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The Entrepreneurs: Dairy farmer perspectives on finding an industry solution for the surplus calf issue—A participatory case study

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Current systems for managing surplus dairy calves are wrought with ethical and animal welfare concerns. Resolving complex problems in the dairy industry requires engagement from dairy farmers and other stakeholders. The main objective of this case study was to pilot a novel methodology to deepen our understanding of how dairy producers envision the future of surplus calves in Atlantic Canada, including identifying who they felt were important to speak to as they discussed this topic. A second objective was to understand the perspectives of a key group the producers requested to speak to, representing a variety of dairy industry partners, including veterinarians, genetics companies, and animal welfare scientists amongst others (referred to as the allied industry) on the future of surplus calves. To reach these objectives, we used an inclusive participatory approach that, to our knowledge, has not yet been applied to the surplus calf issue. This approach included a series of five participatory group discussions with volunteer dairy farmers from Atlantic Canada; the allied industry group was invited to two group discussions. Participants discussed the feasibility of creating a dairy beef system as a potential solution to the surplus dairy calf issue. During the discussions, participants were encouraged to make requests to speak to individuals that would help them design a dairy beef system. Audio-recorded transcripts were subjected to inductive qualitative content analysis where short descriptors were assigned to pieces of the discussion relevant to study objectives. Four key themes from the discussions included: (1) challenges with surplus calf production on the dairy farm, such as a lack of knowledge about what type of calf would be desired by the marketplace, (2) the role of leadership and partnership in the creation of a dairy beef system, including the need to overcome communication barriers between different stakeholders, (3) post-farm gate aspects of surplus calf production, including the desire to cater to a local market, and (4) ensuring that

the proposed system is economically and socially viable. Knowledge gained from this type of participatory engagement can help stakeholders align their goals to resolve complex issues such as surplus calf management.

KEYWORDS

animal welfare, excess calves, participatory methodologies, ethics, complex problems

Introduction

Surplus dairy calves are those that the dairy farm does not need to retain for replacing their milking herd (Marquou et al., 2019). These calves are predominantly male, although the introduction of technologies, such as sexed semen and the increasing use of beef semen, has resulted in an increasing number of female surplus calves (Poock and Beckett, 2022). Regardless of sex, surplus calves are either euthanized immediately after birth (Renaud et al., 2017), slaughtered as "bobby calves" within the first weeks of life when it is more profitable to do so when weighed against rearing costs (Vicic et al., 2022), or are raised to enter the supply chain as veal or dairy beef (Renaud and Pardon, 2022).

There is an abundance of evidence indicating that, in many cases, the care of surplus calves is substandard compared with replacement heifers (Wilson et al., 2020a,b). Surplus calves have a high risk of early morbidity and mortality, and face several stressors associated with transport and remixing into a new social environment (reviewed by Creutzinger et al., 2021). Given the ethical and animal welfare concerns associated with surplus dairy calf management, it is not surprising that the public has concerns about the life led by these calves (Ritter et al., 2022). To address these concerns, some countries have either already implemented a complete ban on early-life slaughter of healthy calves (i.e., Denmark; Ministry of the Environment Food, 2019) or have begun the process of moving toward a complete ban (i.e., Bord Bia, Ireland described by Gilsenan, 2019). Moreover, the dairy industry in the United Kingdom has committed to end this practice by 2023 Agriculture Horticulture Dairy Board(ADHB), 2020.

Management of surplus dairy calves is also under scrutiny in Canada. This discussion has recently gained traction in large part due to the recent changes in the Government of Canada's Livestock Transport Regulations introduced in February 2020 and implemented in February 2022 (CFIA, 2019). These new regulations require that calves under nine days of age be transported for a maximum length of 12 h or less, which is shorter than typical trips for many calves in Canada (summarized by Wilson et al., 2020a), and cannot go through an auction. These regulations have closed the door to many common marketing routes used by Canadian dairy farmers for their surplus calves and will profoundly impact how dairy farmers manage these calves in the future. However, changing the fate of these calves will not be easy, as this issue is a "wicked" problem that cannot be solved solely using traditional experimental methods that seek to find solutions that refine part of the system (e.g., technical solutions such as reduced transport time) (Bolton and von Keyserlingk, 2021). Instead, the issue must be addressed holistically to ensure the system's success and sustainability.

When it comes to solving the surplus calf issue, there are many unanswered questions. For example, implementing the technical solution of using beef semen on dairy is increasing, with reports indicating a global seven-fold increase in beef semen sales to dairy since 1980 (1–7 million units semen sold; Poock and Beckett, 2022). However, despite the growing adoption of this trend, there is little discussion on its long-term economic sustainability, particularly given low tolerance by the packing industry for variation in supply which could arise with the use of different beef breeds (Herald, 2019). There are also unresolved questions about best practices for health, feeding, and social housing for dairy beef cross calves (see review by Creutzinger et al., 2021) and what is needed to prevent buyers from discounting these calves in the future.

When addressing complex problems such as this one, participatory methodologies that include the voices of all stakeholders along the supply chain can help with the development of sustainable solutions (e.g., dairy producers, veterinarians, processors, the public) (Bolton and von Keyserlingk, 2021). One example of bringing the voice of different stakeholders to these discussions comes from our companion study on North American public attitudes regarding the issue of surplus calves (and cow calf separation) using an on-line survey (Ritter et al., 2022). In addition, a participatory approach was recently shown by Bordier et al. (2021) to be an effective way to engage diverse stakeholders when designing a One health surveillance system to tackle antimicrobial resistance in Vietnam. A similar approach was used in the Netherlands for their pork opportunities project that set out to redesign a more sustainable pig husbandry system (Bremmer and Bos, 2017). An inclusive engagement process enables different stakeholders to convey their own perspectives as well as gain an appreciation of other perspectives, thereby allowing for the co-construction of a shared – arguably more sustainable – solution (Bolton and von Keyserlingk, 2021). In the case of the dairy industry, there are

several supporting professional industries, such as veterinarians, genetics companies, nutritionists, and agronomists, who support the farmers in the management of their cattle; this support is usually accompanied by a fee for service. Many of these allied industry representatives have a close relationship with the farmer and are viewed as a trusted advisors (i.e., Hall and Wapenaar, 2012).

The main objective of this case study was to deepen our understanding about how dairy producers envisioned the future of surplus dairy calf management in Atlantic Canada. We reached this objective by piloting a novel methodology to engage dairy producers in a series of participatory group discussions. An integral part of this process was to provide the opportunity for the participants to request information from other stakeholders or "experts" in response to identified gaps in knowledge that arose during the discussions. Given the important role that associated industry partners play in dairy production, a second objective was to understand the perspectives of individuals from the allied industry (e.g., veterinarians, genetics, processors; referred to as the allied industry group) on the future of surplus dairy calves.

Methods

This study was approved by the University of Prince Edward Island (protocol #6008628) and the University of British Columbia (protocol #H18-02880) Behavioral Research Ethics Boards. All participants provided either written or verbal consent.

Researcher reflexivity statement

Researchers in the realism paradigm, where the focus is on relationships, are not value-laden or value free and thus will no doubt influence the research (Healy and Perry, 2000). In response to this acknowledgment, reflexivity or positionality statements are encouraged as part of the narrative when summarizing qualitative work to improve transparency between the authors and the reader. It is the hope that by expanding on their backgrounds, the authors allow for a better understanding of how they approached the study and potential biases that they may bring (Creswell and Miller, 2000). The majority of authors of this study represented three Universities that all have well-established programs engaged in dairy cattle research, including a strong focus on dairy cattle welfare. Proudfoot, Hendricks, Ritter, Renaud, Roche have between 3 and 12 years of experience working in dairy cattle welfare whilst von Keyserlingk has been working in this space for two decades. Five of the authors (Proudfoot, Hendricks, Ritter, Renaud, Roche, and von Keyserlingk) have previous experience using qualitative research methods such as interviews and focus groups to understand dairy farmer, veterinarian, and other dairy industry stakeholder perspectives. Henricks, Ritter, and von Keyserlingk have also used qualitative research methods to understand public perspectives on specific dairy cattle management practices such as surplus calves (Ritter et al., 2022) and dairy calf housing and management practices (Sirovica et al., 2022). Roche is the Director and Principal Consultant at Acer Consulting, a company focused on Agricultural Communications and Epidemiological Research. Higgins works for the Maritime Beef Council's industry coordinator and has an active interest and passion for working with farmers in Atlantic Canada.

Dairy farmer group

This study took place in Atlantic Canada, which includes Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador; collectively this region is home to 6% of the 9.952 dairy farms holding licenses in 2021 (Government of Canada, 2021). We contacted a total of 10 farmers that owned and managed their dairy farms asking them to participate in 3–4 discussions focused on the surplus calf issue that would take place over a 4–6 month period. Of these, seven dairy producers agreed to participate. Personal information about the participants, including their gender, is unknown as we avoided asking these types of questions in the focus groups due to confidentiality. The seven farmer participants were known by the authors to be interested in these topics, and included one dairy farmer representative from each of the three provincial dairy boards (Dairy Farmers of Prince Edward Island, New Brunswick, and Nova Scotia), as well as four farmers (two From Prince Edward Island, one From Nova Scotia and one From New Brunswick) who had been involved in earlier discussions about surplus calf management with the Maritime Beef Council (the organization representing cattle producers in New Brunswick, Nova Scotia and Prince Edward Island). The first dairy farmer group discussion (Dairy Farmer 1) was held in April 2020; all participants of this meeting were invited to attend any subsequent session. This inclusive approach resulted in five group discussions taking place between April and November 2020 (Figure 1). Although the seven participants were invited to all sessions, not all could be present at each meeting (attendance ranged from three to seven farmers).

Approximately two weeks before the first group discussion, participants were e-mailed a copy of a report on "The Marketing of Male Dairy Calves in Canada" commissioned by the National Farmed Animal Health and Welfare Council (NFAHW, 2019) (see also Wilson et al., 2020a). At the first Session, AH gave a factual overview of the new transport regulations and how these changes will, when enforced, impact the transport of surplus calves in Atlantic Canada. Following this overview, the facilitator (SR) used a series of open-ended questions to encourage discussion between the participants on the perceived

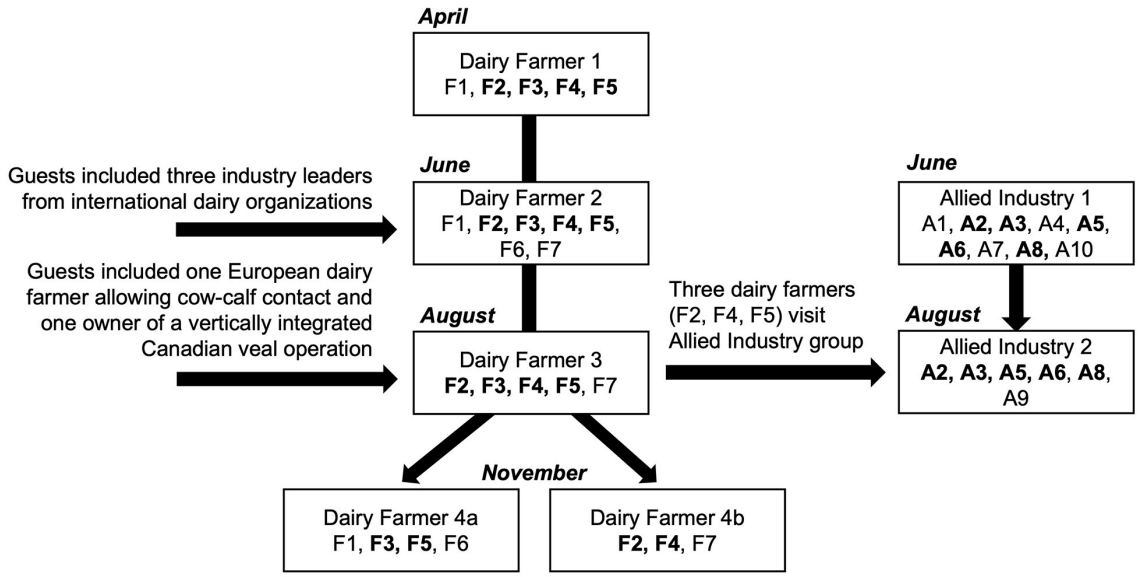

FIGURE 1
Overview of virtual participatory group discussions held for dairy producers, allied industry and guests between April and November, 2020 to discuss surplus calves in Atlantic Canada. Bolded participants (F1–7 and A1–9) attended all meetings for their respective group.

benefits, structure, and development of a dairy beef supply chain in Atlantic Canada.

At the end of the first Session, participants were asked if there was any information that they needed or individuals that the research team could invite to the next group discussion to help expand their knowledge on this topic (a method adapted from O'Doherty et al., 2010). Participants asked to speak with representatives from several support industries, including genetics companies and beef processors, as well as individuals from countries that already have programs in place for their surplus calves. The research team discussed these options and invited guests from other countries to the next dairy farmer group discussion (Figure 1). In response to the farmers' request to speak to the support industries, we decided to first create a new discussion group made up of dairy industry partners (which we called the allied industry) and then facilitate a conversation between the two groups (see details below).

During the second group discussion (Dairy Farmer 2; Figure 1), the facilitator asked each invited guest to summarize their experience with surplus calves in their country, followed by a facilitated open discussion where participants were encouraged to ask questions. At the end of the session, participants were again asked if there was any information that they needed or individuals to speak to next. Participants requested learning about operations that have already established a market for surplus calves, including the names of specific companies. In response to this request, the research team invited guests to the next session (Dairy Farmer 3) from one vertically integrated veal operation in Canada that the guests specifically asked for. To provide an alternative approach, the research team also invited a dairy farmer from Europe who created a niche market for his calves by using a cow-calf contact system.

Given challenges with scheduling, the final dairy farmer group discussion was split into two sessions consisting of three (Dairy Farmer 4a) and four (Dairy Farmer 4b) participants. No guests were invited to these sessions. Instead, to help participants summarize their thoughts on the complex issue of surplus calves, the facilitator asked participants to discuss the strengths, weaknesses, opportunities, and threats (SWOT) of creating a dairy beef supply chain in Atlantic Canada.

Allied industry group

To form the allied industry group, the authors used their contacts to invite participants who represented a breadth of industries that play a supportive role in dairy farming. This resulted in 10 participants, including two veterinarians from Atlantic Canada, two Canadian animal welfare scientists, and one representative from each of the following: a genetics company, a beef processor, the veal industry from Ontario, a national dairy processing company, the Canadian Roundtable for Sustainable Beef, and a government employee specializing in dairy farming from one of the Atlantic Provinces. The first allied industry group discussion (Allied Industry 1) was held in June 2020; all participants were invited to join a second meeting in August 2020 that included three of the farmer participants (Figure 1). Although the 10 participants were invited to all

sessions, not all could be present at each meeting (attendance ranged from six to nine participants).

Before the first allied industry group discussion, participants were given the same background information (NFAHW, 2019; Wilson et al., 2020a) and used the same open-ended discussion questions as the dairy farmer group (Dairy Farmer 1). This allowed the allied industry group the opportunity to learn about the topic before discussing with each other and with farmers. At the end of the session, when asked if there was any specific information that they needed or specific individuals they wanted to speak to next, this group requested to speak to dairy farmers. Given that the farmers had also requested to speak to representatives from the allied industry, the research team elected to combine both requests by sending an email to the farmer group asking for **three** volunteers who would be willing to participate in a **second** allied industry group discussion (Figure 1).

Group discussion sessions

All seven discussions (five farmer and two allied industry) lasted 2 h, were conducted virtually using Zoom (Version: 5.4.7, Zoom Video Communications, Inc., San Jose, California, USA), and were facilitated by SR. One additional researcher team member (either Proudfoot or Ritter) took detailed notes during each session. An interview guide containing a series of open-ended questions was used to facilitate each discussion (Supplementary materials can be found here: https://doi.org/10.5683/SP3/CFVPHO).

After each meeting, the scribe summarized the notes and sent them first to the research team for feedback on clarity and then to the participants to ask if they wanted to remove any material or change any of the summary statements. No participant requested any changes. The notes also allowed the participants to review the previous discussions before the next session. Video data were also sent to participants after each meeting. Audio data from all meetings was transcribed first using Otter Software (Otter.ai Pro Version, Los Altos, California, USA), then corrected where needed by KP or a Professional Transcriptionist.

Qualitative analysis

Inductive qualitative content analysis (Elo and Kyngäs, 2008) was used to analyze the participatory group discussions. The SWOT discussion in the final farmer group discussion was analyzed with the rest of the transcripts as it was used mainly to help the farmers summarize their thoughts. Analysis began by open coding of the transcripts, in which each transcript was first read line-by-line in chronological order. After the first reading, the process became iterative as short descriptors, or codes, were assigned to each piece of discussion that was relevant to the study objective. Only the participants' discussion was analyzed; any discussion among facilitators or guests was excluded from analysis. Coding was done using NVivo (QSR International Pty Ltd., version 12). After all transcripts were coded, codes were organized by similarity, creating a codebook, and identifying the overarching themes from the discussions. Three of the authors (primary coder: Hendricks and secondary coders: Proudfoot and von Keyserlingk) read all the transcripts and together discussed the major themes and agreed on the final version of the codebook. Emphasis is placed on the diversity of and connection between themes brought up by participants as opposed to the quantity (Hendricks et al., 2022). For presentation, participants were assigned a unique identifier (e.g., A1 for participant one from the Allied Industry group). Participant quotes were chosen to represent key ideas brought up by participants and were modified in length for clarity, depicted by [. . .] in the text.

Results and discussion

Four main themes were identified from the content analysis: (1) challenges with surplus calf production on the dairy farm, (2) the role of leadership and partnership, (3) post-farm gate (i.e., beyond the farm level aspects of surplus calf production, and (4) developing a sustainable system. Figure 2 depicts a concept map of the possible relationships between these themes.

Challenges with surplus calf production on the dairy farm

Surplus calf rearing practices

Participants discussed the challenges with rearing surplus calves on the farm of birth, such as a lack of adequate barn infrastructure. One participant stated that: "*The thing, though, is infrastructure. I'm full, I cannot handle beef calves. [. . .] And I think many, many dairy farmers tell you the same thing. We do not have infrastructure to keep these calves. And we have to fix that*" (F3, Dairy Farmer 4a). Some participants suggested that these infrastructure problems may be resolvable. For example: "*There are ways of raising the young calves outside [. . .], this can be a very low-cost housing system. I realize that means you have to go outside [. . .]. and calves can deal with this if you give them enough bedding. So, there are options for lower cost housing*" (A3, Allied Industry 1). Farmers from other countries are choosing to increase their infrastructure instead of transporting calves off the farm at a young age. For example, Osawe et al. (2021) reported that many Irish dairy farmers, in response to no longer being allowed to euthanize healthy calves, have invested in barns so that all calves born can be housed on the farm. Historically, many farmers in Canada house their replacement calves indoors rather than outdoors; only 21% reported using outdoor hutches

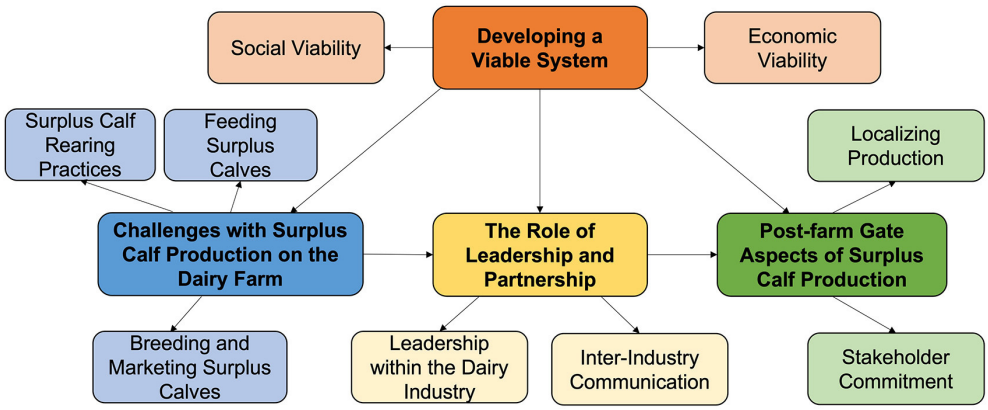

FIGURE 2
Concept map depicting possible relationships between major themes (bolded) and sub-themes that arose from a series of group discussions with dairy producers and allied industry regarding surplus calves. The dark orange, dark yellow, dark blue, and dark green boxes represent the four overarching key themes that emerged from discussions. The lighter boxes within each color represent sub-themes within each of the key themes. Arrows are used to demonstrate organization of the topics.

in a recent survey (Winder et al., 2018). In contrast, Between 30 and 90% of farmers in the US use this form of housing depending on the region (Machado and Ballou, 2022). Housing calves outdoors in hutches has been argued to provide benefits to calves such as lower mortality rates, reduced disease, and higher weight gains compared to indoor housing (see review by Roland et al., 2016). However, any type of housing where the calf is housed individually, including outdoor hutches or indoor pens, is being increasingly criticized due to the plethora of evidence that social housing provides growth, social, and cognitive benefits to calves (e.g., Meagher et al., 2015; Costa et al., 2016; Bolt et al., 2017). Thus, to be sustainable, any housing system for surplus calves should include opportunities for calves to socialize with their peers.

Feeding surplus calves

Feeding was another important aspect of rearing surplus calves on dairy farms discussed by the participants. Colostrum provision was discussed as being critical to helping calves transition to the nursery phase. For Example: "*If you're going to move those calves off the dairy farm, and they're only eight days of age, you've got to make sure that they have their colostrum and that they're well started. Because when you bring them into those nursery barns, it can be a disaster very quickly*" (A1, Allied Industry 1). As one farmer described, providing colostrum to male calves can be dependent upon the economic value of the calf at a given time: "*When you're trying to feed a calf at two o'clock in the morning [. . .] if it's a male calf and I'm getting $20 for this, hell, man, I'm going to go to bed. But if I know I'm getting $200 for this calf, I'll be up there two o'clock in the morning feeding, making sure that calf is getting his colostrum*" (F6, Dairy Farmer 4a). Male calves, which make up most surplus calves, have previously been found to receive a lower volume of colostrum and have higher rates of failed transfer of passive immunity compared with female calves in Canada (Renaud et al., 2020). Canadian veterinarians (Sumner and von Keyserlingk, 2018) and Australian Farmers (Vicic et al., 2022) have both suggested that poor male calf care is linked to their low economic value compared with females.

Providing increased milk allowance throughout the milk feeding period was also discussed. One participant said: "*I would suggest that the calves also need a very good start. And that would help you all along the way if they were putting up a lot of weight right from the start. I don't know if dairy farmers would consider keeping them at the farm and feeding them milk that they don't need for the first at least six weeks and really, you know, 8–12 liters a day and really get development and weight on them. And that gives you a much better chance later*" (A3, Allied Industry 1). However, feeding more milk was viewed as an economic barrier by some participants, as described by farmer F2 (Dairy Farmer 1): "*If a calf comes onto my farm, it's going to get milk replacer. Milk replacer is by far and large our highest cost. So, we're not going to feed that calf 12 liters of milk a day, it's not going to happen.*" Restricted milk allowance (e.g., feeding calves an average of 4 L/d in the first few weeks of life) has been reported among Australian (Abuelo et al., 2019) and Brazilian farmers (Hötzel et al., 2014) for both male and female calves. In contrast, Canadian farmers reported that they provided replacement heifers a maximum of 8.2 L/d (mean) of milk or milk replacer (Winder et al., 2018). However, provision of low milk allowances early in life would explain the low body weight of surplus calves when they arrive at calf rearing facilities, a known risk factor for early mortality (Renaud et al., 2018).

There was some discussion over the general differences in rearing male surplus calves compared with replacement females. For example, one farmer criticized the dairy industry for the lack of care provided to male calves: *"In some senses the dairy industry is a little bit hypocritical. We take excellent care of all the female animals on our farm, but we don't treat the male calves with that same sort of respect, or that same sort of care. And as long as we're not doing that then we can't look at ourselves with any pride or any virtue and say we're doing a good job. If you're not going to do a good job on the least valuable animal on your farm then what pride can you take in taking care of the best animal on your farm?"* (F5, Allied Industry 2). Dairy farmers in Ontario and Australia have also reported that they often do not prioritize surplus/male dairy calves, often due to time constraints (Wilson et al., 2021; Vicic et al., 2022), a concern also raised by Canadian veterinarians in a recent focus group study (Hendricks et al., 2022). Despite this discrepancy between female and male calf care, Canadian dairy farmers were found to be motivated by their own intrinsic pride and sense of responsibility to provide good care to all of their calves, regardless of sex (Wilson et al., 2021).

Breeding and marketing surplus calves

Another challenge described by the participants was how to breed their surplus calves to suit the demands of the market. Participants were interested in identifying optimal calf characteristics and ways to create a consistent product for the supply chain. For example, participants discussed the importance of determining the "right calf" as part of developing a dairy beef production system. In the words of one participant: "*You really have to start looking at the kind of animal that we want to ship out the door after 10 days. And then we as dairy farmers can give you the calf. And it starts with the semen that you put in the cow nine months before that*" (F3, Dairy Farmer 1). Another participant in the same group mentioned that stakeholders who were interested in carcass characteristics would likely be influential in helping farmers determine what type of semen to use: "*The people that will likely be the best people to tell us what type of semen to use are the people that are determining what carcass characteristics are wanted, as well as what type of feed efficiencies? So, you're looking at a group of feedlot producers as well as the meat packers*" (F5, Dairy Farmer 1). In agreement with this idea, Berry et al. (2019) argued that appropriate breeding decisions through bull selection can increase surplus calf marketability. Whether this breeding strategy continues to translate into a higher valued calf remains to be seen as there are now reports indicating that some farms are implanting beef embryos into dairy cows (embryo transfer) as a more profitable option than using beef semen (Le Page, 2020; Thomas, 2021). Embryo transfer, however, may not be sustainable in the long term given that both the donor and recipient cows must receive hormone treatments for this process to work (see Phillips and Jahnke, 2016). Research from Germany has shown that the use of sexed semen, embryo transfer, cloning, or hormone treatments needed to facilitate fertility in cattle were overall perceived negatively by members of the public (Pieper et al., 2016).

Some allied industry participants discussed what they viewed to be the farmers' priorities in terms of breeding. One participant believed that farmers were most interested in calving ease: *"Most farmers are looking for calving ease over anything that has anything to do with calf traits. Because that's more valuable to them than anything they're going to get out of that calf"* (A4, Allied Industry 1). This potential mis-alignment between farmer beliefs on what attributes are desired when making breeding decisions and what the advisors believe the farmers value has been reported by others. For instance, Derks et al. (2012) suggested that differences in values with regards to the farm's goals explained why some farmers failed to follow veterinary advice. However, a different allied industry participant expressed that some farmers are becoming increasingly interested in calf characteristics to produce more profitable calves: "*More and more producers [are] asking about specific traits other than a bull that's black, cheap and polled and high fertility. What should I be looking for? What does marbling mean to me? What does ribeye area mean? What can that do for these crosses? Easy calving has been quite important. We're having discussions with producers now that, you know, all thought calving birthweight is important. Everybody wants live calves and no damage done to the cow. But at the same time, we have producers that are wanting to build a better calf on farm*" (A5, Allied Industry 1).

Participants discussed the idea of creating a consistent supply of calves that are reared similarly to develop a dairy beef supply chain. As one participant described: *"One of the priorities of the co-op is to essentially standardize some of the rations and some of the procedures and protocols, that way we can remove some of that variability. Understand that you're creating a different product than a replacement heifer, and also, if you are sending it or selling it out to a grower, in this case, they'll have their level of expertise that they'll want us to be following as well. If he's sending out 100 calves from his facility, but he's also sending out 100 calves from a couple different dairy farms, they all have to be finishing around the same time, they have to be about the same animal*" (F5, Dairy Farmer 1). Another participant similarly commented: *"[. . .] maybe what we've got to do is make sure that people know that there is a consistent supply of beef cross animals that are going to be available as the use of beef semen increases. I think that we can say that there is there is going to be a consistent supply on Prince Edward Island, there is going to be you know, 5,000 beef calves born in a year. So, there's opportunities here*" (F6, Dairy Farmer 4a).

The role of leadership and partnership

Leadership within the dairy industry

Participants discussed the role of the dairy industry in leading the change in surplus calf management. For example, some participants felt that the dairy industry should be at the forefront of creating a dairy beef supply chain in the region: "*[. . .] Farmers need to be in a position of leadership for this. Specifically, because if government or outside groups like processors or retailers are in the leading position, we're not necessarily going to be able to drive the car*" (F5, Dairy Farmer 2). Another stated that: "*I think my dairy industry has their head in the sand on it completely. We will have to sort through this in the dairy industry in the next three to five years I would say*" (F4, Allied Industry 2). In contrast, one participant argued that dairy beef production systems might evolve more quickly if the government led through the introduction of policy: "*The higher ups have to drive this. We can't just have small companies driving it [. . .] I guess if industry is going to drive this thing, It's going to be slow and disjointed and all over the place. But if policy drives it, industry will react*" (F2, Dairy Farmer 2). Indeed, failing to address contentious management practices, such as the surplus calf issue, could potentially erode public trust in dairy which can undermine this sector's social license to operate (Rollin, 2004).

Inter-industry communication

Participants discussed the possibility of vertical integration or partnerships between stakeholders involved in calf rearing to develop a stable production system for surplus calves. For example, "*In Ontario, many of the animals are purchased right off the farm. I think of the people at [company] that are having agreements with the farmers. And I think that's what we probably should be looking at. And there are requirements for how farmers need to raise their calves. And some kind of a contractual agreement between the farmers and the further growers or somewhere*" (F6, Dairy Farmer 2). In agreement with this idea, Australian farmers who had established contracts with calf rearers expressed greater success with the sale of their male calves and had a more positive outlook on the viability of male calf production in comparison to farmers who did not consistently use targeted supply chains (Vicic et al., 2022).

Participants also discussed tension between agricultural industries. The beef industry and drovers were both described in this context by one participant: "*The other thing comes down to I guess, perceptions of drovers and perceptions of distrust cross-industry. There seems to be a lot of animosity between the beef sector and the dairy sector*" (F5, Allied Industry 2). Another participant commented that lack of communication between industries prevented the progression of dairy beef production: *"I can completely understand why this is getting left on everybody's backburner because the dairy groups like to focus on milk, and don't feel that this is their issue. And the beef side sees this as a threat. So, nobody wants to deal with it*" (F2, Dairy Farmer 4b). Another participant expressed the desire for different stakeholders and organizations involved in dairy beef production to work together as opposed to against one another: *"I really hope that we can all stay on the same page, like we have cattle producers, we have [the] Maritime Beef Council, we have two or three different organizations. Sometimes I'm not sure if they are envious of each other or it's more often than not, it's a personality issue. We don't gain anything by working against each other... And we can gain everything if we work together*" (F3, Dairy Farmer 4a). Reluctance of beef producers to rear animals originating from dairy herds has been discussed as a threat to dairy beef production systems, but some have argued that integration of dairy and beef industries, along with other sectors serves as an opportunity emerging from the development of these systems (Berry, 2021).

Post-farm gate aspects of surplus calf production

Stakeolder commitment

Participants discussed the need for commitment amongst stakeholders involved in dairy beef production to create a new supply chain. In the words of one participant: "*I truly believe we need to look at a formula system, from the dairy producer to the nursery, and then from the nursery to the finisher. They have to be committed regardless of the day of the week or the drover that's in the yard that you're either all in or you're not. But I do think there's an opportunity there to do that*" (A8, Allied Industry 1). Another participant in the same session offered a similar opinion: "*If somebody is committed to the program, they need to stay in the program. They can't say oh, I'm going to jump for a nickel here or dime there. The grass is not always greener on the other side of the fence and if people are committed to making this work, they have to be committed right from the start*" (A1, Allied Industry 1). There is some evidence that an industry can improve the sustainability of its business model by expanding its relationships further along the supply chain beyond that of its direct relationships, however, to be effective the industry must actively manage and maintain these relationships (Norris et al., 2021).

Localizing production

Participants felt that dairy beef systems could be improved by localizing production. One participant described this localization within the region: "*I think our long-term objective is to [. . .] keep a sustainable system within the Maritimes. I think it's a huge benefit to instead localize or regionalize our meat production and our meat sales*" (F5, Dairy Farmer 1). Another participant described producing more calves locally in Canada as opposed to relying on importation: "*And we hope that we can*

generate more Canadian product and not have to be importing products or cattle out of the States [. . .] I'd love to see some milk boards, or industries or something taking the initiative to push this forward" (F2, Dairy Farmer 2). The desire to promote local production in our participants may be explained in part by the ongoing trade discussions between Canada and the US, as the US is pushing for increased access to Canada's dairy market, which is protected by the supply management system (see Heminthavong, 2018 for detailed description). The topic of local food production has received considerable attention (i.e., Hinrichs, 2003), and although these markets are growing in North America, there is also some evidence of decay (e.g., Brinkley et al., 2021).

Developing a viable system

Economic viability

An important aspect to participants was maintaining economic viability if they move forward with dairy beef production. One participant expressed: "*Sustainable agricultural production always has to keep in mind the sustainability of the primary producer. If we're not financially sustainable it's just not going to work*" (F1, Dairy Farmer 4a). Another participant commented: "*The bob calf put on a truck at eight days of age and then going through marketing pathways like they do now is not sustainable. I think that having a system that producers want to get behind because is the right thing to do and it's profitable for them, hopefully [this] would be a way to move forward*" (A6, Allied Industry 2). In agreement with the idea that dairy beef may be a profitable way forward, Ettema et al. (2017) Found that rearing dairy beef calves on Danish herds increased their economic return when used in combination with sexed semen breeding strategies. Expanding a dairy enterprise to include raising dairy beef may increase the farm's financial risks in the short term but failing to do so may also come with risks to the dairy business itself; farmers electing to expand their business will need to trade off these different types of risk (Sinnett et al., 2016).

The notion that participants were willing to engage in discussions about developing a novel system to deal with the surplus calf issue in their region is encouraging and must not be overlooked. There is evidence of a changing outlook observed in some farming communities, as farmers adapt to external pressures by adopting more entrepreneurial attitudes (Janker et al., 2021). This change in attitude is often discussed when looking at contradictory features that are observed in modern farming contexts. Whilst features such as the need for continuity, maintaining the agrarian way of life, risk avoidance and promoting small farm size are often used to describe peasantry attitudes, features such as *"high market dependency, scale enlargement, profit maximization, risk taking and large farm size*" are associated with entrepreneurship attitudes (p. 454, Niska et al., 2012).

Social viability

Participants discussed how public and consumer opinions could influence the social sustainability of dairy beef production systems. One participant expressed that understanding public opinions was an important part of ensuring the success of the system: "*I think if we're going to be developing a product we need to hear from our consumers as well. Because if we do this wrong, and they don't latch on to it then there is no market pull*" (F5, Allied Industry 2). A companion study investigating North American public attitudes recently reported that participants were generally accepting of using surplus calves for meat production (Ritter et al., 2022). However, a key concern to this conditional acceptance was that the calves were provided a reasonably good life. Another participant described their belief that increasing public concern for animal welfare is a growing issue in agriculture: "*Consumers want to support products they can get behind ethically. Because that is an area of focus for us as dairy processors. Because that's what we're hearing from our customers, our major retail and restaurant customers. So that is a really important issue*" (A6, Allied Industry 2). Public concern for ethical and sustainable farm animal production systems is indeed increasing (Croney and Anthony, 2011), and continued inclusion of the public voice (among other stakeholders) is considered critical to ensuring the social acceptability of surplus calf management systems (Bolton and von Keyserlingk, 2021).

Limitations

Our findings are not intended to be generalizable to all Canadian dairy farms, but the results may be transferable to dairy regions with similar contexts. Others have argued that conversational engagements on complex issues can generate two distinct kinds of output: "analytical" or "technical" output, which is largely used by researchers to identify areas requiring further scholarship, and "deliberative output", which is defined as *"a politically legitimate representation of the collective voice of the participants*" (O'Doherty et al., 2010, p. 22). With respect to both of these types of outputs the findings of our case study approach should be viewed with caution. We recognize that our participatory approach was limited to including a small group of "interested" farmers and a limited, not inclusive, representation of the allied industries. We also acknowledge that we did not include voices of all parts of the supply chain in the current discussion, such as the food retail sector, restaurants, and the public (see companion study Ritter et al., 2022); the voices from these and all other stakeholders along the supply chain should be included when discussing the development of sustainable system for the surplus calf issue.

Conclusions

This case study showcases a method for engaging dairy farmers and other stakeholders in discussions about complex issues; to our knowledge is the first time that this method has been applied to the topic of surplus calves. By using an inclusive approach that included a series of discussions that took place over a six-month period, we allowed participants the opportunity to expand their thinking on the topic and learn from others. The results of the group discussions provided insights into the challenges that exist for dairy farmers as they manage their surplus calves. Participating dairy farmers and members of the allied industry identified multiple barriers and paths forward to develop a sustainable system for surplus dairy calves in the Atlantic region, ranging from infrastructure and management issues at the dairy farm to post-farm gate issues further along the supply chain. Salient among the conversations was the desire that any proposed system be sustainable in the long term. Knowledge gained from this type of engagement can help researchers and stakeholders align their goals to resolve complex issues such as surplus calf management.

Implications and recommendations

In this case study, a small group of dairy farmers showed their desire to innovate, despite being limited by several existing barriers. Of the themes described in this study, we believe that there are four critical issues that should be a focus of further work. First, we recommend that researchers use this or similar participatory methods to assess the perspectives of a wider group of stakeholders, including the food retail sector, restaurants, and the general public. We envision this case study will contribute to a larger body of work assessing the perspectives of different stakeholders to help the industry create a more sustainable system for surplus calves. Second, we recommend that the dairy industry, begin to resolve the lack of communication between dairy farmers and other stakeholders involved in supply chain for surplus calves entering the beef market. By speaking with farmers and members of the supporting allied industries, we heard examples where both groups made assumptions about the motivations of the other, but these assumptions were not necessarily correct. For instance, some dairy farmer participants assumed that the allied industry knew what the "right calf" looks like for the dairy beef market, which based on the conversations we heard was not accurate. Similarly, some participants from the allied industries believed that the farmers made breeding decisions based solely on one characteristic (e.g., calving ease), which was again not necessarily true. By resolving these communication problems, we envision that entrepreneurial farmers will have more opportunity to be successful in identifying new markets for these calves. Third, we suggest that the cattle industries, both beef and dairy, avoid focusing on technical solutions to the problem of surplus calves, and instead identify a common vision on how they can support a sustainable outcome for surplus calves that is economically viable but also socially acceptable to the public. A growing body of evidence indicates that simply adopting technical solutions (see Bolton and von Keyserlingk, 2021), such as using beef semen in dairy cows, may not be sustainable in the long run. For instance, public concerns regarding separation of the newborn dairy calf from its dam at birth (Sirovica et al., 2022) are gaining traction, thus, simply switching the type of semen used to produce the calf may not be sufficient in avoid future criticisms about dairy farming. Lastly, although the participants in this study recognized the importance of social and economic viability in a sustainable supply chain, they focused less on environmental aspects of sustainability. Future research on this topic should include more interdisciplinary discussions when seeking sustainable solutions for surplus calves, including how any proposed solution impacts the environment.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved. This study was approved by the University of Prince Edward Island (protocol #6008628) and the University of British Columbia (protocol #H18-02880) Behavioral Research Ethics Boards. All participants provided either written or verbal consent. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

KP, JH, and MK were responsible for the writing of the first draft of the manuscript, including the synthesis, and interpretation in the results and discussion section. SR, KP, AH, and CR were responsible for the discussion group sessions. All authors except for JH collectively contributed to the research question and study design. SR, CR, and DR provided comments and suggestions on the penultimate version of the manuscript. All

authors contributed to the article and approved the submitted version.

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Conflict of interest

AH is employed by the primary funder of this work but the thoughts and opinions expressed in this paper are her own and should not be taken to reflect that of the Maritime Beef Council. SR is employed by ACER Consulting Ltd.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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