euthanasing*" [Interview 7]. Whilst some argued that correctly performed at-birth euthanasia avoided welfare challenges, they acknowledged the ethical dilemma this stance created.

> *"If euthanasia is being conducted in* [an] *appropriate fashion by an appropriately trained staff member and […] blunt force trauma is avoided except when there's absolutely no other option* [then welfare compromise can be avoided]. *But […] if someone did a dump* [launched an exposé] *on us it's going to look really bad and murdering baby calves – that can never have a good look even when it's done humanely"* [Interview 5].

At-birth euthanasia was also seen by some to offer a better welfare outcome in some situations. As one participant said "*I think also […] what's really important is […] ensuring that these calves are getting the correct welfare. There's no point in rearing a calf if it's going to have terrible welfare*" [Interview 7]. Indeed, whilst some argue that when an animal is euthanased correctly there is no compromise to its welfare (Walker et al., 2020), the context under which the animal is killed may still be at odds with a person's core values (Ritter et al., 2022).

Conversely, some participants saw calves slaughtered in the first few days of life and directed into the food chain as justified because the animal is not wasted. As stated by one participant: "*I think it's easier to make the concept palatable if there is a purpose in the death so a calf going to become a foodstuff is an easier sell than a calf that just goes into a hole in the ground*" [Interview 5]. This belief led some participants to argue that the challenge lies in educating the public into understanding this concept, for instance, one participated stated:

> *"In certain areas I think we've actually got it right if we're going to continue with the belief that an appropriate welfare-friendly, sustainable practice is early destruction of male calves to go into the meat industry and the industry seems comfortable with that. It's whether we can perpetrate that belief into the wider community"* [Interview 5].

Previous attempts to educate the public into accepting 'contentious routine dairy practices' have failed given that the practices themselves were at odds with public values (Ventura et al. 2016; Hötzel et al. 2017). In contrast, one individual argued that: *"[…] early slaughter is not a good message…, it is still a baby calf being killed for meat production which, I [...] think is really hard one to try and communicate"* [Interview 7]. Many participants acknowledged that public perception is a key determinant of sustainable surplus calf management practices:

> "*I think in terms of the bad news story,* [the question is] *would it pass the pub* [public approval] *test? I think if the bobby calves have been grown out* [for beef] *and there's a story behind it* …[and] *it's not that they're being euthanased on-farm or just sent straight to slaughter then I think it's a nice story*" [Interview 7].

Our findings indicate that early life killing of young dairy calves is an ethical dilemma for many industry stakeholders, with some justifying early life slaughter of surplus calves while others felt there was no justification for early life killing.

5.3.2. Economics of surplus calf management

Participants frequently emphasised that economic viability is at the heart of the surplus calf challenge and that it is both a key driver of the status quo and a barrier to sustainable change. The traditional separatism of the Australian beef and dairy industries was highlighted as a key contributor, along with the logistical and practical challenges of implementing alternatives to early life killing. Participants also highlighted several challenges and opportunities to improve the quality and productivity of dairy beef as a viable alternative to early life killing.

5.3.2.1. Disunity amongst stakeholders

Participants acknowledged that "*most* [dairy] *farmers don't see past the farm gate"* [Interview 7] and this limited understanding of beef supply chains impacted their ability to implement economically

viable dairy beef systems. Participants often attributed this to a lack of *"[…] tools or the ability* [of farmers] *to follow* [dairy beef] *programmes for these sort of cull animals"* [Interview 3]. Participants also highlighted that *"Typically* [it's been assumed that] *a dairy cross or a dairy steer [...] won't get the weight gain* [and this] *will affect your production"* [Interview 1]. This, in turn, was seen to perpetuate negative attitudes about dairy beef. For example, one participant stated that "*As soon as you say dairy cross, most feedlots and abattoirs just switch off straight away"* [Interview 6].

The perceived lack of unity described by our participants between the beef and dairy sectors has been attributed by some to dairy farms traditionally viewing their businesses as producing only milk and thus in isolation of being able to contribute to beef production (Wolf et al., 2009; Vicic et al., 2022). Some called for greater emphasis on the different contributions that beef production could add to the dairy business *"[...] this calf […] is an offshoot which should add value"* [Interview 3]. However, some argued that for dairy beef to be viable there needed to be *"[…] some* [economic] *margin*" [Interview 1].

Participants believed there to be opportunity for the dairy and beef industries to co-operate in directing surplus calves into beef production, creating mutual benefits. However, it was also emphasised that "*[…] a lot of people just don't understand that we need to utilise what the dairy industry has got […]* [and] *we need to utilise it efficiently*" [Interview 3]. Participants believed that improved understanding by the farmers on the needs of the value chain was necessary to make this co-operation possible. However, they also conveyed that everyone involved, including the farmer, must accept *"their responsibility in the supply chain*" [Interview 1]. The role of the farmer was viewed as key:

> *"*[Dairy farmers] *need to understand what that target market is and what they can do within their breeding operation to ensure that they've got* [a calf] *that's feasible for someone that a) they're not going to get docked* [discounted] *because it's a dairy steer, or b) because they know it's going to hit the economical pocket that they're doing something to progress and move forward in that space to ensure they've got a pathway*" [Interview 1].

Calls for increased collaboration between the cattle industries and the associated beef value chain has been raised by others (AHDB, 2020); embedded within this collaboration is the need to ensure that any negative cultural attitudes amongst beef stakeholders towards surplus dairy calves as beef animals must be overcome.

5.3.2.2. Quality and productivity of dairy beef

Participants identified challenges and opportunities in maximising the quality and productivity of dairy beef production with an emphasis on breeding and managing calves according to market demands. In selecting beef genetics to maximise the viability of surplus calves for beef production, participants noted that whilst dairy breeds often exhibit valued meat quality traits such as marbling (Pfuhl et al., 2007), they can perform poorly in terms of carcase yield and conformation (Clarke et al., 2009). One participant argued that "*The dairy breed has a lot to offer from* [an] *eating quality side of things, however it all comes down to muscle expression in those primal* [cuts]" [Interview 1]. In looking to improve the viability of surplus calves as beef animals, participants emphasised the need to select the correct beef sires. As stated by one participant: "*If they're using some good genetics in that beef side, their* [offspring] *is going to be a lot more marketable and a lot more favourable*" [Interview 1]. The use of sexed semen in combination with beef crossbreeding has been promoted as a 'responsible' breeding strategy (AHDB, 2020).

In discussing the marketing of dairy beef animals, participants struggled with the merit of branding products as beef that originates from the dairy herd. As one participant stated:

> "*I know there's been talk about coming out with a dairy beef brand and* [trying to] *market* [it]. *I don't think you want to highlight the fact that it comes from dairy […] if you don't have to tell* [consumers]*, why tell them? I think* [if you do] *you'd be giving yourself a discount on the beef price before you start*" [Interview 3].

Along the same line, some conveyed that "*the* [dairy] *producers […] want to get paid a premium for it because they think they've got a premium product. Well at the moment they haven't*" [Interview 4]. Generally, participants emphasised that achieving sustainable markets was dependent on *"… going out and doing the homework around your markets and finding out if there is 1) a customer, a retailer or a consumer that is going to take the product you've got, to get it through the door,* [and] *2) whether they're going to pay you a premium for it*" [Interview 4]. Whilst beef from dairy breed animals tends to rate highly in terms of meat quality, red meat yield has been a primary reason for packer discounts on dairy beef. Although evidence of dairy beef being marketed at consistent premium with scale is lacking, it has been shown that beef produced from surplus dairy calves can be successfully marketed alongside conventional beef products when strategically bred and fed for pre-determined markets (Foraker et al. 2022).

Given that beef from the dairy herd already makes up a large percentage of global supply (Greenwood 2021; Foraker et al. 2022) where it is largely not distinguished from beef originating from beef herds, it is unsurprising that value chain stakeholders expressed doubts over the ability to create 'new' markets for dairy beef in Australia. Indeed, marketing beef as dairy origin may pose additional risks, should citizens become aware that differences exist in terms of whether the calf was reared by its mother, as is the routine in the beef industry, or immediately separated, as is routine in the dairy industry (Ventura et al., 2016).

5.3.2.3. Logistical and practical challenges of alternatives to early life killing

When discussing the implementation of alternatives to early life killing, participants highlighted several challenges involved with rearing the calf from birth to finishing. It has been well documented by others that the rearing of surplus calves is fraught with health and welfare challenges (for a review, see Creutzinger et al. 2021). Participants also noted that, to date, Australia does not have a well-established dairy beef calf rearing industry and that "*it's the next step in the chain that needs to be built"* [Interview

6]. The lack of rearing capacity is likely a consequence of the perceived economic risk associated with rearing surplus calves for beef (Vicic et al., 2022). Participants also acknowledged that long-term success would require having different options for different farm businesses, recognising that *"Some people are going to be happy to rear the calves* [while others] *want to send them to a calf-rearer"* [Interview 6].

Inadequate calf-rearing capacity and knowledge were viewed as key challenges in implementing sustainable alternatives to early life slaughter. Artificial rearing of dairy calves in the absence of the dam requires careful attention to health, environment, nutrition, and welfare (Mee, 2008). Indeed, challenges already exist in the care of replacement heifers; for example, 38% of Australian calves failed to receive adequate transfer of passive immunity (Vogels et al., 2013) despite concerted industry extension efforts to improve colostrum management. Evidence exists that surplus calves are less likely to receive appropriate colostrum management compared to replacement heifer calves (Shivley et al. 2016). Additional challenges highlighted by participants included "*biosecurity and* [in some cases] *20% mortality rates and probably 50% morbidity rates so half of all the calves that arrive on the farm have to be treated for some condition and 20% of them are dead*" [Interview 5]. Indeed, managing biosecurity and other stressors, such as mixing and transport, particularly when sourcing calves from multiple birth farms to rear in a central location are well known contributors to increased risk of morbidity and mortality (Renaud et al., 2018a; Wilson et al., 2020b).

Participants also noted that highly seasonal calving systems may overwhelm either calf rearing capacity on-farm, or an abattoir's capacity for bobby calf slaughter, collectively increasing at-birth euthanasia. For example, "*One of the issues in Tasmania has been that there is only really one place that they process dairy calves and they are massively into a spring and an autumn* [calving] *drop* [in that region]. *[…] so the abattoir cannot handle them all and they just have to get knocked on the head"* [Interview 3]. Unsurprisingly, regions in Australia with more seasonal calving and more Jersey and Holstein-Jersey cross cows have higher rates of early life killing of surplus calves and less dairy beef production (Dairy Australia, 2023c).

Participants also commented on the volatility of the Australian climate (Raedts et al., 2017) and that *"there is always competing priorities, if there's not a drought it's a flood and if it's not that it's the price of produce and what's happening in other countries and exports and things like that"* [Interview 7]. The impact of seasonal variation and other market factors on commodity price volatility has been reported as a major contributor to the economic viability of the industries dependent on surplus calves (Raedts et al., 2017). The impact of price volatility on confidence in the long-term economic viability of dairy beef value chains was made clear by one participant:

> *"Like every time when we go through those big spikes in beef prices, everyone goes 'oh I can buy a calf at 20 kgs for 700 bucks' and then by the end of the time when it comes round to selling the animal it's only worth $1,000 in the market because it's a dairy cross and* [they realise] *'I've run that animal for 2½ years for 200 bucks'. So that's not what we want to do"* [Interview 3].

Beef commodity prices are often lower during times of drought in Australia (Countryman et al., 2016), and the annual number of bobby calves slaughtered tends to be higher during low beef commodity prices (Dairy Australia, 2023b). With the impact of climate change likely increasing the severity of future droughts (Vicente-Serrano et al., 2020), implementing long-term, sustainable dairy beef production systems will require solutions that can withstand future volatility in seasonal conditions and commodity price environments.

5.3.3. Moving towards solutions

Despite the associated challenges, participants emphasised the importance of implementing viable alternatives to early life killing of surplus dairy calves. Different approaches to affecting change were explored from both an industry and farmer perspective, along with the importance of leadership and collaboration. Finally, several unique opportunities were highlighted as downstream benefits of long-term, widespread change.

5.3.3.1. Affecting practice change

In discussing the need to implement widespread change in a reasonable timeframe, participants acknowledged that:

> *"Like in any community* [or] *industry you've got a percentage of people who are go-getters, change-makers, and can see the role of the industry and the benefit of it and then you've got a group of people in the middle* [who] *will go one way or the other depending on the difficulty or the ease and then you've got that bottom group of people who for whatever reason sit on their hands"* [Interview 3].

The impact of tradition and culture in the agricultural sector on farmers' willingness to change was also highlighted. *"It's different for different people but doing what you've always done and what your father or your mother did, it is a very large part of it"* [Interview 2]. That farmers vary in their attitudes to implementing change has been recognised (Munoz et al., 2019), whilst the influence of tradition and self-identity on Australian producer attitudes to sustainability and adapting to change has been explored by others (Lankester, 2012).

In affecting change, some participants emphasised the need to ensure ownership and buy-in beginning at the dairy farm and avoiding mandates that may incite push-back. As one participant stated *"[…] as soon as we get to the position where we're telling people how to run their farm, they'll tell us to bugger off and we'll lose that connection*" [Interview 5]. However, others felt legislation may be the only way to shift the behaviours of some segments of the industry. "[There is a] *particular bottom group of people that just want to do what they want to do, how they want to do it, because that's how they've done it. Something like legislation would impact them*" [Interview 3].

Participants also discussed the efficacy of legislation and policy, using blunt force trauma euthanasia as an example, a practice that has been prohibited in Australian industry policies (Australian Dairy Farmers 2020) and legislation (Animal Health Australia, 2016).

> "*I am concerned by the data on blunt-force trauma* [euthanasia] *because we have a […] very clear policy position, yet our survey data doesn't say we're complying with* [it]. *That always concerns me about what is the true appetite to take what you're going to tell us and push it into a sufficient level of implementation to be able to further mitigate the risks around bobby calves or calf management*" [Interview 2].

5.3.3.2. Role of leadership and collaboration

When contemplating sustainable change, participants highlighted the need for industry-level leadership to ensure that sector-wide change is achieved. Desire to take leadership on the issue from singular stakeholders, whilst important, will alone be unlikely to address the problem. Despite initial efforts by dairy farmers in Atlantic Canada to develop a viable dairy beef industry, numerous challenges were identified indicating the complexity of the undertaking (Proudfoot et al., 2022). Our participants stated that any leadership initiatives should be *"[…] concrete* [with] *a clear commitment"* [Interview 2]. The role of an industry-wide commitment to ending early life slaughter was seen as valuable in underpinning community trust. Some viewed an industry-wide commitment as being an integral step in uniting the industry and allowing stakeholders to hold each other accountable; thereby protecting, at least in part, the dairy industry's social license to operate.

Though not a new concept, social license to operate, has grown in popularity in recent years with some arguing it is just another term for legitimacy (Gehman et al., 2017). For alternatives to early life killing of surplus calves to be perceived as legitimate, all categories of stakeholders, including citizens, farmers, and the wider dairy industry, must all view solutions as acceptable and viable (Gehman et al., 2017). The notion that industry (and not government) should lead the process of change was clearly stated

by one participant who desired "*An industry goal* [where each member of the value chain has] *a little bit of skin in this game* [ensuring that we do] *the right thing"* [Interview 6].

5.3.3.3. Downstream benefits of dairy beef production

Participants noted unique opportunities in implementing dairy beef production systems as alternatives to early life killing of surplus calves. Amongst these were the ability for increased production of beef from the dairy herd to improve business resilience. One participant stated that: *"I think […] the really nice thing about where we are now is sustainability, people love the circular economy, they want the whole thing end to end and improving supply chains and improving your* [carbon] *footprint"* [Interview 7]. Similarly, Romera et al. (2020) highlighted the opportunities in redesigning dairy production systems as a coordinated food production network instead of continuing to operate as an isolated entity. The concept of circular bioeconomy business models has also been found to offer opportunities as well as challenges (D'Amato et al., 2020).

Participants also highlighted the potential advantages to be gained from producing dairy beef in reducing carbon emissions (Tichenor et al. 2017; van Selm et al. 2021). The International Dairy Federation's prescribed carbon accounting methodology stipulates that 85% of a dairy cow's annual emissions are attributable to her milk, leaving just 15% attributable to her dairy beef calf (IDF, 2022); this provides a potential advantage to dairy beef value chains over beef originating from the beef herd. In the words of one participant:

> *"We need to ultimately try and decide what's the best solution that's going to* [find] *fitness for purpose in every animal that we produce and from our whole food production sustainability perspective we've got these cows producing milk. If a high proportion of them are also producing beef from a calf, we're reducing our environmental footprint collectively as well"* [Interview 3].

5.4. Study limitations and future research

Whilst the present study included perspectives from a range of stakeholders across the Australian beef and dairy value chains, a limitation of the research is that each stakeholder group was only represented by one or two organisations. Thus, our findings are not intended to be generalisable across the Australian dairy or beef value chains, nor the global network of beef and dairy industry stakeholders. Despite this, the inductive analysis used (Braun & Clarke 2006) allows for an understanding of the complex frame of reference through which our participants understood the surplus calf challenge. We encourage further participatory work that includes the voices of all stakeholders, including industry, the public, and the animals, to enable improved understanding of the surplus dairy calf challenge.

5.5. Animal welfare implications and conclusion

Understanding the attitudes of beef and dairy industry stakeholders to surplus dairy calf management in Australia is critical to implementing socially and economically sustainable alternatives to early life killing. Participants in this study identified that animal welfare outcomes can be both positive or negative whether surplus calves are killed in the first few days of life or raised for beef, indicating that the challenge is complex. However, finding sustainable ways to shift the perception of a class of production animal away from a being waste product and towards being seen as a valued commodity is likely to have widespread benefits to the standard of care received by the animals, thereby improving welfare standards.

Chapter 6. Tackling a 'Wicked Problem': Towards sustainable management of surplus dairy calves through the use of a participatory framework

6.1. Introduction

Specialisation of modern food production has led to the design of animal agricultural systems that sometimes produce unwanted or unneeded offspring (Giersberg et al., 2021). The birth of these offspring usually fulfils a function that is core to the production system (e.g., producing an offspring to initiate the production cycle) but the neonate is, in some cases, not a valuable food producing animal. The management of these 'surplus' neonates is gaining attention for the ethical and welfare concerns that arise for animals viewed as waste products (e.g. surplus dairy calves (Creutzinger et al., 2021), male layer chicks (de Haas et al., 2021), or dairy goat kids (Meijer et al., 2021)).

In modern dairy production systems, not all the calves born each year are required as future 'replacement' milking cows (Mohd Nor et al., 2015). Those not needed for replacements (all males and some females) are considered surplus to requirements (Giersberg et al., 2021). Depending on the country and operating environment, surplus dairy calves may be managed through a variety of production systems, including being raised for beef or veal, sent for slaughter within the first few days of life, or killed at birth on farm (Bolton et al., 2024). In Australia, a common pathway is early life killing (slaughtered at an abattoir beginning at five days of age or killed at birth on-farm) when beef prices are low, or rearing animals for beef when prices are high (Dairy Australia, 2023b).

Whilst previous work has found low awareness of early life killing of surplus calves amongst the public (e.g. in North America (Ritter et al., 2022), Germany (Schulze et al., 2023), and Brazil (Cardoso et al., 2017)), once made aware, there is often widespread rejection of the practice (Cardoso et al., 2017; Ritter et al., 2022). Arguably, this rejection is not unfounded, considering evidence that surplus calves often receive substandard care when killed in the first days of life (Boyle and Mee, 2021), or when raised for beef or veal and slaughtered later in life (Creutzinger et al., 2021).

A sustainable future for the animal agriculture sector is predicated on achieving concurrent environmental, social, and economic sustainability (von Keyserlingk et al., 2013). Given that early life killing of surplus calves is out of step with public values (Ritter et al., 2022), it presents a risk to the social sustainability of the industry and therefore its' future (Rollin, 2011). Despite efforts directed towards the development of technical 'solutions' to address the challenges posed by low value surplus neonates in animal agriculture (e.g., in-ovo sex determination in layer operations (Bruijnis et al., 2015), sexed semen and beef on dairy breeding strategies in dairy operations (Berry, 2021)), the continued production of these arguably 'dispensable' animals remains a global issue. The challenge of developing sustainable ways of managing surplus calves has been described as a 'wicked problem' (Bolton and von Keyserlingk, 2021). Wicked problems are difficult to clearly define, unstable, constantly evolving, multicausal, and different stakeholders have different versions of what the problem is; further, the social complexity of wicked problems, rather than their technical complexity, can overwhelm traditional approaches to problem solving (Australian Public Service Commission, 2007).

Participatory research offers an opportunity to tackle wicked problems in a way that moves beyond incremental technical improvements and instead facilitates cultural and institutional changes (Bremmer and Bos, 2017). Many different types of participatory research exist, but central to the concept is the involvement of different stakeholders in agenda-setting, decision-making, or policy-forming activities (Rowe and Frewer, 2004). One such form of participatory research is deliberative engagement, where citizens take positions, exchange reasons, and sometimes change their minds in the course of discussions (Fung, 2006). According to Carcasson (2016), deliberation can support the constant adjustment, negotiation, and creativity required to tackle wicked problems; an approach previously employed in developing socially sustainable agricultural systems (e.g. egg production (Swanson et al., 2011)). Longitudinal focus groups, where the same groups are reconvened multiple times, periodically revisiting the same issue, are a practical method for achieving deliberative engagement (Baden et al., 2022). This method is therefore appropriate for research addressing sustainable surplus calf management;

a challenge that requires understanding the needs of all stakeholders, including the community and the animals themselves (Bolton and von Keyserlingk, 2021).

This research forms part of a larger project for which we designed a participatory framework to investigate how the Australian dairy industry might implement sustainable approaches to managing surplus dairy calves. This framework included interviews with beef and dairy value chain stakeholders (Chapter 5), community focus groups (Chapters 3 and 4), and the current longitudinal focus group study involving dairy farmers and pre-farm gate advisors (including animal welfare experts representing the needs of the animals) (Figure 6.1). In this paper, our aim is to describe how dairy farmers and pre-farm gate advisors understood the complex environmental, economic, and social factors affecting surplus calf management and examine how this understanding changed over the course of deliberation with exposure to different stakeholder perspectives.

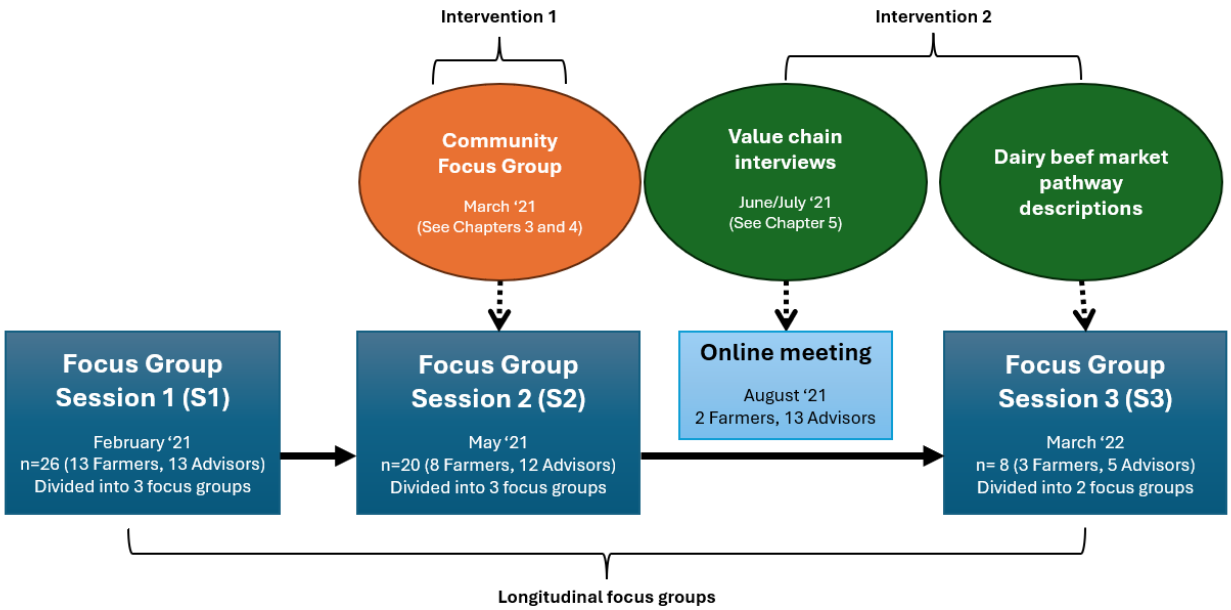

Figure 6.1. Outline of the participatory framework used to investigate how the Australian dairy industry might implement sustainable approaches to managing surplus dairy calves. This framework included longitudinal focus groups involving dairy farmers and pre-farm gate advisors (represented by the dark blue squares). During focus group Session 2, participants received the summarized results of a community focus group that explored community attitudes to surplus calves (represented by the orange circle). During an online meeting (represented by the light blue square) participants received the summarized results of interviews with beef and dairy value chain stakeholders (represented by the left

green circle). During focus group Session 3, participants received descriptions of three currently available commercial dairy beef programs into which surplus calves could be sold as beef animals (represented by the right green circle)**.**

6.2. Materials and methods

6.2.1. Positionality statement

In qualitative research, the researchers' own beliefs, assumptions, and experiences can both limit and facilitate the interpretation and meaning of the data they analyse (Willig, 2012). We have thus provided a positionality statement describing the position of each author in relation to the topic.

Bolton is a female PhD student at The University of Melbourne and a visiting scholar with The University of British Columbia Animal Welfare Program (UBC AWP). She was born and raised in Australia where she grew up on beef and dairy farms. She has since worked as a qualified veterinarian and has experience in dairy farm management and calf rearing. At the time of data collection for the present study, she was the National Animal Welfare Lead at Dairy Australia, the research, development, and extension body for the Australian Dairy Industry. She currently holds the role of Dairy Beef and Animal Welfare Manager with Greenham, a beef packer operating in southeastern Australia.

Koralesky is a female Postdoctoral researcher in the UBC AWP. She was born in Wisconsin and worked with chickens, turkeys, and rabbits on small-scale farms. She completed her graduate work in the UBC AWP and lived and worked on the UBC Dairy Education and Research Centre farm. She is a social scientist who specializes in the human factors that influence animal welfare. She believes that understanding the people who care for or about animals is important to move the field of animal welfare science forward.

von Keyserlingk is a female Professor at UBC where she has co-led the UBC AWP since 2002. She has also held a Natural Sciences and Engineering Research Council of Canada Industrial Research Chair in Animal Welfare since 2008. She grew up on a beef cattle ranch in British Columbia, Canada, and worked in the agribusiness sector for seven years before joining the university as a professor in 2002.

Together with her students she has published extensively in both the natural and social sciences on a broad range of topics in animal welfare.

6.2.2. Participant recruitment

Participants included dairy farmers operating different systems (e.g. varying herd size, cow type, etc.) and subject matter experts in farm-level operations (pre-farm gate advisors) with different expertise (e.g. farm business management, agronomy, animal health and welfare, etc.) (see Table 6.1 for a description of participant backgrounds). To facilitate attendance, we recruited dairy farmers from a single region (the New South Wales south coast dairy region), allowing them to attend focus group sessions between their daily farm management commitments. Advisors that delivered services within a local region (e.g. private veterinarians) were recruited from the same region as the farmers, whilst we recruited other advisors at a national level (e.g. industry research and development representatives, university researchers, etc.).

Participants were identified through existing networks of SB, a process that was facilitated by input from local industry extension officers and wider industry networks. In total, we recruited a convenience sample of 13 dairy farmers and 13 advisors for the study. At each focus group session, we gave participants the option to invoice the research team for their travel costs; two participants took this opportunity.

Table 6.1. Brief descriptions of the farm characteristics of the 13 farmer participants, and subject matter expertise of the 13 pre-farm gate advisor participants, recruited for a participatory framework exploring sustainable surplus dairy calf management in Australia.

Participant	Participant description
Dairy farmer 1	Small farm (<250 cows), mixed herd
Dairy farmer 2	Small farm (<250 cows), mixed herd
Dairy farmer 3	Small farm (<250 cows), mixed herd

Dairy farmer 4	Small farm (<250 cows), mixed herd
Dairy farmer 5	Small farm (<250 cows), mixed herd
Dairy farmer 6	Small farm (<250 cows), mixed herd
Dairy farmer 7	Large farm (>250 cows), mixed herd
Dairy farmer 8	Large farm (>250 cows), Holstein only
Dairy farmer 9	Large farm (>250 cows), mixed herd
Dairy farmer 10	Large farm (>250 cows), red breeds only (e.g. Australian Red, Danish red etc.)
Dairy farmer 11	Large farm (>250 cows), Holstein only
Dairy farmer 12 & 13	Large farm (>250 cows), Jersey only, married couple, participated together in the same focus group
Advisor 1	Dairy farm consultant, farm business management expertise
Advisor 2	Industry extension officer, farm business management expertise
Advisor 3	Government veterinarian, animal health and welfare expertise
Advisor 4	Animal welfare advocacy body representative, animal welfare expertise
Advisor 5	Government extension officer, farm systems expertise
Advisor 6	Private consultant and veterinarian, animal health and welfare expertise
Advisor 7	Government extension officer, agronomy expertise
Advisor 8	University researcher, animal welfare expertise
Advisor 9	Industry research and development representative, meat quality expertise
Advisor 10	Government extension officer, farm business management expertise
Advisor 11	Industry representative, Jersey cow genetics expertise
Advisor 12	Private veterinarian, animal health and welfare expertise
Advisor 13	Industry research and development representative, animal health and welfare expertise

6.2.3. Participatory process

Our goal was to facilitate three focus group sessions, each with multiple individual focus groups, that were anchored in: i) the collective desire to produce reasonable, well-informed opinions about

surplus calf management**,** and ii) participant willingness to listen to the views of other actors along the value chain and be open to the possibility of revising their position in response to new information presented via interactive activities in the second and third focus groups (adapted from O'Doherty et al., (2010)).

At the first focus group session (S1), we allowed participants to explore their own understanding of the surplus calf issue and hear the views of fellow participants. During the second focus group session (S2), we evaluated the effects of an intervention where we shared the results of a community focus group that explored their attitudes about surplus calves (see Chapters 3 and 4). During the third focus group session (S3), we evaluated the effects of sharing beef and dairy value chain stakeholder perspectives (see Chapter 5) prior to the session and presented commercially available dairy beef market pathways for discussion.

We prepared separate semi-structured facilitator guides for each focus group session. SB prepared the first version of each facilitator guide in collaboration with four individuals who were to assist with facilitating the sessions. All four individuals had previous experience with conducting focus groups but were not subject matter experts. MvK and SB then revised the facilitator guides before circulating them for comment amongst the facilitators. All comments received were discussed and the facilitator guides revised accordingly (see Appendices F, G, and H).

6.2.4. Consent and data collection

Participants (n=26 dairy farmers and advisors) were divided into multiple focus groups at each of the three separate sessions (see Figure 6.1). Some were unable to participate in every meeting, with attendance ranging from 26 to 8 participants per session. At each session, we divided participants evenly into either two or three separate focus groups, ranging from four to nine participants in each group. Each focus group was seated at separate tables in one large room, allowing for both collective and within-group dialogues over the course of the session. Consent forms were circulated and discussed, and participants

were given the opportunity to ask questions. Each participant gave consent and conveyed their desire to participate for the entire study (three sessions). Each face-to-face focus group session lasted approximately 4.5 hours and included two breaks of 30 min each.

Session 1 was held in February 2021 and began with participants discussing their understanding of surplus calf management. To identify key tensions, opportunities, and challenges to work on in Session 2 and Session 3, we implemented a frame reflection exercise and a system mapping process. During the frame reflection exercise (Benard and de Cock Buning, 2013), we asked participants to draw and then discuss the dairy industry from the perspectives of a range of different stakeholders (including the cow, consumers, retailers, civil society, animal welfare groups, chefs, vegans, and Government). The systems mapping process involved asking the participants to draw diagrams identifying the causal relationships between elements of the dairy industry that contributed to the surplus calf challenge (see Sedlacko et al., 2014).

Session 2 was held in May 2021 and began with an 'intervention'; whereby, we provided participants with a summary of the preliminary findings of a community focus group study exploring their attitudes to the surplus calf issue (see Chapter 4). Facilitators also presented participants with short 'love' and 'breakup' letters written to the dairy industry by the community focus group participants describing their feelings about dairy (see Chapter 3). The letters acted as stimuli, specifically as 'provokers' (Törrönen, 2002), intended to prompt reactions from participants. Participants expressed their reactions to the letters and discussed findings from the community focus groups.

To elicit further discussion in Session 2, we presented participants with four hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia (Table 6.2; scenarios were the similar to those discussed in Chapter 4 and Chapter 5). Qualitative scenarios have been used in other sectors when deliberating ideal future states to provide contextual information that cannot be adequately described by numbers alone (Ernst et al., 2018). In brief, the scenarios included addressing the

surplus calf issue through milk price increases, supply chain collaboration, hormone use in dairy cows, and use of technology such as sexed semen.

Session 3 was delayed by several months due to COVID-19 restrictions preventing in-person meetings. To maintain participant engagement during the delays, we decided to hold session 3 in two parts. The first part included an online meeting in August 2021 over Zoom (Zoom Video Communications Inc., 2021). In this online meeting, we presented participants with a preliminary analysis of interviews with value chain stakeholders (including genetics companies, meat packers, milk processors and retailers) exploring their attitudes to the surplus calf issue (see Chapter 5). This meeting was not recorded and whilst it was attended by all the advisor participants, only two farmer participants attended.

Once COVID-19 restrictions lifted, we held the second part of Session 3, which constituted the final face-to-face meeting, in March 2022. At this time, we presented participants with an intervention which involved descriptions of three currently available commercial dairy beef pathways into which surplus calves could be sold as beef animals. For each commercial market pathway, participants were provided with information relaying the age and weight at which calves could be sold (ranging from 5-day old calves to finished beef animals at approximately 24 months of age), any dietary and/or management changes required (e.g., colostrum management, animal welfare requirements, grass or grain finishing, etc.), genetic requirements (e.g., use of certain beef genetics for crossbreeding), and the price received upon sale of the animal. The specifics of these descriptions were removed from the transcripts to ensure anonymity of the commercial companies discussed. Participants were encouraged to evaluate and discuss the strengths and weaknesses of each market pathway, select their preferred options, and explain why they chose this option.

Table 6.2. Descriptions of four hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia used to elicit discussion with study participants during a participatory framework exploring sustainable surplus dairy calf management in Australia.

Scenario description
All surplus calves are grown to adulthood for the beef supply chain. This can be done because the costs are covered either through milk price increase or supply chain cooperation.
Hormones are introduced to enable cows to continue to produce milk without having to repeatedly become pregnant, meaning surplus calves are never born in first place.
The local dairy industry transforms into a connected network of farms that work together on a solution. The solution differentiates the region's milk and/or dairy beef and attracts a premium.
Farmers use technology that is currently available including sexed semen to reduce male calves being born. The remaining calves either enter the dairy industry or are grown to adulthood with optimized nutrition and production for the beef supply chain.

6.2.5. Data analysis

Audio recordings were made of each group's discussions during all three focus group sessions. Recordings were then transcribed by a professional transcription service (Rev.com Inc, Austin, TX, USA). SB checked the transcripts for accuracy and removed all identifying information (e.g., names, employer details, etc.). Transcriptions were identified by group number and session number only (i.e., Group 1, Session 1 was abbreviated to 'G1, S1', Group 2, Session 1 was abbreviated to 'G2, S1', etc.).

We selected inductive thematic analysis for analysing the transcribed data from Session 1. This involves analysing data without preconceived themes or codes, allowing the data itself to drive the analysis (Clarke and Braun, 2017). This approach was particularly useful in analysing the data from Session 1, as to our knowledge, this was the first Australian study to explore combined farmer and pre-farm gate advisor understanding of surplus calf management.

We began the analysis with extensive reading of the transcripts and familiarization with the data, followed by the creation of the initial codes. We coded in segments following the questions in the interview guide. The codes were reviewed and refined throughout data analysis by merging specific codes

into broader codes and *vice versa* until clusters of similar codes were developed. Groups of similar codes were merged into sub-themes, which were developed into broader themes. KK and SB conducted intercoder reliability (MacQueen et al., 1998); wherein, both authors initially analysed all data independently using the draft codebook developed by SB, followed by meetings where they compared results and refined the codes and themes until discrepancies were solved. All three authors then discussed and agreed on the final codebook (see Appendix I). SB then recoded the Session 1 transcripts using the final codebook in NVivo (version 12; QSR International Pty Ltd.).

To analyse data from Session 2 and Session 3, we selected deductive thematic analysis using the codes developed for Session 1 because we specifically sought to identify changes in participant sentiment. According to deliberative engagement, it is recognised that any changes in attitudes seen in Sessions 2 and 3 may be attributed to the passage of time and natural evolution in participants' thinking, as well as to exposure to information from all perspectives (which in this study included the interventions and activities applied, and the impacts of discussion and deliberation amongst participants (Gregory et al., 2008)). SB used the final codebook developed in Session 1 and the software to code all transcripts arising from Sessions 2 and 3. Whilst we used different activities to elicit discussion during data collection, such as frame reflection, systems mapping, and future scenarios, we analysed the data based on the discussion points raised, rather than seeking to determine the impact of each individual activity.

6.3. Results

In the Results, we first describe each theme arising from Session 1 and provide exemplary quotes (some modified in length for clarity). We then present changes observed following the interventions in Sessions 2 and 3.

The aim of Session 1 was to explore how participants understood surplus calf management. Participants' discussions centred on two main themes, each with three sub-themes (Figure 6.2); 1) economic and practical aspects of surplus calf management, including breeding strategies, calf rearing,

and markets, and 2) social aspects of surplus calf management, including farmers' connection to the public, duty of care, and affecting change.

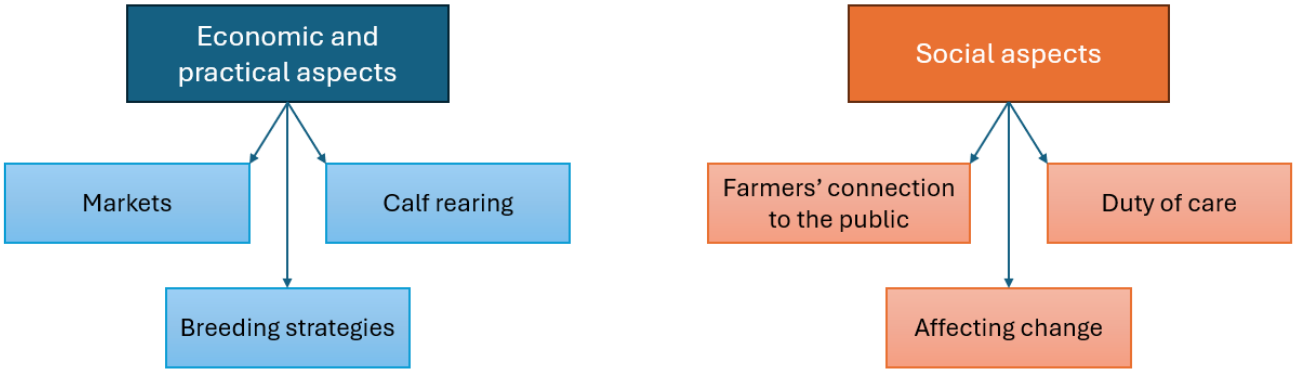

Figure 6.2. Thematic map of themes and subthemes from longitudinal focus groups with Australian dairy farmers and advisors on their understanding of surplus dairy calf management. Boxes in blue represent sub-themes within the broader theme of economic and practical aspects of surplus calf management. Boxes in orange represent sub-themes within the broader theme of social aspects of surplus calf management.

6.3.1. Session 1: Economic and practical aspects of surplus calf management

Participants discussed the economic and practical aspects of surplus calf management. These aspects included breeding strategies, challenges and opportunities associated with rearing additional calves, and the strengths and limitations of beef markets into which surplus calves could be sold.

6.3.1.1. Breeding strategies

Participants often cited the use of beef sires bred to purebred dairy cows to produce 'beef on dairy' calves as an opportunity to improve the economic viability of calves for beef production, thereby diverting calves away from early life killing. However, it was acknowledged by some participants that this strategy was not a panacea, given that they believed a farmer's ability to successfully implement beef on dairy breeding strategies was predicated on their herd's reproductive performance: *"Using a terminal beef sire* [and] *sexed* [dairy] *semen doesn't stack up if you've got reproductive issues in your herd"* [G2, S1]. Participants also questioned whether extended lactations (beyond the standard 305-day lactation)

could play a role in reducing the number of surplus calves produced: *"Could you go to a 360 day instead of a 305* [day lactation]*? Or do you milk the cow for 2 years? What* [is] *the effect of that? It has a potential role in reducing calves* [in the long run]*."* [G1, S1]. Whilst these strategies were seen to have potential, they were not regarded as complete solutions.

6.3.1.2. Calf rearing

Participants placed particular emphasis on the health and welfare challenges associated with rearing surplus calves for beef as an alternative to early life killing. Calf rearing standards were discussed as varying substantially from farm to farm, with one participant summarizing the situation as: *"[…] there* [are] *some shocking farmers that can't rear calves […] and* [those calves] *would have been better off being euthanased."* [G1, S1]. Some participants were wary of increasing the number of calves in the system, for fear that the additional numbers would compromise the health of the calves they were currently rearing. One individual stated that rearing more calves could *"result in substantially worse wellbeing for the majority of animals"* [G1, S1]. Biosecurity challenges were also viewed as a threat, particularly when sourcing calves from multiple farms and rearing them in a central location. However, participants agreed that additional calves could be reared successfully if appropriate health management systems, and incentives encouraging compliance, were in place.

Increasing calf numbers on the farm was frequently discussed in reference to perceived barriers such as additional costs, infrastructure, and labour. One participant suggested that their inability to provide additional infrastructure for surplus calves is *"[…] not* [an] *attitude, it is financial reality."* [G1, S1], whilst another emphasised the problem of sourcing "*[...] the* [required] *staff."* [G2, S1]. Discussion also focused on the cost of rearing calves destined for early life slaughter at 5-30 days of age:

"[…] we've been getting $15 for a bobby calf [and] *it will cost you $2.50 for the piece of paper* [National Vendor Declaration required to sell the calf]*, $4.50 for the* [mandatory radio frequency

identification] *tag to put in its ear, $12.20 to feed the calf for a week and then you're paying someone $28.50 to feed it […] and then you get $15 for it. It is not worth it."* [G2, S1].

Thus, it was emphasised that even sending surplus calves for slaughter at 5-30 days of age may be incurring net costs to the dairy farm business because of the labour and feed costs required.

In addition to increased costs and labour, participants felt that farmers vary in their capacity and willingness to rear additional calves. It was highlighted that for many farmers, the day-to-day running of the farm left them *" […] really, really tired."* [G1, S1] and that rearing additional calves would exacerbate this fatigue, posing a barrier to taking on additional management tasks. Finally, participants reflected on their personal experiences and the associated mental health impacts when things do not go to plan. One participant summarized this point, sharing:

"[…] when I decided to rear all our [calves]*, […] suddenly I have got more calves than I know what to do with. I haven't got the facilities, I have got sick calves, my vet loves me because I keep going in there every other day getting more drugs and then there is the tears and the heartache of animals I just can't look after because I just haven't got the room to do it. So, nothing gets done. Nothing is reared properly. It is really complicated."* [G1, S1].

These perspectives highlight potential barriers to rearing surplus calves which amount to more than economics, with the practical implications of fatigue and work-related emotional stress playing a role in the reluctance of some to take on the challenge.

6.3.1.3. Markets

Commodity price fluctuations, when the price "*goes up and down like a yoyo"* [G2, S1], were seen as a central challenge in implementing economically viable alternatives to early life slaughter. Participants highlighted that when beef prices are high, rearing surplus calves for beef *"is a great*

solution, but when [the] *beef price is low,* [there is] *much less demand* [for the calves]*."* [G1, S1]. One participant also explained how climate and market volatility are inextricably linked:

"Climate controls a lot of it because look at what has happened in the last 2 years; droughts killed out so much [beef] *stock now all these re-stockers* [beef producers] *are dying* [to buy dairy] *bull calves and we're probably going to have the same problem in 5- or 10-years' time."* [G2, S1].

This complexity led to some pessimism towards the economic viability of utilising surplus calves for beef production and a strong conviction amongst participants that farmers could not implement systems that were financially unsustainable.

Participants also noted a perceived lack of understanding on the part of retailers and beef processors of the plight of the dairy farmer. This lack of understanding was seen as a disconnect within the value chain and contributed to participants stating that opportunities to improve prices could be achieved by *"educat*[ing] *the supply chain* [and] mak[ing] *sure that processors and the marketplace value dairy beef so there is a really big pull for* [the product]*."* [G3, S1]. Despite this, ensuring that each stakeholder in the dairy beef supply chain is making a profit, was seen by participants as critical to the viability of directing surplus calves into beef production. For example, one participant described a vision of success that involves *"connected supply chains that are profitable for all the stakeholders involved."* [G3, S1].

Participants often looked to international markets as examples of success in establishing economically viable dairy beef operations. Measures of success included scale and consistency of dairy beef production: *"America feeds 3,000,000 Holsteins a year. You could put a ruler over* [them] *in a feed yard and they are more consistent in* [size, conformation and] *performance than an Angus."* [G2, S1]. International market examples were also referenced when participants debated the value or otherwise of marketing dairy beef. Whilst some saw this as an opportunity, others were adamant it was not viable: *"everywhere else in the world, […] no one markets it as dairy beef.* [One large meat packer slaughters] *a*

million [Holsteins per year]. *There is no mention in their product specifications that* [it] *is Holstein beef."* [G2, S1]. Thus, participants saw value in learning from dairy beef production practices that had proved economically viable in other countries.

Some participants expressed optimism towards the idea of circumventing traditional market pathways and developing new beef markets for surplus calves to improve economic viability. Suggestions were often creative such as *"new markets for surplus calves for things like dog food,* [or] *supplements"* [G2, S1]. Some suggested that *"branded pastured dairy beef"* was the answer as "*there is definitely a market there for it and* [it] *would be great to have* [customers] *lining up* [for it]*."* [G2, S1]. Others, however, were sceptical. For example, another individual responded to this line of discussion by commenting that *"we don't need to create new markets though, if we fine tune our systems and focus on our constraints"* [G2, S1].

Participants also offered their views on dairy farmers' understanding of, and connection to, existing beef market pathways. Whilst they often acknowledged that beef markets are currently available for surplus calves, accessing these markets involved the implementation of difficult management changes described above. Some participants acknowledged a change in their own perspective, with one stating that *"the thing that has resonated with me today is the opportunity exists already to do it and it is* [a question of] *whether we want to embrace that opportunity."* [G1, S1]. Ultimately, participants emphasised that success rests on effectively identifying and addressing barriers, as one participant summarized: *"Is it an information deficit? Is it market understanding? Is it supply chain engagement? Is it cost versus returns? If we can figure out what the challenges are, we can figure out how to address them."* [G3, S1].

6.3.2. Session 1: Social aspects of surplus calf management

Participants also discussed the social aspects of surplus calf management, including the connection (or lack thereof) between farmers and the public, farmers' duty of care towards their animals, and opportunities for affecting change.

6.3.2.1. Farmers' connection to the public

The concept of a social license to operate was central to discussions about the connections between agriculture, farmers, and the public. Participants frequently described a desire to *"maintain or enhance social license"* [G1, S1] and saw value in *"addressing* [the surplus calf] *problem now for future protection"* [G2, S1]. However, some participants felt that social license to farm was not currently compromised: *"I think the thing to remember in all of this is that right at this point […] I think the dairy industry doesn't have the average consumer offside"* [G2, S1]. Other participants were not so sure where they stood with the public, with one participant voicing that *"[…] from my point of view, I can see alarm bells ringing. I think when they shut down the* [New South Wales] *greyhound* [racing] *industry* [in 2016]*, my first reaction was, 'oh shit that is what we do'* [in the dairy industry]*. They get rid of* [kill] *the* [animals] *they don't need.*" [G1, S1]. Evident in these examples are an acknowledgment by participants that current practices may not be socially sustainable.

Participants often discussed the role of animal activism. Organisations that advocate for animal welfare and/or animal rights were seen as particularly influential to the public, with information received by the public from these voices falsely depicting a negative side of farming that falls upon farmers to defend. This led some participants to express a desire to *"restrict the effects of the animal welfare lobby and the vegans on the consumer in its attitude to dairy because at the end of the day, 70% or 80% of the public don't* [care] *about that* [stuff]*, all they want is* [the products]*."* [G2, S1]. In a contrasting approach, one participant suggested that there could be *"a role for animal activists in the community to highlight salient issues across the different industries"* [G2, S1], perhaps flagging issues, such as cow-calf separation and the use of blunt force trauma to euthanase calves, that the industry may need to be proactive in addressing.

The public was often dismissed by participants as having little to no understanding of the dairy industry: "*most local people in this area don't understand anything about the complexity* [of producing]

milk." [G3, S1]. To improve the lack of connection between the broader public and the farming sector, participants frequently cited desires to *"inform the general public on why* [we] *do things […]"* [G1, S1], and called for *"greater consumer education"* [G3, S1], and "*consumers […] learning about the farming system and accepting* [it]*"* [G1, S1]. The concept of educating people into understanding why farmers do what they do was a prominent point of discussion, provoking debate between participants in the same focus group. In response to one participant explaining that there may be value in animal activist campaigns highlighting issues in the industry, another participant replied:

"Can I just challenge you? […] you said all these things […] with regard to blunt force trauma, removing calves from their cows [being public concerns]*; it is actually in the calf's best interest to be removed from the cow within 12 hours so we can […] make sure* [that the calf] *gets colostrum and then* [separation also] *limits the number of bugs that* [the calves] *are […] exposed to […] so we actually need to educate the public about why we do take calves off cows"* [G2, S1].

Despite this debate, in reflecting on acceptable ages for slaughter, one participant conceded that *"I think it will actually go the other way, the public will tell us when they think* [the animal should be killed]*."* [G1, S1]. This dialogue demonstrates that participants understood the public as a diverse group and had different opinions about how to connect with them on surplus calf management.

6.3.2.2. Duty of care

Participants often ruminated on the ethical implications of raising animals for food. They placed value on calves having a life worth living and often discussed the distinction between welfare and ethics. For instance, they debated whether it was best for the welfare of the calf to be killed immediately at birth (despite this being an ethical issue) or transported to slaughter at a few days of age which comes with welfare concerns. Participants also discussed the ethics of killing calves at different ages and wondered how this impacts public acceptance: *"It is the same end result; it is just when does* [death] *become*

[acceptable]*? Is it 7 days, 12 weeks, a year?"* [G1, S1], indicating an acknowledgement of the complex interaction between the biological and ethical associations with death.

The mental health impacts on farmers of performing early life killing were noted as taking a toll. Participants highlighted that in many cases, the decision to euthanase calves is not made lightly: *"I think there is an assumption that it is just something that happens without any thought going into it and I don't think that it is communicated very well that* [farmers do it because] *there is no other option."* [G3, S1]. These impacts were seen as adding to the overall mental load of farming, to the point where one participant disclosed: *"you are just wondering why you are getting up every day, mate."* [G1, S1]. These perspectives demonstrate the considerable emotional load carried by farmers when attempting to fulfil their duty of care towards their animals while also running an economically viable business.

6.3.2.3. Affecting change

Participants thought that a potential future mandate from milk processors or retailers on surplus calf management could have an influential role in motivating an end to early life killing. Some viewed this as a concerning potential method of product differentiation, akin to that already seen in other animal products: *"imagine when* [retailers] *start putting on the* [milk] *label 'sourced from bobby calf-free* [dairies]*'. You know what happened with pigs, poultry, other industries. But we're still ahead of that point, which is the great thing […]"* [G2, S1]. However, participants were sceptical about the likelihood of mandates against early life killing successfully increasing the number of surplus calves reared to older ages because farmers could simply falsify stillbirth records.

In working towards sustainable management of surplus calves in the future, it was emphasised that holistic approaches were needed, prioritising farmer agency and collaboration. Participants often highlighted that *"any outcome has to have a whole system approach and can't focus on just this issue. It has to acknowledge the* [inter]*dependence of what is going on."* [G1, S1]. Industry collaboration was frequently emphasised as an opportunity to affect change. Participants were generally positive towards the

concept of working together and emphasised that the issue was best managed internally by the industry to ensure minimal negative economic impact on farmers: *"it is important […] that farmers […] actually benefit from the outcomes rather than have more cost and imposition impressed on them by systems that may not be financially sustainable."* [G1, S1]. This was seen as achievable through *"identification of clear pathways forward for the industry"* [G2, S1], and learning from the success of other farmers: *"So, if there are people out there that are currently doing it, well how are they doing it? And how does everyone else get onboard with that?"* [G3, S1]. In these instances, industry acknowledgement of farmer challenges and best practices was critical.

6.3.3. Session 2: Social aspects of surplus calf management (post-community focus group intervention)

In Session 2, we presented participants with a summary of the findings from the community focus groups (see Chapters 3 and 4). This intervention resulted in changes under the sub-theme of 'Farmers' connection to the public'.

6.3.3.1. Farmers' connection to the public

When we presented the findings from the community focus groups, including participant demographics, initial concerns revolved around the inclusion of vegans and vegetarians: *"why would you bother* [including them as they] *only make up a small proportion of the Australian population? So as a percentage of the demographic, you have got a distorted thing already."* (G1, S2). Some participants went so far as stating that these voices should not have been included: *"[…] there is no point in involving them in the discussion, like that is ridiculous."* (G1, S2). Despite this, participants still saw the voice of anti-dairy activists as influential: *"[…] it is a loud voice, that is the thing at the moment, right? It is radical, and it is loud."* (G1, S2). Thus, whilst Session 1 discussions focused on the voice of animal activists as overwhelmingly negative with a strong ability to influence public opinion, the intervention

resulted in some participants expressing further desires to counter and restrict the agendas pushed by anti-animal agriculture voices.

The breakup letters written by community focus group participants (see Chapter 3) personally impacted participants. Participants described that: *"You just take these breakup things just so personally, you feel like, 'let's put* [the name of this person beside me] *in there', and that is what you are reading."* (G1, S2), *"It is quite offensive really."* (G1, S2), and *"You are taking it and saying, 'this person hates me'."* (G1, S2). Additionally, during Session 1 participants often conveyed that community members do not understand farming, contributing to an 'us versus them' mentality. This sentiment was carried over to some degree in Session 2, particularly when discussing the community participants' breakup letters; *"I would have loved to have been in the room with this person because he has absolutely no idea."* (G1, S2). However, during Session 2, some participants did alter their thinking as the discussion continued: *"It is important to understand what the market feels because at the end of the day they make the choices […]. People* [in the dairy industry] *have to be realistic and realise that there are 24 million people that don't like* [early life killing of surplus calves] *and that noise can be huge."* (G1, S2).

As part of the delivery of the summarised community group findings, Session 2 participants were told that the findings from the community sessions suggested that *"Australians have guilt fatigue, and they are tired of feeling guilty about the food system."* (Facilitator, S2). This concept of guilt fatigue on the part of the consumer appeared to resonate with Session 2 participants and became a source of common ground to which they could relate: *"I get what they are saying about the fatigue because as a mum, you hear so many messages about what is healthy, what is not, what is good for the environment, what is not"* (G1, S2). This led participants to further explore the weight of responsibility that can be associated with contemporary consumerism:

"Fatigue surely is more about all the information that is out there even if it is a pen and you have to think 'well there is plastic in this pen with ink and probably a metal bit, where does it all come from?'

People [are] *thinking about the production system and* [the] *consequences of the production system on the environment, on people working there. Is there slavery involved? All those things and it just gets too much and consumers, I guess, just want to be confident that if they buy this pen, whoever has produced it has made sure it is environmentally sustainable, ethical, that they have paid their workers, […] and it hasn't harmed anyone or anything."* (G2, S2).

During Session 1 deliberations, participants debated how best to address the perceived disconnect between the farming sector and the public, focusing on how to educate the public into understanding why farmers do what they do. During Session 2, some participants changed their views on how to best address the perceived disconnect between the farming sector and the public. Some maintained that educating the public into understanding was the best approach: *"I actually think it is about how you make your argument and* [it] *might be* [that] *the role that we play is* [providing] *the facts there."* (G1, S2), and another participant suggested *"we need to start being louder"* (G1, S2) to counter animal activist agendas. However, when the facilitator in Session 2 stated *"you can't educate them out of that sense of guilt",* some participants began questioning their previous stance. This line of self-reflection led one participant to provide an example of how aligning production practices with public values could provide an alternative to educating citizens into understanding:

"I [know of a] *a small business selling ethically produced milk, keeping* [calves] *on cows. […]* [Their] *biggest clientele is people who went away from milk because of those ethical reasons. […] so it has brought people back to drinking milk. It might be upsetting most of* [the] *dairy industry but* [they have] *tapped into a niche market opportunity. […] Is it just about, rather than fight the beast […], is the answer we must meet the market demand […]* [and] *just stop fighting the beast?"* (G1, S2).

Despite this, some participants felt that differentiating products by production practices was not helpful, favouring instead the idea of a unified industry with an overall positive image: *"We don't need more products and we don't need more confusion about what dairy is ethical and unethical. We just need*

to make sure that we present the right image […].” (G1, S2). We also observed a shift in attitude towards the farmer-citizen disconnect, aptly described by one participant as the *“realization that consumers are going to make emotional decisions about this and* [we need] *to work with them […] in order to be able to still sell product and create an emotional decision to choose it rather than to choose against it.”* (G1, S2). Thus, sharing the community perspective resulted in some participants acknowledging that educating the public into understanding may not be the answer, and that social sustainability may instead rest on aligning production practices with public values.

6.3.4. Session 3: Economic and practical aspects of surplus calf management (post-value chain stakeholder intervention)

Between Session 2 and 3, we presented participants with a preliminary analysis of beef and dairy value chain stakeholder perspectives on the surplus calf issue (see Chapter 5). During Session 3, we also presented participants with a short description of three commercially available dairy beef market pathways as alternatives to early life killing. In brief, the different pathways involved selling calves at a range of ages (five days to finished beef animals), different breeding, dietary, and management requirements, and different prices paid for the animals depending on the pathway used. Analysis of the discussion following this intervention resulted in changes evident under the sub-themes ‘Breeding strategies’, ‘Markets’, and ‘Affecting change’.

6.3.4.1. Breeding strategies

The first dairy beef market pathway we presented involved breeding surplus calves with beef genetics; participants had mixed reactions to this strategy. Although some participants acknowledged that there were potential benefits, they also placed great value on retaining autonomy in choosing how to breed their animals. For instance, one participant stated *“*[I] *want to address* [our] *surplus calves […] but I don’t want to be told how to breed them. I would want to breed what we are breeding.”* (G1, S3) and another, reluctant to adopt any changes that impacted their day-to-day business operations, feared this

practice would "*[…] actually add cost all the way through our system."* (G1, S3). In contrast, other participants stated that they had already made the move to using beef semen in combination with sexed dairy semen: *"We are going down a* [the pathway of using] *beef* [semen] *and moving to almost all sexed semen to make replacements and then beef on the rest […] because we think it is going to make us money."* (G1, S3).

6.3.4.2. Markets

When presented with details of current beef market pathways available for surplus calves in Session 3, some participants were reserved in their enthusiasm and expressed scepticism about the long-term viability of the proposed pathways. This scepticism was rooted in concerns about the impact of climate volatility on the longevity of the pathways presented: *"[…] it isn't realistic to think in 5 years' time there is not going to be another drought* [and associated low beef prices]*. Then what happens to them all?"* (G1, S3). For others it centred on perceived lack of profitability: *"I can't put pen to paper and say I would recommend any of these."* (G2, S3). However, other participants were more confident and positive towards the options presented; *"*[I] *can sit down and crunch numbers and say, 'this is going to work' and* [if I have] *confidence that the market is going to be there* [long term], *I would say, 'let's go for it then'."* (G1, S3). Thus, participants varied in their attitudes to the economic viability of commercially available alternatives to early life killing, emphasising the importance of this aspect for any proposed future directions.

6.3.4.3. Affecting change

In light of their mixed reactions to the pathways presented in Session 3, participants discussed the possibility of requiring farmers to develop a documented plan for how they will direct surplus calves away from early life killing. Participants described it as *"a bit like having a plan for biosecurity or heat stress"* (G1, S3) that *"gives everyone flexibility and the option to make their own path* [while] *addressing the core issue which is […] is to not put surplus calves in* [a hole in] *the ground or send them on a truck*

that is going to cause a welfare issue for the general public.". This demonstrates an acknowledgement amongst participants that there are no one-size-fits-all solutions to the surplus calf issue and that farmers need support in developing actionable strategies that work for their own individual businesses.

6.4. Discussion

Our results provide a pragmatic and realistic understanding of the surplus calf issue at the farm and farm advisor level. Our findings also indicate that sharing the community perspective with participants had a strong impact on their attitudes towards understanding and working with public sentiment. Whilst participants showed mixed reactions to the viability of commercially available alternatives to early life slaughter, they placed emphasis on the importance of finding socially sustainable solutions to protect the industry's social license.

Implementing proactive approaches to social license preservation is challenging given the need to balance the long-term social acceptability of surplus calf management with the immediate need to be economically viable. Not surprising in Australia, where the practice of early life killing has been a part of dairy farming for decades, dairy businesses have made their decisions regarding the management of surplus calves according to the path of least economic resistance (Dairy Australia, 2023b). This traditional approach arguably protects the feasibility of the dairy business enterprise in the short term (economic viability), despite the decision to 'dispense' with the calves through early life killing potentially threatening the existence of the farm enterprise in the long run (social acceptability).

Some of our participants recognised the potential value of adopting a beef on dairy breeding strategy in Session 1; however, they also highlighted challenges in applying the technology if herd reproductive performance was suboptimal. Whilst other authors have highlighted similar challenges with sexed semen (Holden and Butler, 2018; Balzani et al., 2021), sales of sexed dairy semen and beef semen to dairy farms in Australia have increased year over year (NHIA, 2022). This is a promising development for the industry, although as described by our participants, it is unlikely to act as a panacea.

Health and welfare issues associated with rearing surplus calves as an alternative to early life killing were seen as key challenges, with participants recognising that calf rearing standards vary considerably from farm to farm. Many farms have challenges simply rearing their replacement female calves, making the concept of rearing additional calves understandably daunting. These difficulties may be attributable to the fact that colostrum management practices are substandard on many Australian dairy farms (Vogels et al., 2013; Phipps et al., 2018). This lack of robust preventative health management practices, combined with the health risks associated with sourcing calves from multiple properties with different histories of exposure to disease, was likely central to the concerns raised by participants about establishing centralized calf rearing units. These challenges have been cited by others as fundamental to upholding the welfare of surplus calves when raised for beef or veal (Creutzinger et al., (2021)).

Participants also referenced the costs associated with the additional labour and infrastructure needed to rear surplus calves through to older ages, with similar challenges noted by others (Vicic et al., 2022; Proudfoot et al., 2022). Despite this, it was described that farmers are still likely losing money when sending calves for slaughter at 5-30 days as an alternative to raising for beef or killing at-birth. This is particularly interesting given that in Australia, far more surplus calves are slaughtered at 5-30 days than euthanased at-birth on farm (Dairy Australia, 2023a). Possible explanations for this trend could be a lack of acknowledgment at the farm level of the costs associated with feeding and housing a calf for five days prior to slaughter, and/or a preference from farm workers to distance themselves from the task of killing the animal; a responsibility associated with significant emotions and feelings, including stress, anxiety, and guilt (Denis-Robichaud et al., 2023).

When raising surplus calves for beef, the volatility in beef commodity prices was frequently referenced as both a key challenge and an important driver of behaviours. Participants emphasised that rearing surplus calves for beef was an attractive solution when beef prices are high, but demand for dairy calves raised for beef was low whenever beef prices fell. This relationship is reflected in the number of calves sent for slaughter at 5-30 days of age each year, with more calves killed at this age when beef

prices are low and less calves killed (and likely raised for beef instead) when prices are high (Dairy Australia, 2023b). Beef price volatility has been reported by others as a key barrier in raising surplus calves for beef (Maher et al., 2021) and was seen by our participants as being driven in large part by climatic volatility, a relationship that has been demonstrated by others (Countryman et al., 2016). With climatic volatility predicted to worsen as a results of climate change (Kennett and Marwan, 2015), it is understandable that this led to some pessimism amongst our participants.

Many participants expressed desires to create 'new' markets for surplus calves. Appetite for innovation and developing new markets for surplus calves amongst dairy farmers has been previously reported (Vicic et al., 2022; Proudfoot et al., 2022). The appeal of creating 'some other system' is unsurprising given the numerous barriers cited by participants in accessing existing markets. However, given that dairy cattle comprise just 9% of Australia's total cattle herd, and the majority of Australian beef is exported (MLA, 2022b), developing new markets would require competing with the significant scale and demand of existing value chains.

Participants emphasised an overall lack of capacity and willingness to rear additional calves, combined with a deep sense of work-related fatigue. This focus on human welfare appeared to be rooted in the general sense of fatigue amongst farmers, a sentiment supported by data that just 45% of those working in Australian dairy businesses reported an effective work-life balance (Dairy Australia, 2021b). The challenges associated with dairy farmer mental health have also been reported in Canada, where many farmers report being over extended, disengaged, and at risk of burnout (Jones-Bitton et al., 2019). Phillips (2024) also suggested that the increasing complexity of livestock production is adding to farmers' overall workload and may be discouraging them from making major investments, such as improving animal welfare.

Social license was seen as important, but some participants felt there were currently no challenges in this regard, whilst others stated it could potentially be compromised by early life killing of surplus

calves. Those that questioned the dairy industry's ability to retain social license commented on the power of media exposés highlighting animal welfare issues (e.g., the media exposé associated with the New South Wales greyhound racing industry (Meldrum-Hana, 2015) that led to a temporary government-imposed shut down of the industry in 2016 (Chang et al., 2022)). Poor treatment of bobby calves at Australian abattoirs has been the subject of previous media (ABC News, 2017; Kloser, 2023) and has featured in multiple animal activist campaigns against the dairy industry (PETA Australia, 2013; Animals Australia, 2021), the latter being a key concern for participants.

Despite the availability of this 'negative' information to the public, other research has shown that the public maintains a high level of trust in Australian dairy farmers (Hendricks et al., 2022a). This may be partially explained by our companion study where some focus group participants that were made aware of early life killing of surplus calves were upset but did not blame the farmer (see Chapter 4). Instead, the issue was seen as a symptom of the wider food production system and simply another issue of many they were concerned about, leading to a sense of fatigue and desensitisation. This phenomenon has been described by Rice et al. (2020) who suggested when the public is exposed to multiple media events over time that there may be a cumulative change in attitudes. Furthermore, the maintenance of an industry's social license may be rooted in previously established legitimacy (conforming to established norms and meeting with acceptance) which provides the industry with credit, insofar as its past behaviours have created trust (Gehman et al., 2017). This may well be true for the farming sector, to which the public tends to attribute strong support associated with the stereotypical country-minded characteristics of rural people (Cockfield and Courtenay Botterill, 2012).

When reflecting on the connection, or lack thereof, between the public and the farming sector, at the outset of this study our participants frequently emphasised that the public is disconnected from farming and education would solve this disconnect. Whilst the views and beliefs of the community focus groups did make some participants reflect on this stance others retained their original position. For some participants the 'break-up' letters were seen as personal insults and provoked strong reactions. This

intervention was intended to act as a stimulus, specifically as a provoker (Törrönen, 2002), and arguably had the intended effect. However, upon hearing the content of the letters, other participants acknowledged the need to understand consumer sentiment and related to experiencing guilt fatigue and information overload. This reflection appeared to act as a catalyst, at least to some degree, to finding some common ground with the community perspective - a key goal when using deliberation to tackle wicked problems (Carcasson, 2016). Further evidence of evolution in some participants' thinking during Session 2 was their search for alternatives to educating the public into understanding, leading some participants to suggest a different approach. This alternative approach centred on changing the system of food production to align with public values; a tactic argued as central to achieving social sustainability in animal agriculture (von Keyserlingk et al., 2013; Weary et al., 2016).

Participants discussed the ethics and welfare implications of killing calves at birth versus raising them for transport and slaughter at 5-30 days of age. Calves destined for early life slaughter are at increased risk of mortality on farm, and experience stressors during transport and lairage (Boyle & Mee, (2021)). Importantly, similar welfare concerns can exist for surplus calves raised for veal or beef, despite slaughter of these animals occurring later in life (Creutzinger et al., (2021)). In contrast, when euthanasia (defined as humanely ending a life to relieve pain and suffering (Denis-Robichaud et al., 2023)) is correctly performed, there may be no compromise to the animal's welfare (Walker et al., 2020). Whilst industry literature frequently uses the term euthanasia to refer to calves killed at birth (Dairy Australia, 2023c), arguably these neonates are, in many cases, yet to experience any pain or suffering and it would therefore be more accurate to term the act 'killing' rather than 'euthanasia'. Participants also noted the mental health impacts associated with killing newborn calves. These concerns are supported by the work of others that highlights the painful emotions and complex feelings often associated with performing euthanasia (Denis-Robichaud et al., 2023), and the stress and job dissatisfaction that can be caused when employees are requested to perform the task (Merenda et al., 2023).

Participants also examined the ethics of killing an animal at different ages (i.e. at birth versus later in life), a complex debate also highlighted in our companion studies involving community focus groups (see Chapter 4) and beef and dairy value chain stakeholders (see Chapter 5). Previous work on public attitudes to killing surplus calves at different ages has indicated that trust is predicated on the industry being able to provide assurance that surplus calves have a purpose and are provided a reasonable length of life by contributing to the beef supply chain (Ritter et al., 2022).

In discussing how to affect widespread change in the management of surplus calves, many participants felt that market-based mandates would be influential and likely to occur. Such mandates already exist elsewhere in the world: Sainsbury's supermarket in the UK prohibits the shooting of dairy bull calves in their supply chains and prohibits the knowing sale of calves to buyers who slaughter them immediately. As an alternative, the supermarket runs a scheme where calves are reared to prescribed welfare standards and dairy farmers are paid a premium for the animals (Sainsbury's, 2017). Despite this successful example, there is strong competition amongst Australian milk processors for supply of milk from farmers (Dairy Australia, 2023d). This would likely present a challenging operating environment for singular retailers or processors to impose similar requirements on dairy farmers, as farmers could simply choose to supply their milk to a different company that does not impose such requirements.

Receiving financial incentives for directing calves away from early life killing was seen as an additional way of affecting change. Whilst community focus group participants indicated a willingness to pay an additional cost for milk for this to occur (see Chapter 4), and a similar willingness has been shown amongst community members to address culling of male layer chicks (de Haas et al., 2021), there is also evidence that consumer purchasing behaviours do not always align with attitudes and beliefs (Hyland et al., 2022). Appleby (2004) also suggests that *"it is not reasonable to expect consumers to take day-by-day responsibility for animal welfare at the point of sale, any more than they are expected to do so for other issues of concern to society, such as pollution"*.

In implementing sustainable alternatives to early life killing, participants frequently emphasised that the challenge was complex, and required a long-term, holistic approach; a sentiment that did not change following the interventions. The Hennovation project is one example where such an approach was taken to improve the health and welfare of laying hens (van Dijk et al., 2019).This project facilitated a multi-directional flow of knowledge between farmers and industry who led the activity at a local level, with researchers and farm advisors supporting the process. Participatory processes that are longer in duration and harness the input from a larger group of stakeholders, such as the Hennovation project, have demonstrated that these long-term, holistic approaches can be achieved. Webb et al. (2023) called for system-level rather than incremental change in surplus calf management, created and implemented with input from a wide range of stakeholders. Our participants also saw opportunities to affect change by collaborating amongst stakeholders, prioritising industry ownership of the issue, and learning from the success of others. The use of participatory approaches to facilitate peer-to-peer learning amongst farmers and mobilize different forms knowledge has similarly been demonstrated by others (Morgans et al., 2021).

In Session 3, participants expanded their discussions on opportunities to affect change by suggesting a requirement for farmers to have a plan for surplus calf management, a suggested approach echoed by our community focus group participants (see Chapter 4). This approach draws parallels to the outputs of the Pork Opportunities project that sought to develop designs of new pork production systems that benefit people, planet, profit, and pigs (Bremmer and Bos, 2017). The Pork Opportunities project resulted in designs of new production systems and solutions that were not worked out in detail but instead offered new directions to think about husbandry systems that were not compulsory or threatening and offered space for stakeholders' own interpretation and implementation of outcomes (Bremmer and Bos, 2017). That participants in this study favoured a similar high-level, customizable approach without strict requirements is unsurprising given the numerous and evolving aspects (i.e. the 'wickedness' (Rittel and Webber, 1973)) of the surplus calf challenge.

6.5. Strengths, limitations and future research

A key strength of this work was deliberative engagement, where different stakeholder perspectives were shared, and conversations challenged our participants, leading some to question their own assumptions; eventually identifying some common ground with other perspectives, most notably the public. Further, the love and breakup letters used to elicit discussion resulted in particularly rich data and are thus an activity that could be replicated in future studies. A significant limitation of the work was poor farmer attendance of the online meeting conveying the value chain stakeholder interview results during the COVID-19 pandemic. As such, the impact of this intervention was likely reduced. Farmer attendance was much stronger at in-person sessions, and we recommend that future studies engaging farmers over longitudinal focus groups prioritise in-person dialogues where possible. Additionally, our focus groups were not representative, and the findings of this study are therefore not generalizable across the national or global industry. Whilst our participatory process allowed for the integration of a wide range of views and evolution in longitudinal focus group participant thinking, it did not directly contribute to practice change. Reaching a true consensus from participants about how to implement sustainable management of surplus calves, and subsequently affecting this change, will likely require far longer and more complex, sustained dialogues amongst a wide range of stakeholders. We encourage work that supports the implementation of these approaches.

6.6. Conclusion

Participatory frameworks offer an opportunity to understand and integrate the views of a wide range of stakeholders, a critical step in working towards sustainable solutions for wicked problems such as the management of surplus dairy calves. Our results offer a pragmatic and realistic description of the complexity of the surplus calf challenge at farm level. Sharing the community viewpoint with participants led to a significant shift in the attitudes of some, who moved away from a desire to educate the public into understanding and towards the concept of adapting production practices to align with public values. In

contrast, sharing recently developed commercial alternatives to early life slaughter led to some pushback from participants, and scepticism towards the long-term economic viability of these markets. Our findings indicate that deliberative engagement, where participants take positions and reflect on diverse viewpoints presented over time, can lead to shifts in thinking. However, affecting change at farm-level and along value chains will require longer-term, sustained dialogues.

Chapter 7. General discussion, future research, and conclusion

7.1. Overview

The overall objective of my thesis was to identify how the Australian dairy industry might implement sustainable approaches to managing healthy surplus dairy calves and ending early life killing. Using participatory research methods, I was able to describe the attitudes of multiple stakeholders towards the surplus calf issue and evaluate the impacts of exposing farmers and their advisors to the perspectives of the community, and beef and dairy value chain stakeholders. My research describes complex social, economic, and environmental factors that contribute to how surplus calves are managed and highlights opportunities for working towards sustainable management of surplus calves in the future.

7.2. Strengths of this work

In the following section I will discuss the strengths of this work, including how the research contributes to the field of animal welfare science. Specifically, I will focus on the strengths of framing the surplus calf issue as a wicked problem, mapping the complex social and economic factors that contribute to the issue from multiple stakeholders' perspectives, and the use of a participatory framework to integrate multiple stakeholders' perspectives.

7.2.1. Framing the surplus calf issue as a wicked problem

One of the strengths of my research is that it implemented a novel approach to the surplus calf issue: framing the challenge as a wicked problem that requires novel approaches to address. Specifically, in Chapter 2 it is argued that the problem requires the use of participatory research to understand and integrate the views of all stakeholders, including the community and the animals themselves, to address the issue. Implementation of such an approach is then described in Chapters 3 to 6.

Many researchers have aimed to understand and find opportunities to improve the welfare compromises suffered by surplus calves (Renaud et al., 2017; Hyde et al., 2020; Wilson et al., 2020a;

Roadknight et al., 2021), including the implementation of incremental technical improvements such as colostrum management (Sumner et al., 2018), euthanasia practices (Turner and Doonan, 2010), and transport standards (Cave et al., 2005). Much work has also focused on how best to implement sexed semen (McCullock et al., 2013; Holden and Butler, 2018) in combination with beef crossbreeding (Hietala et al., 2014) to improve the performance of 'beef on dairy' cattle as beef animals (Foraker et al., 2022). However, each of these approaches attempts, in some way, to break the research problem down into manageable, disciplinary parts, an approach that, when used alone, has been argued as inadequate for addressing challenges that fit the characteristics of wicked problems (Carcasson, 2016). This may offer an explanation as to why, despite ongoing research, the surplus calf issue remains a problem across much of the world. It may also offer an explanation as to why we have seen reasonable success in addressing more linear issues in dairy animal welfare research such as tail docking, but are yet to see significant shift in the incidence of more complex issues such as lameness (von Keyserlingk and Weary, 2023).

My thesis presents some of the first work to frame the management of surplus dairy calves as a wicked problem and investigate novel approaches to dealing with the issue's complexity. In doing so, I have attempted to move beyond the use of incremental technical advancements to instead investigate approaches to achieving widespread cultural and institutional change within the industry. While this is not a perfect solution, this aspect of my thesis is a novel contribution to the field. Attempting to understand the complex operating environment of challenges in animal welfare offers opportunities for addressing other contentious issues in animal agriculture.

7.2.2. Mapping the complex social, economic and environmental factors that contribute to the surplus calf issue from multiple stakeholders' perspectives

A key focus of my research was to investigate the perspectives of a wide range of Australian stakeholders on the management of surplus calves. Chapters 3 and 4 explored community perspectives on the issue, Chapter 5 examined beef and dairy value chain stakeholders' perspectives, and Chapter 6

investigated how those operating at farm level understood the issue, including farmers and pre-farm gate advisors. In doing so, my thesis is perhaps the most comprehensive attempt thus far at mapping the breadth and depth of complex social, economic, and environmental factors contributing to the surplus calf challenge in Australia.

While other work has looked at community (e.g. Cardoso et al., 2017; Herrler et al., 2023; Ritter et al., 2022; Schulze et al., 2023), farmer (e.g. Maher et al., 2021; Proudfoot et al., 2022; Vicic et al., 2022), and industry actor (e.g. Hendricks et al., 2022; Proudfoot et al., 2022) attitudes to the management of surplus calves, my thesis broadens and deepens our understanding of these stakeholders' perspectives within the Australian context. To the best of my knowledge, it is also the first to investigate Australian community, and Australian beef and dairy value chain stakeholders' attitudes to surplus calf management. Further, my thesis presents some of the first work that allows for comparing and contrasting a wide range of stakeholder perspectives on surplus calf management within a similar context (similar geographic, climatic, economic, and political conditions).

In investigating community attitudes to surplus calves, a particular strength of Chapters 3 and 4 was including a diverse range of participants, such as those who identified as vegans. In doing so, this work focused not only on consumers of animal products, but also integrated the views of those that do not consume animal products but are interested in the issues and who influence corporate and government responses (Weary and von Keyserlingk, 2017). Further, by including focus group participants who varied widely in their attitudes to the industry, we encouraged the sharing of widely different perspectives which prompted participants to explore and question their own values and behaviours and contributed to richer dialogues during the focus groups.

In Chapter 2, the surplus calf challenge is described as complex, fitting many of the characteristics of a wicked problem. My research, summarized in Chapters 3 to 6, affirmed this complexity; widening and deepening our understanding of the myriad of factors that contribute to the challenge and therefore must

be overcome in order to implement sustainable solutions. Understanding the wide range of complex factors that contribute to the surplus calf challenge are applicable in informing future work attempting to address the issue.

7.2.3. Use of a participatory framework to integrate multiple stakeholders' perspectives

My research, described in Chapters 3 to 6, employed a participatory framework to integrate a wide range of stakeholder perspectives on the management of surplus calves. Within this wider framework, the research described Chapter 6 used a form of deliberative engagement (Carcasson, 2016), a participatory research paradigm where different stakeholder perspectives were shared and discussed amongst participants. This methodology allowed for deeper, more nuanced conversations, leading some participants, when exposed to perspectives from other actors, to question their assumptions and find common ground with these other perspectives (i.e. the farmers and advisors with the community). Allowing participants the time and space to develop their ideas through facilitated conversations was a particular strength of this work, given that such nuanced levels of conversation can be rare in day-to-day life. While other work has used participatory research to implement sustainable animal management practices (e.g. in US egg production (Swanson et al., 2011)) and investigate the perspectives of farmers and the allied industries on surplus calf management in Atlantic Canada (Proudfoot et al., 2022), the research in this thesis represents the first attempt to integrate the views of the community and industry stakeholders in developing sustainable approaches to the management of surplus calves in Australia.

A specific strength of this approach was exposing industry stakeholders (farmers and advisors) to the views of non-experts (i.e. the community); actors that have been acknowledged for their ability to contribute to the development of innovative approaches and strategies because they are free from the techniques and knowledge that is often embedded in specific sectors (Fung, 2006). In doing so, the research in this thesis recognised that the values and ideals of those not directly connected to the issue but affected by it (i.e. community members) were of equal importance as the needs of industry stakeholders.

This approach has been promoted for its ability to circumvent the implementation of solutions that may fail to resonate with public values (Weary et al., 2016).

Further, the use of 'love' and 'breakup' letters as a methodological approach to documenting community perspectives (Chapter 3) was a particularly effective 'provoker' (Törrönen, 2002) when presented to farmer and advisor participants in Chapter 6. These letters captured the top-of-mind thoughts of the community on the concept of 'dairy', a term open to interpretation (i.e. 'dairy products', 'dairy industry', etc.), and reflected the framing effects of the myriad of information streams impacting their daily lives (Tversky and Kahneman, 1981; Schuldt et al., 2015). The use of this technique resulted in intervention material that elicited rich dialogues and evolution in participants' thinking, contributing to the overall impact of the deliberative process in Chapter 6.

This thesis addressed, in part, the clear and pressing need to engage in research that expands on the traditional focus on technical solutions by instead developing and evaluating participatory methodologies, enabling the dairy industry to move forward in addressing the ever evolving, wicked problem of surplus calf management. Such methodological approaches are applicable for addressing the surplus calf challenge in other operating environments (e.g. other geographical regions, different future operating environments), and for addressing other similarly complex challenges both within dairy, the wider agricultural industry, and other sectors.

7.3. Limitations of this work

Whilst a strength of this thesis was the inclusion of community focus group participants, it may be argued that a limitation of the work was that this engagement was unidirectional (i.e. from the community to the farmers only). Weary & von Keyserlingk, (2017) emphasise the importance of two-way conversations with the community when working to resolve societal concerns about animal welfare. Thus, this work could have been strengthened by allowing for a more complex dialogue between the community participants and the farmer and advisor participants.

Further, the Australian public, and the dairy industry, are both geographically and culturally diverse. As such, the findings of Chapters 3 to 6 should not be seen as generalizable across the wider public or dairy industry. In particular, the farmers and community members that participated in this research were only recruited from one geographic region, whilst each value stakeholder group in Chapter 5 was only represented by one or two organisations.

A further limitation of this work was the poor farmer participant attendance at the online meeting held as part of the research in Chapter 6. This likely resulted in a much-reduced impact of the second intervention. While conducting the research in Chapter 6, we found that farmer attendance was far greater when sessions were in-person. As such, future studies engaging farmers should look to prioritize in-person dialogues where possible.

Finally, whilst the research in this thesis contributed to a rich understanding of the complexity of the surplus calf challenge from multiple stakeholders' perspectives, by its design, it did not contribute directly to farm-level practice change and as such plays an indirect role in working towards the sustainable management of surplus calves and an end to early life killing in the future.

7.4. Future research

Addressing the surplus calf issue at a global level and implementing truly sustainable alternatives to early life killing will require a concerted research effort in multiple disciplines. Whilst I have emphasised in this thesis that incremental technical advancements should not be viewed as a panacea, they are still required to support improvements in the way animals are managed. Future work should look to further our understanding of how to breed, feed, and manage surplus calves so that they are economically viable for beef production. Indeed, we must show that these animals have purpose (Ritter et al., 2022) and experience a reasonably good life.

Research that interrogates potential mechanisms to affect farm-level and value chain-level change across the industry should also be prioritized. Whilst this was investigated in part in Chapters 5 and 6, it is worthy of further interrogation. Potential mechanisms to affect change in surplus calf management in Australia include legislation. However, examples of other contentious issues in Australian livestock production, such as live export, have demonstrated a reluctance from Government to legislate beyond minimum welfare requirements (Rice et al., 2020). A second potential mechanism for change is an industry-owned commitment to ending early life killing, as seen in the UK (AHDB, 2020). Although the peak advocacy body for dairy farmers in Australia implemented a policy on surplus calf management in 2022 requiring that all calves enter a value chain by 2034 (Australian Dairy Farmers, 2022), it does not address the issue of early life slaughter. Specifically, under this policy, whilst 'entering a value chain' excludes killing calves at birth on farm it still allows for calves to be transported to abattoirs and slaughtered at 5-30 days. A third potential mechanism is a media exposé on surplus calf management. However, as discussed in Chapter 6, previous Australian media exposés have aired poor treatment of bobby calves at Australian abattoirs (ABC News, 2017; Kloser, 2023), with little to no sustained reduction in early life killing since (Dairy Australia, 2023b). A fourth potential mechanism for change could be the development of new beef market pathways for surplus calves. Descriptions of four possible pathways were utilized to facilitate discussion in Chapter 6 and whilst met with some optimism, there were persistent concerns as to the economic viability of these options. A fifth potential mechanism to support an end to early life killing could be market-based mandates. Participants in Chapter 6 saw mandated bans on early life killing from milk processors or retailers as being potentially impactful in affecting change. Future research should look to improve our understanding of which, if any of these mechanisms, or what additional mechanisms, could be most likely to affect widespread change in how surplus calves are managed.

Further, this thesis demonstrated the benefits of moving beyond research that focuses on technical advancements to instead working to understand and address the complexity of the surplus calf issue.

Whilst promising, the research in this thesis represents only a first step in a much longer required journey towards facilitating widespread sustainable change. Future research should focus on implementing longer, sustained, more complex dialogues between multiple stakeholders that identify ideal future scenarios in surplus calf management and how to implement them. This work should include both quantitative and qualitative research and prioritize genuine two-way engagement between stakeholders. Within these dialogues, representation of all stakeholders affected by the issue, including the industry, the community, and the animals, should be prioritized.

Finally, future research should also look to identify limitations of, and risks to, the social sustainability of food animal production systems beyond the management of surplus dairy calves. This work should also aim to design alternative systems that meet the future needs of animals, farmers, the wider agricultural sector, consumers, and the broader community. Within the dairy industry there are a number of other contentious issues, such as cow-calf separation, pasture access, involuntary culling due to lameness and other diseases, and the welfare of cull cows. Future research efforts that employ participatory approaches could be useful in navigating the road ahead. Further, given that human social evolution is constant (Klüver, 2008), ongoing research should look to design food production systems that align with evolving societal values.

7.5. Conclusion

The design of modern agricultural systems has placed emphasis on the values of food safety, food security, and economic viability. However, the driving forces that inform a fit for purpose food production system are not static; they shift and change. The systems designed for producing food from animals are, in many cases, no longer fit for purpose as we now recognise that social acceptability and environmental impacts should be weighted equally to economic viability for an industry to be sustainable in the long run. The management of surplus dairy calves, including the practice of early life killing, is one

such element of a food production system that is now recognised as a threat to the social sustainability of the dairy industry, and therefore to its future.

The body of research summarized in my thesis clearly shows that early life killing of surplus calves is contentious but also complex and thus cannot be addressed with simple technical solutions alone. Rather, this challenge necessitates nuanced, sustained dialogues between a wide range of stakeholders to identify what sustainable alternatives look like, and how to apply them. Implementing sustainable food production systems into the future will require an ongoing ability to question what elements are no longer fit for purpose and to continuously adapt our systems to maintain alignment with constantly evolving driving forces. Having effective mechanisms to do this is critical and will centre on listening to and understanding the needs of all humans, animals, the land, and its traditional custodians into the future.

References

ABC News 2017. Abattoir boss admits calves ill-treated after Animal Liberation releases video. Retrieved on 8 April 2024, from *https://www.abc.net.au/news/2017-05-04/abattoir-owner-admits-calves-ill-treated/8495952*.

Adamczyk D, Jaworska D, Affeltowicz D and Maison D 2022. Plant-Based Dairy Alternatives: Consumers' Perceptions, Motivations, and Barriers—Results from a Qualitative Study in Poland, Germany, and France. Nutrients 14, 2171.

Agriculture and Agri-Food Canada 2020. Per capita disappearance - protein disappearance of animal protein sources in Canada. Retrieved on 23 January 2021, from *https://www.agr.gc.ca/eng/animal-industry/poultry-and-egg-market-information/industry-indicators/per-capita-disappearance/?id=1384971854413*.

AHDB 2020. GB Dairy Calf Strategy. Retrieved on 31 May 2023, from *https://ahdb.org.uk/GB-calf-strategy*.

Alberta Government 2020. Per Capita Consumption of Meats in Canada and United States. Retrieved on 14 January 2021, from *https://open.alberta.ca/dataset/per-capita-consumption-of-meats-in-canada-and-united-states-1985-2014#summary*.

Albertí P, Panea B, Sañudo C, Olleta JL, Ripoll G, Ertbjerg P, Christensen M, Gigli S, Failla S, Concetti S, Hocquette JF, Jailler R, Rudel S, Renand G, Nute GR, Richardson RI and Williams JL 2008. Live weight, body size and carcass characteristics of young bulls of fifteen European breeds. Livestock Science 114, 19–30.

American Veterinary Medical Association 2020. AVMA Guidelines for the Euthanasia of Animals: 2020 Edition.

Ammann J, Grande A, Inderbitzin J and Guggenbühl B 2023. Understanding Swiss consumption of plant-based alternatives to dairy products. Food Quality and Preference 110, 104947.

Animal Health Australia 2012. Australian Animal Welfare Standards and Guidelines, Edition One Version 1.1 - Land Transport of Livestock. Retrieved on 23 January 2021, from *http://www.animalwelfarestandards.net.au*.

Animal Health Australia 2016. Australian Animal Welfare Standards and Guidelines for Cattle Edition One. Retrieved on 31 May 2023, from *www.animalwelfarestandards.net.au*.

Animals Australia 2021. The reality of dairy: killing calves. Retrieved on 8 April 2024, from *https://animalsaustralia.org/our-work/farmed-animals/what-happens-to-dairy-calves/*.

Appleby MC 2004. Science is not enough: How do we increase implementation? Animal Welfare 13, 159–162.

Aschemann-Witzel J and Schulze M 2023. Transitions to plant-based diets: the role of societal tipping points. Current Opinion in Food Science 51, 101015.

Australian Dairy Farmers 2020a. Australian Dairy Farmers Policies. Retrieved on 19 January 2021, from *https://australiandairyfarmers.com.au/policy-advisory-groups/animal-health-and-welfare/*.

Australian Dairy Farmers 2020b. Australian Dairy Farmers Farm Operations Policies. Retrieved on 5 December 2023, from *https://australiandairyfarmers.com.au/policy-advisory-groups/farm-operations/*.

Australian Dairy Farmers 2022. Surplus Calves Taskforce. Retrieved on 23 April 2024, from *https://australiandairyfarmers.com.au/surplus-calves-taskforce/*.

Australian Public Service Commission 2007. Tackling wicked problems: a public policy perspective. Retrieved on 1 April 2021, from *https://catalogue.nla.gov.au/catalog/4400097*.

Baden C, Pasitselska O, Aharoni T and Tenenboim-Weinblatt K 2022. Serial Focus Groups: A Longitudinal Design for Studying Interactive Discourse. International Journal of Qualitative Methods 21.

Balzani A, Aparacida Vaz do Amaral C and Hanlon A 2021. A Perspective on the Use of Sexed Semen to Reduce the Number of Surplus Male Dairy Calves in Ireland: A Pilot Study. Frontiers in Veterinary Science 7, 623128.

Bank Australia 2020. Bank Australia: Is the money in your bank doing good or harm? Retrieved on 19 January 2021, from *https://www.bankaust.com.au/responsible-banking/what-we-do-and-dont-lend-to/live-export-and-intensive-animal-farming*.

Barkema HW, von Keyserlingk MAG, Kastelic JP, Lam TJGM, Luby C, Roy JP, LeBlanc SJ, Keefe GP and Kelton DF 2015. Invited review: Changes in the dairy industry affecting dairy cattle health and welfare. Journal of Dairy Science 98, 7426–7445.

Bastian B and Loughnan S 2016. Resolving the Meat-Paradox: A Motivational Account of Morally Troublesome Behavior and Its Maintenance. Personality and Social Psychology Review 21.

Beaver A, Meagher RK, von Keyserlingk MAG and Weary DM 2019. Invited review: A systematic review of the effects of early separation on dairy cow and calf health. Journal of Dairy Science 102, 5784–5810.

Beaver A, Proudfoot KL and G von Keyserlingk MA 2020. Symposium review: Considerations for the future of dairy cattle housing: An animal welfare perspective. Journal of Dairy Science 103, 5746–5758.

Beggs DS, Fisher AD, Jongman EC and Hemsworth PE 2015. A survey of Australian dairy farmers to investigate animal welfare risks associated with increasing scale of production. Journal of Dairy Science 98, 5330–5338.

Benard M and de Cock Buning T 2013. Exploring the Potential of Dutch Pig Farmers and Urban-Citizens to Learn Through Frame Reflection. Journal of Agricultural and Environmental Ethics 26, 1015–1036.

Berry D 2021. Invited review: Beef-on-dairy - The generation of crossbred beef x dairy cattle. Journal of Dairy Science 104.

Berry HL, Botterill LC, Cockfield G and Ding N 2016. Identifying and measuring agrarian sentiment in regional Australia. Agriculture and Human Values 33, 929–941.

Bollani L, Bonadonna A and Peira G 2019. The Millennials' Concept of Sustainability in the Food Sector. Sustainability 11, 2984.

Bolton SE and von Keyserlingk MAG 2021. The Dispensable Surplus Dairy Calf: Is This Issue a "Wicked Problem" and Where Do We Go From Here? Frontiers in Veterinary Science 8, 347.

Bolton SE, Vandresen B and von Keyserlingk MA 2024. Waste not, want not: Value chain stakeholder attitudes to surplus dairy calf management in Australia. Animal Welfare 33, 1–10.

Boone ME and Snowden DJ 2007. A Leader's Framework for Decision Making. Harvard Business Review 85, 68–77.

Bórawski P, Pawlewicz A, Mickiewicz B, Pawlewicz K, Bełdycka-Bórawska A, Holden L and Brelik A 2020. Economic Sustainability of Dairy Farms in the EU. European Research Studies Journal XXIII, 955–978.

Bos B and Koerkamp PG 2009. Synthesising needs in system innovation through structured design: A methodical outline of the role of needs in reflexive interactive design (RIO). Transitions Towards Sustainable Agriculture and Food Chains in Peri-Urban Areas, 219–238.

Boulton AC, Kells NJ, Cogger N, Johnson CB, O'Connor C, Webster J, Palmer A and Beausoleil NJ 2020. Risk factors for bobby calf mortality across the New Zealand dairy supply chain. Preventive Veterinary Medicine 174, 104836.

Boyle LA and Mee JF 2021. Factors Affecting the Welfare of Unweaned Dairy Calves Destined for Early Slaughter and Abattoir Animal-Based Indicators Reflecting Their Welfare On-Farm. Frontiers in Veterinary Science 8, 283.

Brambell R 1965. Report of the Technical committee to enquire into the welfare of animals kept under intensive livestock husbandry systems. London.

Braun V and Clarke V 2006. Using thematic analysis in psychology. Qualitative Research in Psychology 3, 77–101.

Bremmer B and Bos B 2017. Creating Niches by applying Reflexive Interactive Design. In AgroEcological AgroEcological Transitions: Changes and Breakthroughs in the Making (eds. B. Elzen, M. Augustyn, M. Barbier and B. van Mierlo), pp. 19–34. Wageningen University and Research.

Britt JH, Cushman RA, Dechow CD, Dobson H, Humblot P, Hutjens MF, Jones GA, Ruegg PS, Sheldon IM and Stevenson JS 2018. Invited review: Learning from the future—A vision for dairy farms and cows in 2067. Journal of Dairy Science 101, 3722–3741.

Broad GM 2016. Animal Production, Ag-gag Laws, and the Social Production of Ignorance: Exploring the Role of Storytelling. Environmental Communication 10, 43–61.

Bruers S 2023. The animal welfare cost of meat: evidence from a survey of hypothetical scenarios among Belgian consumers. Journal of Environmental Ethics and Policy 12, 324–341.

Bruijnis MRN, Blok V, Stassen EN and Gremmen HGJ 2015. Moral "Lock-In" in Responsible Innovation: The Ethical and Social Aspects of Killing Day-Old Chicks and Its Alternatives. Journal of Agricultural and Environmental Ethics 28, 939–960.

Brümmer N, Petersen W and Christoph-Schulz I 2018. Consumer acceptance of dual-purpose chickens a mixed methods approach. German Journal of Agricultural Economics 67, 234–245.

Buczinski S, Fecteau G, Blouin L and Villettaz-Robichaud M 2021. Factors affecting dairy calf price in auction markets of Québec, Canada: 2008–2019. Journal of Dairy Science, 2008–2019.

Burdick NC, Randel RD, Carroll JA and Welsh TH 2011. Interactions between temperament, stress, and immune function in cattle. International Journal of Zoology 2011.

Burton RJF, Kuczera C and Schwarz G 2008. Exploring Farmers' Cultural Resistance to Voluntary Agri-environmental Schemes. Sociologia Ruralis 48, 16–37.

Busch G, Weary DM, Spiller A and von Keyserlingk MAG 2017. American and German attitudes towards cow-calf separation on dairy farms. PLOS ONE 12, e0174013.

CANFAX 2022. Dairy-Beef: How much? Weekly Market Outlook and Analysis LII.

Capper JL, Cady RA and Bauman DE 2009. The environmental impact of dairy production: 1944 compared with 2007. Journal of Animal Science 87, 2160–2167.

Carcasson M 2016. Tackling Wicked Problems Through Deliberative Engagement. National Civic Review 105, 44–47.

Cardoso CS, Hötzel MJ, Weary DM, Robbins JA and von Keyserlingk MAG 2016. Imagining the ideal dairy farm. Journal of Dairy Science 99, 1663–1671.

Cardoso CS, von Keyserlingk MAG and Hötzel MJ 2017. Brazilian Citizens: Expectations Regarding Dairy Cattle Welfare and Awareness of Contentious Practices. Animals 2017, Vol. 7, Page 89 7, 89.

Cave J, Callinan A and Woonton W 2005. Mortalities in bobby calves associated with long distance transport. Australian Veterinary Journal 83, 82–84.

Chakraborty K 2005. Consumers' attitude towards hormone-free milk: what have we learned? Applied Economics Letters 12, 633–637.

Chang V, Descovich K, Henning J and Allavena R 2022. Greyhound morbidity and mortality in Australia: A descriptive analysis of reported data from regulatory racing agencies. Frontiers in Veterinary Science 9, 925948.

Chapinal N, Liang Y, Weary DM, Wang Y and von Keyserlingk MAG 2014. Risk factors for lameness and hock injuries in Holstein herds in China. Journal of Dairy Science 97, 4309–4316.

Clarke V and Braun V 2017. Thematic analysis. Journal of Positive Psychology 12, 297–298.

Clarke AM, Drennan MJ, McGee M, Kenny DA, Evans RD and Berry DP 2009. Intake, live animal scores/measurements and carcass composition and value of late-maturing beef and dairy breeds. Livestock Science 126, 57–68.

Climent F 2018. Ethical Versus Conventional Banking: A Case Study. Sustainability 10, 2152.

Cockfield G and Courtenay Botterill L 2012. Signs of Countrymindedness: A Survey of Attitudes to Rural Industries and People. Australian Journal of Political Science 47, 609–622.

Cockram MS 2021. Invited Review: The welfare of cull dairy cows. Applied Animal Science 37, 334–352.

Cole J and Fraser D 2018. Zoo Animal Welfare: The Human Dimension. Journal of Applied Animal Welfare Science 21, 49–58.

Coleman G and Toukhsati S 2006. Consumer attitudes and behaviour relevant to the red meat industry. Meat and Livestock Australia Limited, North Sydney.

Collier ES, Harris KL, Bendtsen M, Norman C and Niimi J 2023. Just a matter of taste? Understanding rationalizations for dairy consumption and their associations with sensory expectations of plant-based milk alternatives. Food Quality and Preference 104, 104745.

Cook NB and von Keyserlingk MAG 2024. Perspective: Prolonged cow-calf contact—A dilemma or simply another step in the evolution of the dairy industry? Journal of Dairy Science 107, 4–8.

Cooney J 2017. Reflections on the 20th anniversary of the term 'social licence'. Journal of Energy and Natural Resources Law 35, 197–200.

Cornish A, Raubenheimer D and Mcgreevy P 2016. What We Know about the Public's Level of Concern for Farm Animal Welfare in Food Production in Developed Countries. Animals 6.

Countryman AM, Paarlberg PL and Lee JG 2016. Dynamic Effects of Drought on the U.S. Beef Supply Chain. Agricultural and Resource Economics Review 45, 459–484.

Crawford KL, Finnane A, Greer RM, Phillips CJC, Woldeyohannes SM, Perkins NR and Ahern BJ 2021. Appraising the Welfare of Thoroughbred Racehorses in Training in Queensland, Australia: The Incidence, Risk Factors and Outcomes for Horses after Retirement from Racing. Animals 2021, Vol. 11, Page 142 11, 142.

Creutzinger K, Pempek J, Habing G, Proudfoot K, Locke S, Wilson D and Renaud D 2021. Perspectives on the Management of Surplus Dairy Calves in the United States and Canada. Frontiers in Veterinary Science 8, 344.

Creutzinger KC, Pempek JA, Locke SR, Renaud DL, Proudfoot KL, George K, Wilson DJ and Habing G 2022. Dairy producer perceptions toward male dairy calves in the Midwestern United States. Frontiers in Animal Science 3, 1000897.

Croney CC and Anthony R 2011. Invited review: Ruminating conscientiously: Scientific and socio-ethical challenges for US dairy production. Journal of Dairy Science 94, 539–546.

Croyle SL, Belage E, Khosa DK, LeBlanc SJ, Haley DB and Kelton DF 2019. Dairy farmers' expectations and receptivity regarding animal welfare advice: A focus group study. Journal of Dairy Science 102, 7385–7397.

Curtis G, Argo CMG, Jones D and Grove-White D 2018. The impact of early life nutrition and housing on growth and reproduction in dairy cattle. PLoS ONE 13.

DAFF 2024. Dairy in Australia. Retrieved on 14 April 2024, from *https://rb.gy/1qei1d*.

Dagevos H and van Ophem J 2013. Food consumption value: Developing a consumer-centred concept of value in the field of food. British Food Journal 115, 1473–1486.

Dairy Australia 2019. Animal Care on Australian Dairy Farms - Results of the Dairy Australia Animal Husbandry Survey 2019. Retrieved on 1 November 2020, from *https://t.ly/Rof1Y*.

Dairy Australia 2020. Australian Dairy Industry Materiality Assessment Report 2019. Retrieved on 24 April 2024, from *https://rb.gy/8c78o2*.

Dairy Australia 2021a. Dairy NSW Annual Report 2020/21. Retrieved on 18 April 2024, from *https://nla.gov.au/nla.obj-3054857905/view*.

Dairy Australia 2021b. Workforce: the power of people on Australian dairy farms in 2020. Retrieved on 2 December 2023, from *https://rb.gy/d26cv6*.

Dairy Australia 2022. Rearing Healthy Calves 2nd Edition. Retrieved on 25 April 2024, from *https://t.ly/xb4vC*.

Dairy Australia 2023a. The Australian Dairy Industry In Focus 2023. Retrieved on 4 December 2023, from *https://rb.gy/tugegj*.

Dairy Australia 2023b. Dairy calf market pathways trends 2010-22. Retrieved on 12 June 2023, from *https://rb.gy/grkngj*.

Dairy Australia 2023c. Animal Husbandry and Genetics Survey 2022 Report. Retrieved on 12 June 2023, from *https://rb.gy/ucdyma*.

Dairy Australia 2023d. Situation and Outlook: September 2023. Retrieved on 9 April 2024, from *https://rb.gy/emizjx*.

D'Amato D, Veijonaho S and Toppinen A 2020. Towards sustainability? Forest-based circular bioeconomy business models in Finnish SMEs. Forest Policy and Economics 110, 101848.

Damiaans B, Renault V, Sarrazin S, Berge AC, Pardon B, Ribbens S, Saegerman C and Dewulf J 2019. Biosecurity practices in Belgian veal calf farming: Level of implementation, attitudes, strengths, weaknesses and constraints. Preventive Veterinary Medicine 172, 104768.

Deming J, Kinsella J, O'Brien B and Shalloo L 2019. An examination of the effects of labor efficiency on the profitability of grass-based, seasonal-calving dairy farms. Journal of Dairy Science 102, 8431–8440.

Denis-Robichaud J, Rousseau M, Denicourt M, Villettaz-Robichaud M, Lamothe A-M and DesCôteaux L 2023. Methods used by Canadian dairy farmers for on-farm euthanasia and the emotions associated with the decision and the practice of euthanasia. Journal of Dairy Science 106, 1301–1314.

DFC-NFACC 2023. Code of Practice for the Care and Handling of Dairy Cattle. Retrieved on 31 May 2023, from *www.nfacc.ca*.

Dicicco-Bloom B and Crabtree BF 2006. The qualitative research interview. Medical Education 40, 314–321.

van Dijk L, Buller HJ, Blokhuis HJ, van Niekerk T, Voslarova E, Manteca X, Weeks CA and Main DCJ 2019. HENNOVATION: Learnings from Promoting Practice-Led Multi-Actor Innovation Networks to Address Complex Animal Welfare Challenges within the Laying Hen Industry. Animals 2019, Vol. 9, Page 24 9, 24.

van Dijk L, Hayton A, Main DCJ, Booth A, King A, Barrett DC, Buller HJ and Reyher KK 2017. Participatory Policy Making by Dairy Producers to Reduce Anti-Microbial use on Farms. Zoonoses and Public Health 64, 476–484.

Edwards-Callaway LN, Walker J and Tucker CB 2019. Culling Decisions and Dairy Cattle Welfare During Transport to Slaughter in the United States. Frontiers in Veterinary Science 5, 343.

Elkink JA, Farrell DM, Reidy T and Suiter J 2015. Understanding the 2015 Marriage Referendum in Ireland: Constitutional Convention, Campaign, and Conservative Ireland. University College Dublin. Geary Institute.

Eriksson H, Fall N, Ivemeyer S, Knierim U, Simantke C, Fuerst-Waltl B, Winckler C, Weissensteiner R, Pomiès D, Martin B, Michaud A, Priolo A, Caccamo M, Sakowski T, Stachelek M, Spengler Neff A, Bieber A, Schneider C and Alvåsen K 2022. Strategies for keeping dairy cows and calves together – a cross-sectional survey study. Animal 16, 100624.

Ernst A, Biß KH, Shamon H, Schumann D and Heinrichs HU 2018. Benefits and challenges of participatory methods in qualitative energy scenario development. Technological Forecasting and Social Change 127, 245–257.

Farrell DM, Suiter J and Harris C 2019. 'Systematizing' constitutional deliberation: the 2016–18 citizens' assembly in Ireland. Irish Political Studies 34, 113–123.

Field L 2018. The abortion referendum of 2018 and a timeline of abortion politics in Ireland to date. Irish Political Studies 33, 608–628.

Fisher AD, Stevens BH, Conley MJ, Jongman EC, Lauber MC, Hides SJ, Anderson GA, Duganzich DM and Mansell PD 2014. The effects of direct and indirect road transport consignment in combination with feed withdrawal in young dairy calves. Journal of Dairy Research 81, 297–303.

Flower FC and Weary DM 2001. Effects of early separation on the dairy cow and calf: 2. Separation at 1 day and 2 weeks after birth. Applied Animal Behaviour Science 70, 275–284.

Foley JA, Ramankutty N, Brauman KA, Cassidy ES, Gerber JS, Johnston M, Mueller ND, O'Connell C, Ray DK, West PC, Balzer C, Bennett EM, Carpenter SR, Hill J, Monfreda C, Polasky S, Rockström J, Sheehan J, Siebert S, Tilman D and Zaks DPM 2011. Solutions for a cultivated planet. Nature 2011 478:7369 478, 337–342.

Fonterra 2022. Caring for animals. Retrieved on 31 May 2023, from *https://rb.gy/ggxnce*.

Foraker BA, Frink JL and Woerner DR 2022. Invited review: a carcass and meat perspective of crossbred beef × dairy cattle. Translational Animal Science 6.

Fraser D 2008a. Animal Welfare and the Intensification of Animal Production. In The Ethics of Intensification. The International Library of Environmental, Agricultural and Food Ethics (ed. P.B. Thompson), pp. 167–189. Springer, Dordrecht.

Fraser D 2008b. Understanding animal welfare. Acta Veterinaria Scandinavica 50, S1.

Fraser D 2014. Could animal production become a profession? Livestock Science 169, 155–162.

Fraser D, Weary D, Pajor E and Milligan B 1997. A Scientific Conception of Animal Welfare that Reflects Ethical Concerns. Ethics and Animal Welfare Collection 6, 187–205.

Fung A 2006. Varieties of participation in complex governance. Public Administration Review 66, 66–75.

Fung A 2015. Putting the Public Back into Governance: The Challenges of Citizen Participation and Its Future. Public Administration Review 75, 513–522.

Futureye 2018. Australia's Shifting Mindset on Farm Animal Welfare. Retrieved on 28 January 2021, from *https://www.outbreak.gov.au/sites/default/files/documents/farm-animal-welfare.pdf*.

Gavrilets S, Tverskoi D and Sánchez A 2024. Modelling social norms: an integration of the norm-utility approach with beliefs dynamics. Philosophical Transactions of the Royal Society B 379.

Gehman J, Lefsrud LM and Fast S 2017. Social license to operate: Legitimacy by another name? Canadian Public Administration 60, 293–317.

Giacomin J 2014. What Is Human Centred Design? The Design Journal 17, 606–623.

Gibson KE, Lamm AJ, Lamm KW and Warner LA 2020. Communicating with Diverse Audiences about Sustainable Farming: Does Rurality Matter?. Journal of Agricultural Education 61, 156–174.

Giersberg MF, Renaud D and Kemper N 2021. Editorial: Perspectives in Dealing With Surplus Male Farm Animals. Frontiers in Veterinary Science 8, 797081.

Government of Canada 2020. Humane transport and animal welfare. Retrieved on 30 January 2021, from *https://www.inspection.gc.ca/animal-health/humane-transport/eng/1300460032193/1300460096845*.

Greenwood PL 2021. Review: An overview of beef production from pasture and feedlot globally, as demand for beef and the need for sustainable practices increase. Animal 15, 100295.

Gregory J, Watson R and Hartz-Karp J 2008. Using deliberative techniques to engage the community in policy development. Australia and New Zealand Health Policy 5.

Gremmen B 2020. Moral dilemmas of animal production systems. Animal Frontiers 10, 15–20.

de Haas EN, Oliemans E and van Gerwen MAAM 2021. The Need for an Alternative to Culling Day-Old Male Layer Chicks: A Survey on Awareness, Alternatives, and the Willingness to Pay for Alternatives in a Selected Population of Dutch Citizens. Frontiers in Veterinary Science 8, 381.

Haas R, Schnepps A, Pichler A and Meixner O 2019. Cow Milk versus Plant-Based Milk Substitutes: A Comparison of Product Image and Motivational Structure of Consumption. Sustainability 11, 5046.

Hampton JO, Jones B and McGreevy PD 2020. Social License and Animal Welfare: Developments from the Past Decade in Australia. Animals 2020, Vol. 10, Page 2237 10, 2237.

Hansen BG, Langseth E and Berge C 2023. Animal welfare and cow-calf contact-farmers' attitudes, experiences and adoption barriers. Journal of Rural Studies 97, 34–46.

Harrison R 1964. Animal Machines. Vincent Stuart Publishers, London.

Haskell MJ 2020. What to do with surplus dairy calves? Welfare, economic and ethical considerations. Landbauforschung 70, 45–48.

Heidemann MS, Molento CFM, Reis GG and Phillips CJC 2020. Uncoupling Meat From Animal Slaughter and Its Impacts on Human-Animal Relationships. Frontiers in Psychology 11, 535710.

Hendricks J, Mills KE, Sirovica L V, Sundermann L, Bolton SE and G von Keyserlingk MA 2022a. Public perceptions of potential adaptations for mitigating heat stress on Australian dairy farms. Journal of Dairy Science 105.

Hendricks J, Weary DM and von Keyserlingk MAG 2022b. Veterinarian perceptions on the care of surplus dairy calves. Journal of Dairy Science 105, 6870–6879.

Herrero M, Palmer J, Thornton PK and Research C 2018. Livestock, land and the environmental limits of animal source-food consumption. Retrieved on 2 December 2020, from *https://www.scienceforum2018.org/*.

Herrler M, Chagunda MGG and Stroebele-Benschop N 2023. Public Awareness, Attitude and Empathy Regarding the Management of Surplus Dairy Calves. Journal of Agricultural and Environmental Ethics 36, 1–18.

Hietala P, Bouquet P and Juga J 2014. Effect of replacement rate, crossbreeding and sexed semen on the efficiency of beef production from dairy herds in Finland. Acta Agriculturae Scandinavica, Section A — Animal Science 64, 199–209.

Hohenboken WD 1999. Applications of sexed semen in cattle production. In Theriogenology, pp. 1421–1433. Elsevier.

Holden LA 2020. Understanding the environmental impact of global dairy production. Journal of Animal Science 98, 1–2.

Holden SA and Butler ST 2018. Review: Applications and benefits of sexed semen in dairy and beef herds. Animal 12, s97–s103.

Hölker S, von Meyer-Höfer M and Spiller A 2019. Animal Ethics and Eating Animals: Consumer Segmentation Based on Domain-Specific Values. Sustainability 11, 3907.

Holmes AGD 2020. Researcher Positionality: A Consideration of Its Influence and Place in Qualitative Research - A New Researcher Guide. Shanlax International Journal of Education 8, 1–10.

Hötzel MJ, Cardoso CS, Roslindo A and von Keyserlingk MAG 2017. Citizens' views on the practices of zero-grazing and cow-calf separation in the dairy industry: Does providing information increase acceptability? Journal of Dairy Science 100, 4150–4160.

Hyde RM, Green MJ, Sherwin VE, Hudson C, Gibbons J, Forshaw T, Vickers M and Down PM 2020. Quantitative analysis of calf mortality in Great Britain. Journal of Dairy Science 103, 2615–2623.

Hyland JJ, Regan Á, Sweeney S, McKernan C, Benson T and Dean M 2022. Consumers attitudes toward animal welfare friendly produce: An island of Ireland study. Frontiers in Animal Science 3, 930930.

IDEO.org 2015. The field guide to human centred design. Retrieved on 24 April 2024, from *https://www.designkit.org/resources/1.html*.

IDF 2022. The IDF global Carbon Footprint standard for the dairy sector. Bulletin of the IDF. Retrieved on 31 May 2023, from *https://t.ly/q9nBk*.

Ioannidou M, Lesk V, Stewart-Knox B and Francis KB 2024. Don't mind milk? The role of animal suffering, speciesism, and guilt in the denial of mind and moral status of dairy cows. Food Quality and Preference 114, 105082.

Jaborek JR, Zerby HN, Moeller SJ, Fluharty FL and Relling AE 2019. Evaluation of feedlot performance, carcass characteristics, carcass retail cut distribution, Warner-Bratzler shear force, and fatty acid composition of purebred Jersey and crossbred Jersey steers. Translational Animal Science 3, 1475–1491.

Jackson S 2019. Building trust and establishing legitimacy across scientific, water management and Indigenous cultures. Australian Journal of Water Resources 23, 14–23.

Jacobs A 2020. Is Dairy Farming Cruel to Cows? The New York Times. Retrieved on 19 January 2021, from *https://www.nytimes.com/2020/12/29/science/dairy-farming-cows-milk.html Accessed*.

Janssen M, Busch C, Rödiger M and Hamm U 2016a. Motives of consumers following a vegan diet and their attitudes towards animal agriculture. Appetite 105, 643–651.

Janssen M, Rödiger M and Hamm U 2016b. Labels for Animal Husbandry Systems Meet Consumer Preferences: Results from a Meta-analysis of Consumer Studies. Journal of Agricultural and Environmental Ethics 29, 1071–1100.

Jones RJ, Reilly TM, Cox MZ and Cole BM 2017. Gender Makes a Difference: Investigating Consumer Purchasing Behavior and Attitudes Toward Corporate Social Responsibility Policies. Corporate Social Responsibility and Environmental Management 24, 133–144.

Jones-Bitton A, Hagen B, Fleming SJ and Hoy S 2019. Farmer Burnout in Canada. International Journal of Environmental Research and Public Health 2019, Vol. 16, Page 5074 16, 5074.

Jongman EC and Butler KL 2014. The Effect of Age, Stocking Density and Flooring during Transport on Welfare of Young Dairy Calves in Australia. Animals 4, 184–199.

Kato H, Ono H, Sato M, Noguchi M and Kobayashi K 2022. Relationships between management factors in dairy production systems and mental health of farm managers in Japan. Journal of Dairy Science 105, 441–452.

Kauppinen T, Vainio A, Valros A, Rita H and Vesala KM 2010. Improving animal welfare: qualitative and quantitative methodology in the study of farmers' attitudes. Animal Welfare 19, 523–536.

Kennett DJ and Marwan N 2015. Climatic volatility, agricultural uncertainty, and the formation, consolidation and breakdown of preindustrial agrarian states. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences 373.

von Keyserlingk MAG, Martin NP, Kebreab E, Knowlton KF, Grant RJ, Stephenson M, Sniffen CJ, Harner JP, Wright AD and Smith SI 2013. Invited review: Sustainability of the US dairy industry. Journal of Dairy Science 96, 5405–5425.

von Keyserlingk MAG and Weary DM 2023. A Good Life for Cattle. In Cattle Welfare in Dairy and Beef Systems (ed. M. Haskell). Springer, Cham.

King MTM, Matson RD and DeVries TJ 2021. Connecting farmer mental health with cow health and welfare on dairy farms using robotic milking systems. Animal Welfare 30, 25–38.

Kirchhelle C 2021. Staging Welfare: Writing Animal Machines. In Bearing Witness. Palgrave Studies in the History of Social Movements., pp. 79–92. Palgrave Macmillan, Cham.

Kish Bar-On K and Lamm E 2023. The interplay of social identity and norm psychology in the evolution of human groups. Philosophical Transactions of the Royal Society B 378.

Kloser E 2023. Tasmanian Quality Meats abattoir facing suspension after activists film slaughter practices. ABC News. Retrieved on 8 April 2024, from *https://www.abc.net.au/news/2023-12-09/tasmanian-quality-meats-abattoir-accused-of-cruelty/103205378*.

Klüver J 2008. The socio-cultural evolution of our species. EMBO reports 9, S55–S58.

Lankester A 2012. Self-perceived Roles in Life and Achieving Sustainability on Family Farms in North-eastern Australia. Australian Geographer 43, 233–251.

Lavin C 2009. Factory Farms in a Consumer Society. American Studies 50, 71–92.

Lay DC, Fulton RM, Hester PY, Karcher DM, Kjaer JB, Mench JA, Mullens BA, Newberry RC, Nicol CJ, O'Sullivan NP and Porter RE 2011. Hen welfare in different housing systems. Poultry Science 90, 278–294.

Levitt T 2019. Rise of ethical milk: 'Mums ask when cows and their calves are separated'. The Guardian. Retrieved on 19 January 2021, from *https://www.theguardian.com/environment/2019/jun/29/mums-ask-when-cows-and-their-calves-separated-rise-ethical-milk-vegan*.

Loughnan S, Haslam N and Bastian B 2010. The role of meat consumption in the denial of moral status and mind to meat animals. Appetite 55, 156–159.

MacQueen KM, McLellan E, Kay K and Milstein B 1998. Codebook development for team-based qualitative analysis. Cultural Anthropology Methods 10, 31–36.

Maher JW, Clarke AM, Byrne AW, Doyle R, Blake M and Barrett D 2021. Exploring the Opinions of Irish Dairy Farmers Regarding Male Dairy Calves. Frontiers in Veterinary Science 8, 1–9.

Malhi GS, Kaur M and Kaushik P 2021. Impact of Climate Change on Agriculture and Its Mitigation Strategies: A Review. Sustainability 2021, Vol. 13, Page 1318 13, 1318.

Marquou S, Blouin L, Djakite H, Laplante R and Buczinski S 2019. Health parameters and their association with price in young calves sold at auction for veal operations in Québec, Canada. Journal of Dairy Science 102, 6454–6465.

McCarthy KS, Parker M, Ameerally A, Drake SL and Drake MA 2017. Drivers of choice for fluid milk versus plant-based alternatives: What are consumer perceptions of fluid milk? Journal of Dairy Science 100, 6125–6138.

McCulloch SP 2013. A Critique of FAWC's Five Freedoms as a Framework for the Analysis of Animal Welfare. Journal of Agricultural and Environmental Ethics 26, 959–975.

McCullock K, Hoag DLK, Parsons J, Lacy M, Seidel GE and Wailes W 2013. Factors affecting economics of using sexed semen in dairy cattle. Journal of Dairy Science 96, 6366–6377.

Meagher RK, Beaver A, Weary DM and von Keyserlingk MAG 2019. Invited review: A systematic review of the effects of prolonged cow–calf contact on behavior, welfare, and productivity. Journal of Dairy Science 102, 5765–5783.

Meale SJ, Beauchemin KA, Hristov AN, Chaves A V. and McAllister TA 2014. BOARD-INVITED REVIEW: Opportunities and challenges in using exogenous enzymes to improve ruminant production. Journal of Animal Science 92, 427–442.

Mee JF 2008. Newborn Dairy Calf Management. Veterinary Clinics of North America: Food Animal Practice 24, 1–17.

Meijer E, Goerlich VC, Brom R van den, Giersberg MF, Arndt SS and Rodenburg TB 2021. Perspectives for Buck Kids in Dairy Goat Farming. Frontiers in Veterinary Science 8, 662102.

Meldrum-Hana C 2015. Making a killing. Retrieved on 8 April 2024, from *https://www.abc.net.au/news/2015-02-17/making-a-killing/6127124*.

Mellor DJ, Beausoleil NJ, Littlewood KE, McLean AN, McGreevy PD, Jones B and Wilkins C 2020. The 2020 Five Domains Model: Including Human–Animal Interactions in Assessments of Animal Welfare. Animals 10, 1870.

Mench JA, Sumner DA and Rosen-Molina JT 2011. Sustainability of egg production in the United States-the policy and market context. Poultry Science 90, 229–240.

Merenda VR, de Oliveira EB, Lopez-Soriano M, Arruda AG, Robbins A and Pairis-Garcia MD 2023. Dairy workers' attitudes toward dairy cattle euthanasia. Journal of Dairy Science 106, 7076–7088.

Milfont TL, Satherley N, Osborne D, Wilson MS and Sibley CG 2021. To meat, or not to meat: A longitudinal investigation of transitioning to and from plant-based diets. Appetite 166, 105584.

Millar KM, Tomkins SM, White RP and Mepham TB 2002. Consumer attitudes to the use of two dairy technologies. British Food Journal 104, 31–44.

MLA 2022a. Global beef industry and trade report. Retrieved on 12 April 2024, from *https://t.ly/qlvTx*.

MLA 2022b. State of the Industry Report. Retrieved on 12 June 2023, from *https://t.ly/Qp4f8*.

MLA 2023a. State of the Industry Report 2022-2023. Retrieved on 14 April 2024, from *https://t.ly/6zAt7*.

MLA 2023b. Lot feeding brief: Results for the December quarter 2022 feedlot survey. Retrieved on 4 March 2024, from *https://t.ly/hBXrX*.

Moffat K and Zhang A 2014. The paths to social licence to operate: An integrative model explaining community acceptance of mining. Resources Policy 39, 61–70.

Mogensen L, Hermansen JE, Nguyen L and Preda T 2015. Environmental impact of beef: by life cycle assessment (LCA) - 13 Danish beef production systems. DCA - Danish Centre for Food and Agriculture.

Mohd Nor N, Steeneveld W, Mourits MCM and Hogeveen H 2015. The optimal number of heifer calves to be reared as dairy replacements. Journal of Dairy Science 98, 861–871.

Morgans LC, Bolt S, Bruno-McClung E, van Dijk L, Escobar MP, Buller HJ, Main DCJ and Reyher KK 2021. A participatory, farmer-led approach to changing practices around antimicrobial use on UK farms. Journal of Dairy Science 104, 2212–2230.

Muir PD, Wallace GJ, Dobbie PM and Bown MD 2000. A comparison of animal performance and carcass and meat quality characteristics in Hereford, Hereford × Friesian, and Friesian steers grazed together at pasture. New Zealand Journal of Agricultural Research 43, 193–205.

Munoz CA, Coleman GJ, Hemsworth PH, Campbell AJD and Doyle RE 2019. Positive attitudes, positive outcomes: The relationship between farmer attitudes, management behaviour and sheep welfare. PLOS ONE 14, e0220455.

Murphy C, Shalloo L and Butler ST 2016. The influence of sexed semen use and genotyping on genetic gain in seasonal-calving pasture-based dairy herds. Animal Reproduction Science 169, 129.

Neave HW, Sumner CL, Henwood RJT, Zobel G, Saunders K, Thoday H, Watson T and Webster JR 2022. Dairy farmers' perspectives on providing cow-calf contact in the pasture-based systems of New Zealand. Journal of Dairy Science 105, 453–467.

New Zealand Ministry of Primary Industries 2016. Animal welfare regulations. Retrieved on 5 December 2023, from *https://t.ly/oAhrf*.

NFACC 2017. National Farm Animal Care Council Public Comment Period Review - Final Report. Retrieved on 29 January 2021, from *https://www.nfacc.ca/pdfs/nfacc_pcp_final_report_2018_en.pdf*.

NFACC 2021. Codes of Practice for the care and handling of farm animals. Retrieved on 28 January 2021, from *https://www.nfacc.ca/resources/codes-of-practice/NFACC_Code_Brochure.pdf*.

Nguyen TLT, Hermansen JE and Mogensen L 2010. Environmental consequences of different beef production systems in the EU. Journal of Cleaner Production 18, 756–766.

NHIA 2022. Semen Market Survey 2022 Results. Retrieved on 31 May 2023, from *https://t.ly/cLgFz*.

Nielsen SS, Alvarez J, Bicout DJ, Calistri P, Canali E, Drewe JA, Garin-Bastuji B, Gonzales Rojas JL, Gortázar Schmidt C, Herskin M, Miranda Chueca MÁ, Padalino B, Pasquali P, Roberts HC, Spoolder H, Stahl K, Velarde A, Viltrop A, Winckler C, Estevez I, Guinebretière M, Rodenburg B, Schrader L, Tiemann I, Van Niekerk T, Ardizzone M, Ashe S, Hempen M, Mosbach-Schulz O, Rojo Gimeno C, Van der Stede Y, Vitali M and Michel V 2023. Welfare of laying hens on farm. EFSA Journal 21, e07789.

NMPF 2019. FARM Animal Care Technical Writing Group. Retrieved on 29 January 2021, from *https://nationaldairyfarm.com/dairy-farm-standards/animal-care/technical-writing-group/*.

O'Doherty K, Burgess M and Secko DM 2010. Sequencing the salmon genome: A deliberative public engagement. Genomics, Society and Policy 6, 15–32.

OED Online 2020. deliberation, n.1. Oxford University Press. Retrieved on 28 January 2021, from *https://www.oed.com/view/Entry/49350?rskey=ciA1X3&result=1&isAdvanced=false#eid*.

Parkinson TJ, Vermunt JJ, Malmo J, Laven R. 2019. Diseases of cattle in Australasia: a comprehensive textbook. Massey University Press.

Peden RSE, Camerlink I, Boyle LA, Loughnan S, Akaichi F and Turner SP 2020. Belief in Pigs' Capacity to Suffer: An Assessment of Pig Farmers, Veterinarians, Students, and Citizens. Anthrozoös 33, 21–36.

Pempek J, Trearchis D, Masterson M, Habing G and Proudfoot K 2017. Veal calf health on the day of arrival at growers in Ohio 1,2. Journal of Animal Science 95, 3863–3872.

PETA Australia 2013. Bobby Calves – a 'Waste Product' of the Dairy Industry. Retrieved on 8 April 2024, from *https://www.peta.org.au/news/bobby-calves-a-waste-product-of-the-dairy-industry/*.

Pfuhl R, Bellmann O, Kühn C, Teuscher F, Ender K and Wegner J 2007. Beef versus dairy cattle: a comparison of feed conversion, carcass composition, and meat quality. Archives Animal Breeding 50, 59–70.

Phillipov M and Loyer J 2019. In the wake of the supermarket 'milk wars': Media, farmers and the power of pastoral sentimentality. Discourse, Context & Media 32, 100346.

Phillips CJC 2024. Farm Animal Welfare—From the Farmers' Perspective. Animals 14, 671.

Phillips CJC and Molento CFM 2020. Animal Welfare Centres: Are They Useful for the Improvement of Animal Welfare? Animals 2020, Vol. 10, Page 877 10, 877.

Phipps AJ, Beggs DS, Murray AJ, Mansell PD and Pyman MF 2018. A survey of northern Victorian dairy farmers to investigate dairy calf management: colostrum feeding and management. Australian Veterinary Journal 96, 101–106.

Pickett-Baker J and Ozaki R 2008. Pro-environmental products: Marketing influence on consumer purchase decision. Journal of Consumer Marketing 25, 281–293.

Proudfoot KL, Hendricks J, Higgins A, Roche S, Ritter C, Renaud DL and von Keyserlingk MAG 2022. The Entrepreneurs: Dairy farmer perspectives on finding an industry solution for the surplus calf issue—A participatory case study. Frontiers in Sustainable Food Systems 0, 415.

Raedts PJM, Garcia SC, Chapman DF, Edwards GR, Lane N and Rawnsley RP 2017. Is systems research addressing the current and future needs of dairy farms? Animal Production Science 57, 1311–1322.

Raman S and Mohr A 2014. A Social Licence for Science: Capturing the Public or Co-Constructing Research? Social Epistemology 28, 258–276.

Reinhardt V and Reinhardt A 1981. Natural sucking performance and age of weaning in zebu cattle (Bos indicus). The Journal of Agricultural Science 96, 309–312.

Renaud DL, Duffield TF, LeBlanc SJ, Ferguson S, Haley DB and Kelton DF 2018a. Risk factors associated with mortality at a milk-fed veal calf facility: A prospective cohort study. Journal of Dairy Science 101, 2659–2668.

Renaud DL, Duffield TF, LeBlanc SJ, Haley DB and Kelton DF 2017. Management practices for male calves on Canadian dairy farms. Journal of Dairy Science 100, 6862–6871.

Renaud DL, Kelton DF, LeBlanc SJ, Haley DB and Duffield TF 2018b. Calf management risk factors on dairy farms associated with male calf mortality on veal farms. Journal of Dairy Science 101, 1785–1794.

Rice M, Hemsworth LM, Hemsworth PH and Coleman GJ 2020. The Impact of a Negative Media Event on Public Attitudes Towards Animal Welfare in the Red Meat Industry. Animals 10.

Rittel HWJ and Webber MM 1973. Dilemmas in a General Theory of Planning. Policy Sciences 4, 155–169.

Ritter C, Hötzel MJ and von Keyserlingk MAG 2022. Public attitudes toward different management scenarios for “surplus” dairy calves. Journal of Dairy Science 105, 5909–5925.

Ritter C, Mills KE, Weary DM and von Keyserlingk MAG 2020. Perspectives of western Canadian dairy farmers on the future of farming. Journal of Dairy Science 103, 10273–10282.

Roadknight N, Mansell P, Jongman E, Courtman N and Fisher A 2021. Invited review: The welfare of young calves transported by road. Journal of Dairy Science 104, 6343–6357.

Robbins JA, Franks B, Weary DM and von Keyserlingk MAG 2016a. Awareness of ag-gag laws erodes trust in farmers and increases support for animal welfare regulations. Food Policy 61, 121–125.

Robbins JA, von Keyserlingk MAG, Fraser D and Weary DM 2016b. INVITED REVIEW: Farm size and animal welfare. Journal of Animal Science 94, 5439–5455.

Rokka J and Uusitalo L 2008. Preference for green packaging in consumer product choices – Do consumers care? International Journal of Consumer Studies 32, 516–525.

Rollin BE 2011. Animal Rights as a Mainstream Phenomenon. Animals 2011, Vol. 1, Pages 102-115 1, 102–115.

Román S, Sánchez-Siles LM and Siegrist M 2017. The importance of food naturalness for consumers: Results of a systematic review. Trends in Food Science and Technology 67, 44–57.

Romera AJ, Bos AP, Neal M, Eastwood CR, Chapman D, Mcwilliam W, Royds D, Connor CO, Brookes R, Connolly J, Hall P, Clinton PW and Zealand N 2020. Designing future dairy systems for New Zealand using reflexive interactive design. Agricultural Systems 181, 102818.

Rosenberger K, Costa JHC, Neave HW, von Keyserlingk MAG and Weary DM 2017. The effect of milk allowance on behavior and weight gains in dairy calves. Journal of Dairy Science 100, 504–512.

Rothgerber H 2020. Meat-related cognitive dissonance: A conceptual framework for understanding how meat eaters reduce negative arousal from eating animals. Appetite 146, 104511.

Rothgerber H and Rosenfeld DL 2021. Meat-related cognitive dissonance: The social psychology of eating animals. Social and Personality Psychology Compass 15, 1–16.

Rowe G and Frewer LJ 2004. Evaluating Public-Participation Exercises: A Research Agenda. Science, technology, & human values 29, 512–557.

Rutten CJ, Velthuis AGJ, Steeneveld W and Hogeveen H 2013. Invited review: Sensors to support health management on dairy farms. Journal of Dairy Science 96, 1928–1952.

Sainsbury's 2017. Animal Health & Welfare Report. Retrieved on 9 April 2024, from *www.about.sainsburys.co.uk/discover-more/our-stories/2017/setting-sustainable-sourcing-standards*.

Sandøe P, Christiansen SB and Rollin BE 2008. Ethics of Animal Use. John Wiley & Sons, Incorporated.

Santarossa JM, Stott AW, Woolliams JA, Brotherstone S, Wall E and Coffey MP 2004. An economic evaluation of long-term sustainability in the dairy sector. Animal Science 79, 315–325.

Schoenmaker S and Alexander D 2012. Live Cattle Trade - The Case of an Online Crisis. Social Alternatives 31, 17–21.

Schuldt JP, Roh S and Schwarz N 2015. Questionnaire Design Effects in Climate Change Surveys. The ANNALS of the American Academy of Political and Social Science 658, 67–85.

Schulze M, Kühl S and Busch G 2023. We have Some Calves left! Socially Accepted Alternatives to the Current Handling of Male Calves from Dairy Production. Food Ethics 8, 1–14.

Schuppli CA and Fraser D 2007. Factors Influencing the Effectiveness of Research Ethics Committees. Source: Journal of Medical Ethics 33, 294–301.

Sedlacko M, Martinuzzi A, Røpke I, Videira N and Antunes P 2014. Participatory systems mapping for sustainable consumption: Discussion of a method promoting systemic insights. Ecological Economics 106, 33–43.

Segerkvist KA, Hansson H, Sonesson U and Gunnarsson S 2020. Research on Environmental, Economic, and Social Sustainability in Dairy Farming: A Systematic Mapping of Current Literature. Sustainability 12.

van Selm B, de Boer IJM, Ledgard SF and van Middelaar CE 2021. Reducing greenhouse gas emissions of New Zealand beef through better integration of dairy and beef production. Agricultural Systems 186, 102936.

Shields S, Shapiro P and Rowan A 2017. A Decade of Progress toward Ending the Intensive Confinement of Farm Animals in the United States. Animals 7, 40.

Shivley C, Lombard J, Urie N, Weary D and von Keyserlingk M 2019. Management of preweaned bull calves on dairy operations in the United States. Journal of Dairy Science 102, 4489–4497.

Shivley CB, Urie N and Lombard JE 2016. Management of dairy bull calves on U.S. dairy operations. Journal of Animal Science 94, 581–581.

Silva ARA, Silva MMN and Ribeiro BD 2020. Health issues and technological aspects of plant-based alternative milk. Food Research International 131, 108972.

Sirovica L V., Ritter C, Hendricks J, Weary DM, Gulati S and von Keyserlingk MAG 2022. Public attitude toward and perceptions of dairy cattle welfare in cow-calf management systems differing in type of social and maternal contact. Journal of Dairy Science 105, 3248–3268.

Skelhorn EPG, Garcia-Ara A, Nova RJ, Kinston H and Wapenaar W 2020. Public opinion and perception of rosé veal in the UK. Meat Science 167, 108032.

Skidmore ME, Moffette F, Rausch L, Christie M, Munger J and Gibbs HK 2021. Cattle ranchers and deforestation in the Brazilian Amazon: Production, location, and policies. Global Environmental Change 68, 102280.

Statham J, Green M, Husband J and Huxley J 2017. Climate change and cattle farming. In Practice 39, 10–19.

Stevens EG, Baker T and Lewis N 2021. Dealing with sentient surplus: A moral economy of greyhound rehoming. Environment and Planning E: Nature and Space 5, 2033–2051.

Sumner DA 2014. American Farms Keep Growing: Size, Productivity, and Policy. Journal of Economic Perspectives 28, 147–66.

Sumner CL and von Keyserlingk MAG 2018. Canadian dairy cattle veterinarian perspectives on calf welfare. Journal of Dairy Science 101, 10303–10316.

Sumner CL, von Keyserlingk MAG and Weary DM 2018. How benchmarking motivates farmers to improve dairy calf management. Journal of Dairy Science 101, 3323–3333.

Sun HZ, Plastow G and Guan LL 2019. Invited review: Advances and challenges in application of feedomics to improve dairy cow production and health. Journal of Dairy Science 102, 5853–5870.

Swanson JC, Lee Y, Thompson PB, Bawden R and Mench JA 2011. Integration: Valuing stakeholder input in setting priorities for socially sustainable egg production. Poultry Science 90, 2110–2121.

Tanner G, Schümann M, Baur C and Bamberg E 2021. Too fatigued to consume (ir)responsibly? The importance of work-related fatigue and personal values for responsible consumption. International Journal of Consumer Studies 45, 1322–1334.

Thompson PB 2008. The Ethics of Sustainable Agricultural Intensification. In The Ethics of Intensification, pp. 19–41. Springer Science and Business Media B.V.

Thompson PB 2010. Animal Ethics and Public Expectations: The North American Outlook. Journal of Veterinary Medical Education 37, 13–21.

Tichenor NE, Peters CJ, Norris GA, Thoma G and Griffin TS 2017. Life cycle environmental consequences of grass-fed and dairy beef production systems in the Northeastern United States. Journal of Cleaner Production 142, 1619–1628.

Tiplady CM, Walsh D-AB, Phillips CJC, Tiplady CM, Phillips CJC and Walsh D-AB 2013. Public Response to Media Coverage of Animal Cruelty. Journal of Agriculture and Environmental Ethics 26, 869–885.

Törrönen J 2002. Semiotic theory on qualitative interviewing using stimulus texts. Qualitative Research 2, 343–362.

Tucker HA 1981. Physiological Control of Mammary Growth, Lactogenesis, and Lactation. Journal of Dairy Science 64, 1403–1421.

Turner P V. and Doonan G 2010. Developing on-farm euthanasia plans. Canadian Veterinary Journal 51, 1031–1034.

Tversky A and Kahneman D 1981. The Framing of Decisions and the Psychology of Choice. Science 211, 453–458.

USDA-FSIS 2013. Veal from Farm to Table. Retrieved on 29 January 2021, from *https://t.ly/XoUrf*.

Vasseur E, Borderas F, Cue RI, Lefebvre D, Pellerin D, Rushen J, Wade KM and de Passillé AM 2010. A survey of dairy calf management practices in Canada that affect animal welfare. Journal of Dairy Science 93, 1307–1316.

Vechakul J, Shrimali BP and Sandhu JS 2015. Human-Centred Design as an Approach for Place-Based Innovation in Public Health: A Case Study from Oakland, California. Maternal and Child Health Journal 19, 2552–2559.

Ventura BA, von Keyserlingk MAG, Wittman H and Weary DM 2016. What difference does a visit make? Changes in animal welfare perceptions after interested citizens tour a dairy farm. PLoS ONE 11, 1–18.

Vicente-Serrano SM, Quiring SM, Peña-Gallardo M, Yuan S and Domínguez-Castro F 2020. A review of environmental droughts: Increased risk under global warming? Earth-Science Reviews 201, 102953.

Vicic V, Saliba AJ, Campbell MA and Quinn JC 2022. Barriers to Utilizing Non-replacement Male Calves in the Australian Dairy Industry: A Qualitative Study. Frontiers in Veterinary Science 8, 1671.

Vinci C 2022. European Union beef sector - Main features, challenges and prospects. European Parliamentry Research Service. Retrieved on 23 April 2023, from *https://t.ly/2S7C8*.

Vogels Z, Chuck G and Morton J 2013. Failure of transfer of passive immunity and agammaglobulinaemia in calves in south-west Victorian dairy herds: prevalence and risk factors. Australian Veterinary Journal 91, 150–158.

Walker JB, Roman-Muniz IN and Edwards-Callaway LN 2020. Timely Euthanasia in the United States Dairy Industry – Challenges and a Path Forward. Animals 10, 71.

WBCSD 2011. Collaboration, innovation, transformation: ideas and inspiration to accelerate sustainable growth - A value chain approach. Retrieved on 15 June 2023, from *https://tinyurl.com/msxh6pde*.

Weary DM and von Keyserlingk MAG 2017. Public concerns about dairy-cow welfare: How should the industry respond? Animal Production Science 57, 1201–1209.

Weary DM and Robbins JA 2019. Understanding the multiple conceptions of animal welfare. Animal Welfare 28, 33–40.

Weary DM, Ventura BA and von Keyserlingk MAG 2016. Societal views and animal welfare science: understanding why the modified cage may fail and other stories. Animal 10, 309–317.

Webb LE, Verwer C and Bokkers EAM 2023. The future of surplus dairy calves – an animal welfare perspective. Frontiers in Animal Science 4, 1228770.

Webster AJF 2001. Farm Animal Welfare: the Five Freedoms and the Free Market. The Veterinary Journal 161, 229–237.

van der Weele CN 2013. Meat and the benefits of ambivalence. The Ethics of Consumption: The Citizen, the Market and the Law, 290–295.

Willig C 2012. Perspectives on the epistemological bases for qualitative research. In APA handbook of research methods in psychology, Vol 1: Foundations, planning, measures, and psychometrics., pp. 5–21. American Psychological Association, Washington.

Wilson DJ, Canning D, Giacomazzi T, Keels K, Lothrop R, Renaud DL, Sillett N, Taylor D, Van Huigenbos H, Wynands B, Zuest D and Fraser D 2020a. Hot topic: Health and welfare challenges in the marketing of male dairy calves—Findings and consensus of an expert consultation. Journal of Dairy Science 103, 11628–11635.

Wilson DJ, Pempek JA, Roche SM, Creutzinger KC, Locke SR, Habing G, Proudfoot KL, George KA and Renaud DL 2021. A focus group study of Ontario dairy producer perspectives on neonatal care of male and female calves. Journal of Dairy Science 104, 6080–6095.

Wilson LL, Smith JL, Smith DL, Swanson DL, Drake TR, Wolfgang DR and Wheeler EF 2000. Characteristics of veal calves upon arrival, at 28 and 84 days, and at end of the production cycle. Journal of Dairy Science 83, 843–854.

Wilson DJ, Stojkov J, Renaud DL and Fraser D 2020b. Short communication: Condition of male dairy calves at auction markets. Journal of Dairy Science 103, 8530–8534.

Windig JJ, Calus MPL, Beerda B and Veerkamp RF 2006. Genetic correlations between milk production and health and fertility depending on herd environment. Journal of Dairy Science 89, 1765–1775.

Wolf J, Asrar GR and West TO 2017. Revised methane emissions factors and spatially distributed annual carbon fluxes for global livestock. Carbon Balance and Management 12, 1–24.

Wolf CA, Black JR and Hadrich JC 2009. Upper Midwest dairy farm revenue variation and insurance implications. Agricultural Finance Review 69, 346–358.

Wolf CA, Tonsor GT, McKendree MGS, Thomson DU and Swanson JC 2016. Public and farmer perceptions of dairy cattle welfare in the United States. Journal of Dairy Science 99, 5892–5903.

Zoom Video Communications Inc. 2021. Security Guide. Retrieved on 14 June 2023, from *https:// explore.zoom.us/docs/doc/Zoom-Security-White-Paper.pdf.*

Appendix A. Codebook for Chapter 3 study

Theme and sub-theme	Definition	Example quote
Dairy Relationship		
Emotions	Participants' statements about how they feel/the emotions they have towards dairy (products, farming practices, and/or the overall industry).	*"For a while I was angry with you. […] Then I got upset with myself that I should have known what you did to baby calf's if they were born male.... or how you treated cows."* *"Oh, Dairy how I love you. You fulfil me every day. Thank you."*
Ethical concerns	Participants' concerns about the ethics of dairy farming and how it impacts society, animals, and the environment.	*"So, the reason I'm breaking up with you, Dairy, is in the hope that by doing so, [animals] may get a chance to […] not have to experience such a torturous life. I hope one day things turn for the better and [they] can live naturally again."*
Affective memories	Participants' memorable interactions with dairy (such as social gatherings, familiar environments, childhood memories, or related aspects).	*"When I was a kid you and I were inseparable."* *"The cheese just makes for a perfect night with my wife as we drink wine together."*
Dairy Industry		
Trust	Participants' arguments about discrepancies between the societal image or participants' previous perceptions of dairy and the industry's reality.	*"I learnt that those colourful images on the packets of your tastiest foods and drinks were not the reality of your world. The reality was harsh, cruel, and violent, and I very quickly wanted nothing to do with it."* *"But how could I know? It was all hidden, wasn't it? You made a great effort of that."*
Farming practices	Participants' views about practices they perceived to be common in the dairy industry.	*"The list of reasons goes on, including forced pregnancy then separation from your calves, the use of antibiotics, filthy living conditions, and finally ending with a slaughterhouse."* *"It took me a while to realise that the male calves you never spoke about*

		were being taken away and slaughtered"
Dairy Farmers	Participants' attitudes towards farmers' character and role in dairy production.	*"l also appreciate the fact that you provide local farmers with a job and support the local community."* *"Thank you for standing strong amidst drought, fires, floods, COVID & all those alternative milk drinkers. Thanks to all the farmers dedicating themselves to this industry and working long hours to make ends meet."*
Dairy Products		
Consumption motivators	Participants' reason to consume dairy products, the frequency they consume dairy products, any changes in their consumption of dairy products, and the significance of dairy products in the participants' daily routines.	*"I love the textures and flavours of your richest cheeses. I love the bite of your best Greek yoghurt." "You make everything better. There is no such thing as too much cheese, and sour cream completes every dish. I wish I could put it on absolutely everything. […] you complete me."*
Health and Nutrition	Participants' views about the consumption of dairy products and the impact on their health and nutrition.	*"I can't make calcium on my own so I would be useless without you. Don't ever leave me."* *"We are not breaking up but you are making my tummy too big and cholesterol too high. I have found your rice milk is yummy, sweet but not as bad for me."*
Dairy avoidance	Participants' perspectives on whether they should avoid dairy products and the associated ease or otherwise of doing so, including the role for alternatives.	*"Sorry Dairy, I've already started seeing Soy and Almond and we are really hitting it off. Don't call me again."* *"Your vegan counterparts surpass you in taste, are suited for humans, and are more ethical and free of the cruelty of animal industry."*

Appendix B. Discussion guide for chapter 4 study

INTRODUCTION 10 min	Introductions: Name Who is at home? What they get up to during the day Participants to share their 'story' Connection to the region 'Connection' to dairy/ dairy products
GENERAL ATTITUDES TO SUSTAINABILITY *Derive the values that they link to sustainability.* 10 min	What does sustainability mean to us? How important is it? What industries/ companies can you think of that place a premium on sustainable behaviour? How do we think and act towards them? How does our attitude to sustainability affect what we purchase/ spend our money on? How do we think sustainability will affect our purchasing in the future? Why?

GENERAL ATTITUDES TO ANIMAL WELFARE *Derive the values that they link to animal welfare.* 20 min	What is important to them, how important is it? What is good animal welfare? How do we know, if it's good animal welfare? What role does science play in us knowing what good animal welfare is? What industries/companies can you think of that place a premium on animal welfare? What industries/companies can you think of with bad animal welfare? How does our attitude to animal welfare affect what we purchase/ spend our money on? When is our shopping driven by animal welfare decisions… when is it not? Why do we make these choices? How do we think this will change in the future? How does 'animal welfare' fit with sustainability?
UNDERSTANDING OF THE DAIRY INDUSTRY (SYSTEM) *Unpicking attitudes to dairy and the assumptions/ knowledge they're based on.* 40 min On hand: example of systems map, homework tasks printed.	ACTIVITY: Participants to draw pictures of the dairy industry from: • Consumer perspective • Farmer perspective • Processor perspective • Vegan perspective How accurate do we think these pictures are? How accurate do we think we want the pictures in our head to be? ACTIVITY: Participants to draw a systems map of 'dairy' Participants to share maps to see what they have in common. MODERATOR: Show pre-prepared dairy industries systems map What, if anything, did we miss? What is our general attitude to each part of the industry on this map? What is driving our attitudes? How do they differ across different parts? Why?

	What are our attitudes towards dairy farmers? What do dairy farmers value? What different hats do they wear? For your homework task, we asked you to write a love letter or breakup letter to dairy. Let's bring these out and talk about them. Share your letters with the rest of us! What are the common themes? What stands out?
Break	
RESPONSE TO SURPLUS CALVES AND COW_CALF SEPARATION ISSUES *Understand community response to key issues and understand potential threat to industry.* 50 min On hand: Post-it notes, Sharpies	ACTIVITY: Moderator to read statement explaining the issues in layman's terms – participants to take notes of what resonates on post-it notes What is our initial response? Why? What did you write as stand-out thoughts on your post-it notes? Why? How surprised are we? Why? How aware of this were you? What questions do you have? Why? Why does this happen this way do you think? (Check knowledge/assumptions) How does this change how we think about the industry? How does this change how we think about dairy farmers? Knowing this, what do we think is important to dairy farmers? What do they value? What does this say about the dairy industry and animal welfare? What does this say about the dairy industry and sustainability? If scientific research were to tell us this is okay, how do we respond? Why? How might this change our behaviour? Why?
Break	
DIAGNOSE THE 'PROBLEM'	Look at your systems maps again…

Understand community acceptance of this as a systemic issue. 10 min	How/ where do these issues arise? Why is this the way it is? – diagnose the cause…
FEEDBACK ON HYPOTHETICAL FUTURE SCENARIOS *Initial feedback on proposed solutions.* 15 min	Moderator: Show five broad-ranging hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia, one at a time. First thoughts… How would this shift how we feel about the industry? How come? How would this shift how we feel about farmers? How come? How would this shift how we feel about the issue? How might it shift how we buy dairy? How come?
FINDING THE OPTIMISM *Reinforce the point that the industry is taking positive action on the issue.* 20 min	What industries/companies/organisations can the dairy industry learn from? (e.g. egg industry) What can the dairy industry learn? Why do these examples resonate? What could they learn?
SUMMING UP 5 min	Sum up the challenge for the dairy industry… What is the most interesting thing you've heard today? What key piece of advice would you give the dairy industry? Whole group summary of learnings Read and distribute debriefing statement. THANK & CLOSE

Appendix C. Codebook for Chapter 4 study

Theme	Sub-theme	Description
Animal agriculture as an industry	Sustainability	References to sustainability and how it relates to the dairy industry and agriculture more broadly, including climate change and how it relates to animal agriculture.
	Farmers	Reflections on farmers as people, including their attitudes towards animals, workload, and priorities.
	Farming practices and animal welfare	Attitudes towards specific farming practices, including cow-calf separation and management of surplus dairy calves.
Personal impacts and reflections as citizens	Ethical considerations	Reflections on the ethics of raising and killing animals for food, including consuming different species at different ages.
	Consumer behaviours	References to participants' roles as consumers, including their ability to impact and be impacted by food production systems and intentions towards changing behaviours or otherwise.

Appendix D. Interview guide for Chapter 5 study

Opening
Before we get going it would be great to get an idea of your understanding of the bobby calf issue?
Has your organisation ever investigated how to address this issue?
Project Overview
SB provides a 10-minute overview of the project and where we are up to: *This project aims to work with industry stakeholders and members of the community to implement alternatives to early life slaughter of surplus calves (bobby calves) that are not just financially viable, but socially acceptable.* *The management of surplus calves is complex, with many opportunities but many persistent challenges. This project will pilot a new approach to developing alternatives that recognises that the people who face a problem every day are the ones that hold the key to sustainable solutions. These solutions may have a direct benefit for farm businesses as well as the wider Australian dairy industry through farm output diversification, potentially increased revenue, improved market access and improved community trust.* *This project will be conducted in two phases. In Phase 1 of the project, an 'industry' group will take part in several facilitated discussions designed to explore attitudes to surplus calf management, perceived factors contributing to the status quo, barriers to practice change and possible methods for overcoming these barriers. At the same time, the project will hold separate 'community' group discussions, designed to explore the attitudes of the general public to how we manage calves now, and what will be socially acceptable in the future. Interviews will also be held with supply chain stakeholders, in which you are invited to participate today.* *Through professional facilitation, the industry group will use findings from the community group workshops, supply chain stakeholder interviews, as well as their own discussions and learnings, to identify barriers to implementing sustainable surplus calf management.*
Feedback
Interested in your high-level feedback on the approach outlined?
We are interested in your top line thoughts on the four pathways that we tested with consumers. What would work/ wouldn't with your customers? Just a reminder these aren't the pathways developed out of the program, rather these are ideas commonly suggested. We will be designing potential pathways for the South coast dairy region in our June workshop.
1. All surplus calves are grown to adulthood for the beef supply chain. This is able to be done because the costs are covered either through milk price increase or supply chain cooperation.
2. Hormones are introduced to enable cows to continue to produce milk without having to repeatedly become pregnant, meaning surplus calves are never born in first place.

3. The South Coast dairy industry transforms into a connected network of farms that work together on a solution. The solution differentiates the region's milk and/or dairy beef and attracts a premium.
4. Farmers use technology that is currently available including sexed semen to reduce male calves being born. The remaining calves either enter the dairy industry or are grown to adult hood with optimised nutrition and production for the beef supply chain.
Role in issue
From your perspective is there a part of the supply chain that should be responsible for addressing this issue?
Is cooperation and collaboration along the supply chain required?
Is supply chain cooperation on this issue something that your organisation would be interested in exploring?
Would this be limited to the South Coast or are there other dairying regions you'd be interested in being involved in exploring solutions?
Do you think that solutions will differ between regions?
Other Comments
Any other comments?
Would you like to stay informed/engaged/other?

Appendix E. Codebook for Chapter 5 study

Theme	Subtheme	Subtheme description
Ethics of surplus calf management	Concerns about societal views	Perception of calf surplus as a problem because of public ethical concern for animal welfare.
	Personal views of industry stakeholders	Arguments regarding the impact of surplus calf management practices on the personal lives of farmers and supply chain stakeholders.
	Animal welfare versus ethics and public perception	Views on the ethics of different practices (e.g., early life slaughter vs on-farm euthanasia) and their impact on animal welfare and public perception.
Economics of surplus calf management	Disunity amongst stakeholders	Perception of divergent views from different stakeholder groups about surplus calves.
	Quality and productivity of dairy beef	Reasons for the reduced product quality of dairy beef calves and surplus dairy calves.
	Logistical and practical challenges of alternatives to early life killing	Pre-farm, on-farm and post-farm challenges faced by farmers and other stakeholders when rearing, managing and marketing surplus calves.
Moving towards solutions	Affecting practice change	Attitudes of supply chain stakeholders towards creating change to achieve a solution to the surplus calf issue.
	Role of leadership and collaboration	Positive economic, environmental and practical outcomes of achieving a sustainable solution to the surplus calf issue. Views about the importance of leadership and initiative roles, as well as collaborative commitment of all stakeholders.

Appendix F. Facilitator guide for Chapter 6 study, focus group session 1 (S1)

WELCOME AND CONTEXT SETTING 10 min	Introductions: Welcome and introduction of the project team Overview of surplus calf issue, the project and methodology Emphasise no right or wrong answers, encourage listening, being open minded Goal: We are able to see the dairy sector from multiple points of view and can build a more resilient and flourishing future
WHAT DOES SUCCESS LOOK LIKE FOR INDUSTRY? 15 min	Explain origins of project. Emphasise industry funding and buy-in. Describe success across short- and long-term time frames (balancing social acceptability and economic viability to achieve sustainable management of surplus dairy calves). Motivate participants by assuring them that this project is meaningful with top-down legitimacy.
WHAT DOES SUCCESS LOOK LIKE FOR PARTICIPANTS? 50 min	Aim to start a dialogue, introduce and get comfortable with multiple perspectives, hint at possible tensions, start to frame this issue as multi-faceted and complicated. Individual participants articulate what success from the project (i.e. not just this session) will be for them (e.g. is it to maximise profits, maintain their farm to pass down to generations, change bobby calf practices, protect against activists etc.). Participants write first thoughts of what success looks like for them on post-it notes stuck on a proforma. Participants encouraged to write multiple versions of success on multiple post-its. Moderators encourage thoughts about time (long term vs. short term) and space (their farms vs. the region vs. Australia etc.).

	Participants to discuss their vision of success across each table. Participants given the option to add thoughts to their individual 'success' (write new post-its). Each participant to share success with the room. Moderators to collect post-its/proformas, order into themes and summarize on one wall of the venue for continued reference. Moderators to collect similarities and differences and start to highlight any potential tensions.
DEFINING SUCCESS FROM MULTIPLE PERSPECTIVES 55 min	Aim to reinforce multiple perspectives, gain an understanding of and comfort with complexity, start to set up tensions to work through. Participants are introduced to a stakeholder map (including 'the cow') and work through any additions they'd like to make as a whole room. Stakeholders can include: the cow, consumers, retailers, farmers, milk processors, meat processors, civil society, animal welfare groups, chefs, vegans, transport, vets, government, etc. Participants are then individually nominated to take the viewpoint of one of the stakeholder groups so all stakeholder groups are covered. They individually draw a picture of the dairy industry from their nominated perspective. Participants talk to the group about the pictures they have drawn. Moderator to collate pictures as they are discussed and group into stakeholder groups (collect on one wall of the venue). Moderator to highlight similarities within each stakeholder group. As a group, participants identify what is missing from each perspective. Once all perspectives/pictures have been collected, moderators to lead whole room discussion about similarities and differences across the stakeholder groups. Start to build a unified picture of the industry across different perspectives. Start to identify any potential tensions.
Break	
SYSTEMS MAPPING 55 min	Aim to develop a systems-thinking mindset to consider the complexity of the issue and multiple perspectives at play. Then develop a unified map of the system to highlight key tensions and opportunities to work on. Moderators to show and talk through demonstration of systems mapping and why it is a useful tool. Moderators float around tables to assist and encourage. Participants to individually map the system around sustainable surplus calf management. Participants are then grouped into pairs to blend their two maps into one.

	Pairs to present their maps back to the group. Moderator to collect maps and collate on one wall of the venue. Moderator to lead whole group discussion to negotiate a unified model of the system.
IDENTIFY AND AGREE ON KEY TENSIONS, CHALLENGES AND OPPORTUNITIES TO WORK ON 40 min	Aim to build interest, excitement, and commitment for next session. Moderator to lead full group discussion to tease out and highlight tensions on the map What are the cause-and-effect relationships we've identified? What 'forces' are at odds with each other? What forces reinforce each other, causing a reinforcing loop? Moderator prompts: What values are at play in our map? What rules are at play in our map? What knowledge is at play in our map? Moderator to lead discussion on framing tensions as opportunities and challenges to tackle. Team to collect these first thoughts on a wall. Where on the map can we make interventions? What might those interventions drive? Moderator to start group discussion to see if participants can see ways of tackling these issues. What if certain values were different? What if certain rules were different? What if certain knowledge was different?
WRAP UP 15 min	Moderator to recap the 'journey' travelled in the session to highlight the progress made using material on the walls to support. Officially thank participants, detail next steps.

Appendix G. Facilitator guide for Chapter 6 study, focus group session 2 (S2)

INTRODUCTION 15 min	Introduction and welcome back. Reminder of project goals Where we are at in the overall process Review of outcomes from S1 Objectives and agenda for the day
COMMUNITY FOCUS GROUP RESULTS (INTERVENTION 1) 60 min	Share results of Community Focus Group (CFG) sessions. Overview of CFG methodology and high-level findings. Share 'love letters' and 'breakup letters' (plus 'distance letters') written by CFG participants. Each group to discuss how they think the discussion amongst CFG participants went. Summarize the implications (CFG participants were conflicted by a love of dairy products and concern about farming practices, including surplus calf management, but did not place blame on the farmer for these issues).
Break	
QUESTION AND ANSWER SESSION 15 min	Opportunity for participants to ask questions about CFG results. Facilitation: what was surprising/expected, known/unknown?
HYPOTHETICAL FUTURE SCENARIOS 45 min	Present descriptions of the four broad ranging hypothetical future scenarios involving different approaches to addressing the surplus calf issue in Australia. Handouts with written descriptions placed on tables in front of participants. In groups of 3 to 4 participants, choose one of the potential solutions to focus on. Participants brainstorm: what are all the barriers/roadblocks that prevent this scenario being a reality?

	Create a list of all potential issues/barriers. • What must change for this scenario to eventuate? • What needs to stop happening? • What (new) things need to start?
Break	
EXAMINING THE BARRIERS 35 min	Collate lists of barriers from previous session. Each table read aloud the hypothetical scenario they discussed and associated barriers. Encourage group to think deeply to consider all of the deeper challenges or structural barriers. For EACH issue, identify whether each barrier is tied to knowledge, rules or values. Start with the 'top issue' participants think is in the way of change. Then work through your list. For each barrier, repeatedly encourage participants to consider why it is so. Consider: • What is desired? (What are the social trends, wants or needs driving this?) • What is allowed? (What are the rules, habits, structures that prevent changing?) • What is known? (What is not known? Not known to everyone? Which information does not inform decision making?)
TOWARDS SOLUTIONS 45 min	Review what was uncovered when we dug deeper and continued to ask 'why?'. Participants to vote on the barriers they see as most important. Vote for the top three things you could change/tackle to make this solvable. • Discuss which scenarios offer the most potential. • Which are easier?

	• Which can be most driven by farmers? Review systems maps. Discuss the tensions in the system and opportunities to transform the system. Emphasise the need for a solution that works at both farm level and across the value chain (including consumers/community).
SUMMARY AND WRAP UP 10 min	Summarize findings. Next steps. Thank you and see everyone at next session (S3).

Appendix H. Facilitator guide for Chapter 6 study, focus group session 3 (S3)

INTRODUCTION 10 min	Introduction and welcome back. Reminder of goals Reminder of the process and where we're at.
PLAN FOR THE DAY 10 min	Objectives for session three (S3) and agenda for the day. Reminder of rules of engagement, roles and responsibilities. Goals for session 3: start developing an adoption plan for your own farms, communities, and the dairy industry more broadly. Set up a future mindset - imagine you're in one of these futures with one of the pathways we will present. You need to put yourself into the future and help us to understand what you did and what you needed to get there. Remember back to the first session when we did some drawings? We'll be doing something similar again.
OVERVIEW OF EMERGING MARKET PATHWAYS FOR DAIRY BEEF CATTLE (INTERVENTION 2) 40 min	Discuss with participants that up until this point, we have focused on creating new markets for dairy beef. In recent months, multiple new commercial market pathways have emerged for dairy beef cattle. We don't have all the answers, but we have some commercial options that may work. We now need your feedback to work out how it can be made better for yourself. There's not one way forward, but there are options now and into the near future. This is your chance to influence and fine tune them so they can work for you. Present and explain the details of three currently available commercial dairy beef programs into which surplus calves can be sold as beef animals. For each commercial market pathway, provide information on: • The age and weight at which calves could be sold (ranging from 5-day old calves to finished beef animals)

	• Any dietary and/or management changes required (e.g. colostrum management, welfare requirements, grass or grain finishing, etc.) • Genetic requirements (e.g. use of certain beef genetics for crossbreeding) • The price received upon sale of the animal
Break	
EXPLORING THE THREE MARKET PATHWAYS PRESENTED 60 min	Participants break into groups and each group will assess the three options. In each group participants individually assess the three different market pathway options and discuss how this pathway fits into your world, whether it be your farm specifically, or your world of work. Encourage participants to avoid thinking about how it might impact others, instead think about how it will impact them personally. Encourage participants to be selfish, it's all about them. Remind participants that we are here today to try and make each option as good as it can be. Encourage them to think about each option and make suggestions that could make it even better for their farm or for their work, or their community. Then, as a group, participants are to discuss and compare their feedback. Now that participants have seen all the options, they are to imagine that we're five years into the future and they have implemented each pathway. Participants discuss how each pathway works in their world and how they made it work.
Break	
SELECTING PREFERRED OPTION 30 min	Thinking over all of the options, participants now choose the option they think works best for them personally. Participants then discuss as a group and present their favourite option to the other groups and explain why.
THANK YOU AND CLOSE 5 min	Thank all participants. Close.

Appendix I. Codebook for Chapter 6 study

Theme	Subtheme	Subtheme description
Economic aspects	Breeding strategies	Views on the role of breeding strategies in achieving change including sexed semen, beef cross breeding, extended lactation.
	Calf rearing	Views on challenges and opportunities associated with rearing surplus calves including cost and availability of labour, and infrastructure, health/welfare/biosecurity challenges, and farmer capacity, willingness, and fatigue.
	Markets	Views on developing new markets (e.g. local, high value), understanding of/connectedness to existing markets (including meeting market specifications), volatility (climate, commodity price) and risk.
Social aspects	Farmers' connection to the public	Attitudes towards the connection/disconnect between dairy farmers and the public including views on social license, activism, and how to address (e.g. educate into understanding vs align practices).
	Duty of care	Views on personal duty of care towards animals including ethics of animal use, welfare versus ethics, and associated burden/impact on mental health.
	Affecting change	Views on effective ways to implement change including motivators, opportunities, and challenges.