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Assessing beef producer's interest in cooperative business models to address processing capacity constraints in New Hampshire, Maine, and Vermont

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ASSESSING BEEF PRODUCER'S INTEREST IN COOPERATIVE BUSINESS MODELS TO ADDRESS PROCESSING CAPACITY CONSTRAINTS IN NEW HAMPSHIRE, MAINE, AND VERMONT

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ABSTRACT

New Hampshire, Maine, and Vermont are well-positioned to grow their capacity for local beef production, however significant barriers to accessing processing services exist. The challenges of processing capacity are complex, and the COVID-19 pandemic further compounded those challenges. Cooperative business models, such as cooperative processing and marketing, have been used to address the issues producers face with processing capacity. This study aimed to determine if beef producers in New Hampshire, Maine, and Vermont would be willing to participate in cooperative business models, whether interest in cooperative models varies by different types of beef producers, and what attributes would these business models possible. An online closed-ended survey was conducted, followed by phone interviews to address the research objectives. Participants were reached through non-probability sampling methods using a combination of non-purposive and snowball sampling. Data were analyzed using multiple regression with backward elimination, and Pearson correlations were calculated to identify relationships between demographics and willingness to participate in cooperative business models. A coding system was used to analyze qualitative data from follow-up interviews. Results showed there was a willingness among beef producers to participate in cooperative processing and marketing. Still, there were reservations due to unfamiliarity and concerns with financial investment and pay-off.

Through both qualitative and quantitative assessments, it was possible to theoretically predict what type of beef producer might be willing to experiment with cooperative processing and cooperative marketing. Future research on the economics of cooperative business models and how to implement cooperative business models for beef producers is needed to move forward successfully.

CHAPTER I

INTRODUCTION

Beef Production in Northern New England

Beef production is a critical part of the agricultural landscape and plays a significant role in keeping land open and preserving the rural character of New Hampshire, Maine, and Vermont. According to the 2017 USDA NASS Census, the percentage of beef contributing to the total market of agricultural products sold is 5.2% in New Hampshire, 7.8% in Maine, and 4% in Vermont. New Hampshire reported 595 beef farms, Maine 1,807 beef farms, and Vermont 1,253 beef farms (USDA-NASS, Census of Agriculture, 2017).

Consumer demand for locally raised meat has risen consistently in the United States throughout the last 10 to 15 years (Conner and Hamm, 2007; Wilson and Andersen, 2011; Lewis and Peters, 2012; Gwin et al., 2013) and increased further as a result of the Coronavirus pandemic (Darcy, 2020; NMPAN, 2020; Baker et al., 2021). The Northeast region holds the second-largest share of direct-to-consumer sales, making up 22% of the U.S.'s direct marketing of agricultural products. Local-level livestock sales account for 37% of gross farm sales (Johnson et al., 2014). Consumers' changing attitudes toward meat production contribute to the increase in demand for local meat products. Consumers who purchase local meat products value knowing how animals are raised and slaughtered, the composition of their diet, and their overall welfare (Johnson et al., 2014).

As consumer demand for locally grown beef products increases, New England is well-positioned to expand its capacity for local beef production. New England has approximately 820,300 acres of pastureland suitable for livestock production and 1,450,400 acres of cropland,

much of which is used to grow livestock feed (Lewis and Peters, 2012). In addition, meat production is a typical transitional enterprise for dairy farmers in New England who seek to diversify their income (Lewis and Peters, 2012) or leave the dairy industry. Adding small-scale livestock production to an existing mix of agricultural activities has perceived benefits when managed well, including improved ecological sustainability and overall quality of life (Lewis and Peters, 2012). As a result, the land capacity, consumer demand, and producers' desire to grow their businesses favor expanding local beef production in New England. However, significant barriers prevent producers from increasing their beef product inventory.

Significance

Processing capacity was one of the top production constraints for beef producers in New Hampshire, Maine, and Vermont, according to a preliminary survey conducted by Enzien in March 2021. Livestock processing facilities struggled to maintain consistent supply due to the seasonality of production, labor shortages, and cold storage capacity (Lewis and Peters, 2012; Johnson et al., 2014; West, 2014; Waro, 2019;). As a result, there was a disconnect between producers' ability to schedule dates for processing services and processing facilities' ability to maintain adequate production (Gwin et al., 2013). This issue was amplified at the start of the COVID-19 pandemic when producers experienced increased consumer demand for local beef (NMPAN, 2020; Baker et al., 2021). However, research suggests that building new facilities alone would not solve the challenges producers and processing facilities experience (Lewis and Peters, 2012; Waro, 2019; West, 2014).

Previous studies have shown that cooperative marketing and cooperative processing were successful business models in other parts of the country to help alleviate processing constraints

for livestock producers (Gwin et al., 2013; Ellsworth, 2015; Quanbeck, 2015; Scott, 2017; Jumars and Coordinator, 2018; Park et al., 2019). Participating in cooperative business models, specifically for beef producers, is not common practice in New Hampshire, Maine, or Vermont. While previous studies conducted by Gwin et al. (2013), Ellsworth (2015), Quanbeck (2015), Jumars (2018), and Park et al. (2019) have provided an understanding of what opportunities and constraints are involved in cooperative business models, there has been no prior research to understand whether beef producers in New Hampshire, Maine, and Vermont would be interested in cooperative models or what demographic of beef producers would or would not be interested.

For this study, cooperative business models included *cooperative processing* and *cooperative marketing.* Cooperative processing is a collaborative model where producers form a cooperative to offer their members slaughter, processing services, or both. Access to services may be accomplished by acquiring mobile slaughter units (MSU), acquiring facilities to conduct USDA slaughtered beef processing, or developing permanent infrastructure to perform slaughter and processing. In any of these scenarios, marketing is the responsibility of the producers (Gwin et al., 2013; Johnson et al., 2014). These cooperative processing models aim to improve cooperative members' immediate access to slaughter and processing. Cooperative marketing is a collaborative model where producers conduct sales under a regional or local brand that coordinates and aggregates the supply to create a larger, more consistent volume of products (Scott, 2017). The brand is either a cooperative formed and owned by the producers or a cooperative owned by an independent company (Johnson et al., 2014). In this model, the cooperative would support obtaining access to slaughter facilities, marketing, customer service, and shared transportation (Ellsworth, 2015). Another type of cooperative marketing model

entails selling the finished animal to the central brand entity to alleviate the logistics of procuring processing dates and marketing altogether (Gwin et al., 2013; Park et al., 2019). This model aims to improve access and consistent supply to processing facilities by providing consistent business year-round and enhancing access to larger regional markets. The term *processing facilities* refer to USDA or State inspected facilities providing slaughter and processing services. Slaughter is the dispatching of the animal, and processing is the handling, cutting, wrapping, and holding of the final products (Waro, 2019). Processors refer to those owners or employees working within the facilities.

Objectives

The long-term goals of this study include the development of resources, programs, and networks to aid in the expansion and sustainability of beef businesses and processing facilities in northern New England. To that end, this study assessed beef producers' willingness to adopt cooperative business models for beef producers in New Hampshire, Maine, and Vermont to alleviate processing capacity constraints. It was hypothesized that beef producers are open to experimenting with cooperative marketing and processing business models.

The objectives of this study were to:

1. Identify the types of beef producers willing and interested in participating in cooperative business models.
2. Identify the attributes of cooperative business models that would make them viable for beef producers.
3. Assess the opportunities and constraints of cooperative models for northern New England beef producers.

Research Questions

The study met its objectives by addressing the following research questions:

- Assuming that forming cooperative business models would help alleviate processing capacity bottlenecks, would beef producers be willing to participate in cooperative models?
- What type of beef producers are open to participating in cooperative models?
- What characteristics of cooperative business models would make them advantageous for beef producers to commit in northern New England?

CHAPTER II

REVIEW OF LITERATURE

Understanding the Processing Facility Bottleneck

The strong public interest in local, regional food system development and consumer demand for locally raised meat has created an economic opportunity for beef producers in northern New England. However, the challenges beef producers experience with processing capacity has created a barrier for them to expand production. Beef producers often pointed to a lack of federally inspected (USDA), and state inspected (only in Maine and Vermont) processing facilities as the major constraint to their ability to market their products locally, according to the preliminary study conducted in March 2021. New England beef producers traveled an average of 52 miles to an inspected processing facility (West, 2014), and in some areas, they traveled up to 100 miles. In contrast, spatial data indicated that processing facilities have enough physical capacity to serve all areas of New England (Lewis and Peters, 2012; West, 2014). For instance, Lewis and Peters (2012) found enough infrastructure to slaughter most of the livestock produced in New England. The study concluded that increasing livestock production would require more than increasing the number of inspected processing facilities. Although the assumption remains that there has been insufficient access to federal and state inspected processing facilities in New England, previous data support that there were other barriers to the region's processing capacity than lack of federal and state inspected facilities alone.

In 2019, Cornell University evaluated the barriers to livestock processing in New York and New England by surveying USDA inspected red meat processing facilities. The results indicated that the top bottlenecks for processing facilities were a lack of qualified workers (74% of

respondents), limits to cold storage (68% of respondents), limited access to funding to grow their business (57% of respondents), and the seasonality of livestock production (Waro, 2019). Most animals were finished and processed in the fall months, intensifying the constraints of limited cooler space and labor (Waro, 2019). In addition, Waro (2019) found that it takes processing facilities less labor and time to slaughter animals than it does to process the carcasses completely. Most facilities only slaughter one or two days a week, compared to processing five days a week, as it requires more time and highly skilled labor (Lewis and Peters, 2012; Waro, 2019). In 2009, Vermont formed a Meat Processing Task Force and identified seasonality of demand and production, cut-and-wrap capacity, and cold storage as the most significant bottlenecks for processing capacity (Gwin et al., 2013). The Vermont Meat Processing Taskforce concluded that new processing facilities would not solve the processing capacity bottlenecks, which is consistent with the study results reported by Lewis and Peters, 2012 (Gwin et al., 2013). While these facilities may not have been limited by slaughter capacity, processing capacity became the biggest challenge in the production chain, especially for beef producers.

Barriers to expanding beef production in New England are complex, and since the Coronavirus pandemic, much has changed for producers and processors in New England. Demand for local food products, beef in particular, surged due to the COVID-19 pandemic (Darcy, 2020; NMPAN, 2020; Baker et al., 2021). In addition, consumers turned to local meat sources as beef became scarce in grocery stores (NMPAN 2020). However, at the same time, as consumer demand increased, large and small processors faced heightened labor shortages as pandemic protocols stressed normal operations, causing many large plants to halt production altogether (Thilmany et al., 2021). A year after the March 2020 shutdown in March 2021, a research team at the University of New Hampshire conducted a preliminary study titled,

"Exploring Constraints to the Expansion of Beef Production In New Hampshire, Maine, and Vermont since COVID-19". The purpose of this preliminary study was to help further understand the challenges northern New England's beef industry faced due to increased local demand for meat during the pandemic.

The preliminary study included phone interviews with 18 beef producers and processors in New Hampshire, Maine, and Vermont. There were 16 beef producers and two processors. Of the 16 producers, a combination of beef and dairy-beef producers, a majority saw growth in sales during the pandemic, and many stated they had more consumer demand than they could supply. Regarding business growth, a majority of respondents wanted to grow their business but felt they could not grow due to various constraints. Of those constraints, processing capacity was one of the top challenges identified by the beef producers who participated in the interviews. These results were consistent with what Cornell Cooperative Extension found in a recent study looking at the impacts of the COVID-19 pandemic on livestock producers' businesses. After surveying 650 farmers, 85% reported demand had increased, but 81% could not meet increased demand due to the constraints on processing capacity (Baker et al., 2021). As demand increased, the limitations on labor, cold storage, lack of funding for facility expansion, and seasonality of production intensified. Over the last several years, slaughter and processing plants have declined by 7% nationwide, adding to the supply chain bottleneck leading up to COVID-19 (Thilmany et al., 2021). Small plants with fewer than 20 employees make up 60% of all processing facilities nationally and are typically custom-exempt facilities serving a localized market (Thilmany et al., 2021). These small plants are typical for northern New England.

In the preliminary study, the two processors interviewed from Maine and Vermont reported operating at 70-100% capacity during the height of the pandemic regardless of the season, which

was a shift from what they experienced before the pandemic. Labor shortages and consistent product supply became more challenging, resulting in processing facility employees feeling overworked and burned out. The trends in northern New England were consistent with studies around the U.S., reporting that local processors quickly hit capacity and required processing dates to be scheduled 18 months in advance (Thilmany et al., 2021). The pandemic highlighted how vulnerable meat slaughter and processing systems were in the United States and how small processors were critical to keeping our local beef supply chains sustainable (Grebner, 2020; Ruane, 2020; Thilmany et al., 2021).

Navigating Processing Constraints Around the Country

As a result of COVID-19, there is renewed interest in promoting a more reliable meat production system that benefits processors and producers (Thilmany et al., 2021). Before COVID-19, a study by Gwin et al. (2013) utilized regional case studies across the United States, interviews with key informants, and cost analysis data to show existing models of processing and marketing that address the barriers to bringing more local meats to market. The top issue addressed was the dichotomy of the producer and processor complaint of: “there are not enough processing facilities” and “there aren’t enough farmers bringing me enough livestock” (Gwin et al., 2013). In other words, there was a disconnect between a producer’s ability to access processing services and the processor’s ability to maintain adequate volume year-round, which is critical to maintaining a processing business. One theme that kept emerging in the study conducted by Gwin et al. (2013) was the idea of producers working more collaboratively to address processing capacity constraints. The idea of collaboration among producers was also present in studies conducted by Quanbeck (2015), Scott (2017), Jumars (2018), and Park et al.

(2019). These studies found that collaboration among producers had the ability to improve processing constraints in the following ways:

1) Gwin et al. (2013) and Scott (2017) found that when producers aggregated their product supply, it allowed for better coordination with processors by creating more consistent volume to the facility year-round. In turn, working collaboratively helped increase access to processing services for producers
2) Consistent supply and volume year-round are critical to processing facilities since they rely on a limited labor force with specialized skills. Gwin et al. (2013) found that processors with anchor customers could maintain consistent supply. Anchor customers were those who provided enough supply to keep the business going year-round; these were typically larger producers. In addition, processors and producers who worked with aggregators (sourcing livestock from multiple farmers and coordinating the rest of the supply chain) were found to be valuable partners.
3) In working collaboratively, smaller producers who could not provide consistent supply to processors have benefitted from economies of scale (Park et al., 2019). Producers who participated in cooperative business models were able to have more collective influence with processors since they could provide a more consistent supply. As a result, this improved their ability to access processing services. However, a unified vision among producers and an explicit agreement on the cooperative's operations were critical to maintaining longevity of the cooperative (Jumars, 2018).
4) Processors used tools to ensure producer commitment, such as active scheduling systems, variable pricing, and financial penalties to keep supply consistent year-round. In the case of cooperative processing, some cooperatives offered a 10% discount to members if they

processed during the time of year processors were less busy (Quanbeck, 2015). In several case studies, farmers also invested time and money into their processing facilities, which deepened the commitment between the two entities (Gwin et al., 2013). This commitment and personal stake among producers were important components of the success of cooperative business models (Jumars, 2018).

By working cooperatively, these models addressed the constraints of cold storage capacity, funding for expansion, and seasonality of beef production, which were the top constraints for processors (Waro, 2019). The scenarios described were compelling examples demonstrating how to improve processing facilities' throughput. Whether these models could work for northern New England's beef producers was challenging to determine but worth exploring.

Cooperative marketing or aggregation was also described as a way to help better meet consumer demands, in addition to helping improve access to processing services (Gwin et al., 2013). A report released by Vermont Public Radio in 2017 showed success with this model in northern New England. The report assumed there was no shortage of high-quality beef in the region, but farmers were not working together to produce at a larger scale to tap into the market potential (Weiss-Tisman, 2017). This report discussed one farm's success in joining Adirondack Grazers, a meat cooperative. The meat cooperative aggregated products from small and mid-sized beef producers in Vermont, New Hampshire, New York, and Pennsylvania (Weiss-Tisman, 2017). Meat cooperatives were a new concept and proved to be a successful model for this farm. The farm was able to increase production, spend less time marketing, and spend more time raising a quality beef product. With increased collaboration among beef producers and processing facilities, there was the potential to provide more meat to the local market (Weiss-Tisman, 2017).

Potential Solutions for Northern New England

There is not a simple, single solution to alleviate the constraints faced by beef producers and processing facilities. COVID-19 compounded pre-existing processing constraints, and small processing facilities could no longer meet the needs for slaughter and processing (Baker et al., 2021). Baker et al. (2021) addressed this issue in New York and found that financial, labor, and space remained the top processing capacity barriers. The most significant constraints to expanding beef production in New Hampshire, Maine, and Vermont were the inefficiencies processing facilities experienced due to the seasonality of production, lack of qualified labor, limited processing capacity and cold storage, and lack of funding to support expansion. In addition, it was difficult for beef producers to justify business expansion without the guarantee of processing dates even though consumer demand existed.

The literature reviewed demonstrates that researchers and stakeholders in the beef industry understand the constraints for processing facilities throughout the region. However, there has been little action to address these ongoing constraints in northern New England. In other parts of the country, cooperative business models improved processing bottlenecks by improving processing date availability for producers, strengthening producer-processor relationships, and increasing processing facility throughput (Gwin et al., 2013). In addition, cooperative models have shown financial promise for producers by providing better market access, more consistent market prices, and increased bargaining power (Ellsworth, 2015; Park et al., 2019). Cooperative models are utilized in numerous ways, but the common advantage is that collaborative efforts allow producers to benefit from economies of scale (Park et al., 2019). Therefore, cooperative processing and marketing provide opportunities for northern New England beef producers to

explore. If beef producers were willing to participate in cooperative processing, marketing, or some form of cooperative business model, it could alleviate some of the constraints they face with accessing processing facility services. Cooperative models could also allow northern New England beef producers to expand their markets to meet consumer demands while maintaining their bottom line.

CHAPTER III

METHODOLOGY

Phase One: Preliminary Survey

In March 2021, a small preliminary study was conducted to explore the major constraints to expanding beef production in New Hampshire, Maine, and Vermont since Covid-19. This study aimed to gather information on how Covid-19 impacted beef businesses, understand how beef producers are processing and marketing their products, learn about perceptions regarding the climate of northern New England's beef industry, and learn how producers define success and adapt to changes. Before conducting the interviews, the study was reviewed and approved by the University of New Hampshire Institutional Review Board (IRB protocol number 8461). The principal investigator spent one month conducting telephone interviews with participants. A total of 18 subjects were involved, and research was conducted in accordance with the procedures reviewed and approved by the IRB.

Of the 18 participants, there were 16 beef producers (six from New Hampshire, six from Vermont, and four from Maine) and 2 USDA processors (one from Maine and one from Vermont). Interviews were conducted over the phone in a non-public setting to allow for a private conversation and recorded using the "TapeAcall" smartphone application. Subjects were recruited using a combination of criterion sampling and purposeful sampling to capture data representing the three states. New Hampshire, Maine, and Vermont all have active beef producer associations, which provided the opportunity to identify and connect with participants. In addition, extension personnel and other service providers in the three states identified other

individuals who are not involved with these organizations. Participants were not compensated for their time.

The informed consent protocol included a recruitment email, follow-up email communication to schedule a phone interview, an introductory script to describe the project, an informed consent statement, and a list of semi-structured guiding questions. Consent was obtained orally in the interviews with the following protocol: 1) The interviewer read the Informed Consent statement to the participant. 2) Then, the interviewer asked if the participant had any questions and if the participant consented. 3) The interviewee was given a copy of the consent statement. Next, the research subject was asked to participate in a 1.5-hour phone interview about their beef business and the beef industry in northern New England. Data were transcribed, reviewed, aggregated, and any identifying information was removed. The results from this preliminary study were used to identify key challenges, opportunities, and perceptions of the beef industry and served as the baseline data to inform the focus of Phase Two of this study.

Phase Two: Survey

Sample Selection

Non-probability sampling methodology was used that involved a combination of purposive and snowball sampling. The target population was commercial beef producers in New Hampshire, Maine, and Vermont who sell USDA inspected, state inspected, or custom processed meat directly to consumers. This sampling strategy helped reach hidden populations since a complete list of beef producers does not exist in New Hampshire, Maine, or Vermont (Wurtz, 2010). This approach was similar to what Gunn and Loy (2015), Jones (2020), and Becot et al. (2021) did in their studies when looking to easily target a wide range of producers without access

to a complete list. The sample was reached online through producer organizations, social media, Cooperative Extension mailing lists, regional food guide listings, educational events or conferences, and agriculture businesses serving the target population. The target response was 300, which is 10% of the projected population of beef producers in NH, ME, and VT, according to 2017 USDA NASS (National Agricultural Statistics Service) data, recognizing the numbers reported could be over or under-reported and not all populations counted met the specifications for this study. Prior to launching the survey, the study was reviewed and approved by the University of New Hampshire Institutional Review Board (IRB protocol number IRB-FY2022-186) (Appendix A).

Survey Instrument and Design

The survey was administered at one point in time using closed-ended questions (Deutskens et al., 2004). The presence of complex questions created lower response rates in a study by Avemegah et al., 2021. They found survey questions that did not require record searching helped improve response rates. A 33-question survey was developed using Qualtrics (Qualtrics, Provo, Utah). Questions were broken into four categories: producer demographics, processing experiences, cooperative marketing, cooperative processing, and assistance needed. The questions were a combination of multiple choice, Likert scale, and ranked values. Survey questions and corresponding numerical codes can be found in Appendix B. In addition, survey respondents were allowed to contact the researcher if they wanted to discuss responses in detail. Researchers maintained anonymity throughout the survey by using an anonymous link and not asking for any personal information. If participants volunteered to be interviewed in the survey, names and identifying information were kept confidential. Survey questions were reviewed by

the research committee, the University of New Hampshire Survey Center, and three producers from the target population tested the survey to ensure the questions were clear and concise.

Recruitment materials were designed for distribution through beef producer association networks, cooperative extension services, beef producer stakeholders in each target state, workshops or conferences, businesses supporting beef producers, and processor networks utilizing social media and email. Producer contacts were recruited through public listservs and food guides in each state to reach as many individual producers as possible. These producers were more likely to sell direct to consumers and be USDA certified, or state inspected if they were online advertising products. However, there was still potential for bias and missed audiences, especially if they were not active online. In February, a second push was sent to individuals to participate in the survey.

The survey data collection period was from January 3, 2022, to March 15, 2022. The initial launch was completed through social media, and after three weeks, posts were shared a second time. Sending reminders and contacting participants multiple times from multiple avenues proved to increase response rates (Avemegah et al., 2021). After a social media push, the survey was shared with producer organizations and agriculture service provider networks via email. A script was shared with organization contacts, who then shared it within their networks. Table 1 shows each avenue where the survey was shared. March 1 was the final call to participate in the survey, and the script was sent to each organization and producer contact list a final time.

Table 1. Survey Recruitment and Distribution List

Social Media	**Producer Organizations/ Networks**	**Agriculture Service Providers**	**Individual Producer Contacts**
Personal Facebook account	Windham Butcher	University of Maine Cooperative Extension	88 individuals, UNH Extension dairy producer contact list
"Everything Cattle Maine" Facebook Group	Northeast Kingdom Processing	University of New Hampshire Cooperative Extension	72 individuals sourced from local food maps, Northeast Beef Promotion Initiative, NH Department of Agriculture beef directory, Seacoast Processing directory

"New Hampshire Beef Producers" Facebook Group	New Hampshire Beef Producers Association	University of Vermont Cooperative Extension	158 individuals in VT sourced from Northeast Beef Promotion Initiative, Vermont Farm to Plate directory
"VT Grass Farmers" Facebook Group	Vermont Beef Producers Association	Vital Communities	43 individuals in ME sourced from Northeast Beef Promotion Initiative, Maine Beef Producers Association directory, Seacoast Processing directory
Press release in "Morning Ag Clips"	Maine Beef Producers Association	NH Department of Agriculture, Markets, and Food	
	Vermont Grass Farmers Association	Vermont Agency of Agriculture Food and Markets	
	Shared during Vermont Grazing Conference	Maine Department of Agriculture, Conservation and Forestry	
		Blue Seal Representatives and Stores (NH, ME, and VT)	
		NH, ME, and VT Farm Bureau Organizations	
		New Hampshire, Maine, and Vermont Organic Farming Associations	
		NH, ME, and VT Veterinarian Networks	

Phase Three: Follow-Up Interviews

Survey participants were asked to provide contact information for voluntary follow-up interviews about the information presented in the questionnaire. Participants who volunteered to participate in follow-up interviews were selected based on their survey responses in order to ensure representation of a variety of types and demographic characteristics of beef producers. The researchers did not draw significant conclusions from any interview responses provided as the answers collected likely had more bias or extreme views. However, as with Gunn and Loy (2015), this approach provided more context and added depth to the survey findings. Interviews with nine voluntary participants were conducted over the telephone. This was separate from the anonymous survey. The interviews were semi-structured with 4 open-ended questions (Appendix

C). Interviews were recorded utilizing the TapeAcall (Teltech Systems, Inc.) phone application. Participants' names and identifying information were kept confidential.

Out of 161 respondents to the Qualtrics Survey, 81 said they would be willing to talk further in a follow-up interview. An equal number of interviewees were strategically selected based on their answers to the following questions: “How willing are you to experiment with cooperative processing?” and “How willing are you to experiment with cooperative marketing?” to decrease bias towards those who answered one way or another. The research team aimed to interview ten respondents from each state for a total of 30 possible interviews so that each state had equal representation. An email was sent to the 30 participants to request a time and date to be interviewed. While the target response was 30 total, only nine participants (5 from New Hampshire, two from Maine, and two from Vermont) elected to be interviewed within the given timeframe. Once interviews were completed, the recordings were transcribed and summarized in Microsoft Excel. The goal of the interviews was to add greater depth and context to the quantitative survey results.

Statistical Analysis

Survey data were coded in SPSS and saved to Microsoft Excel, and then transferred to SAS (SAS Version 9.4, SAS Institute Inc., Cary, NC) for analysis. The dependent variables were “willingness to experiment with cooperative marketing” (CM) and “willingness to experiment with cooperative processing” (CP). The independent variables were the producer demographic and attitudes towards cooperative model questions. Cooperative business models were broken into two dependent variables, cooperative marketing, and cooperative processing, as there were enough differences between the two models that were worth exploring. Coded variables and their

descriptions can be found in Table 2. Pearson correlation coefficients for all variables were calculated to identify the strength of relationships between the willingness to experiment with cooperative models and beef producer demographics and attitudes towards cooperative models.

Data were then further analyzed using multiple regression with backwards elimination to assess whether a willingness to experiment with cooperative business models could be predicted by beef producer demographics and attitudes towards cooperative models. The backward elimination procedure was performed so that all effects of variables could be considered simultaneously. The variance inflation factor procedure (VIF) in SAS was used to determine relationships between the model parameters and detect any multicollinearity within the analysis. This procedure calculates a VIF for each variable, and for each iteration, the highest valued parameter is removed from the model until all values are ≤10 (Cabral et al., 2016). Variables that were least significant were removed from the model until all remaining variables in the model had individual *P*-values ≤0.1 (Cabral et al., 2016). The remaining variables in the model were potential predictors of the characteristics of beef producers who would be willing to experiment with cooperative processing or marketing business models.

Table 2 Description of variables and their corresponding codes used in data analysis.

Variable Code	Description of Variable
Producer Demographics	
State	State farm is located in
Role	Participant's role on the farm (owner or employee)
Gender	Participant gender
Head	Number of cattle a participant has on average
Years	Number of years raising cattle
Breed	Breed of cattle
Labor	Whether a farm has paid labor or not
Income	Gross annual income of beef business
Processing Experiences	
Markets	Are there marketing opportunities for your beef products you cannot currently access due to processing date availability?

NumProcessed	Average number of cattle processed each year
ProcessTrend	Did a participant increase, decrease, or stay the same with the number of cattle processed in the last two years
FacilityType	Type of facility used to process beef
Miles	Miles participants drive to processing facility one-way
PreferFall	Prefers processing beef in fall
PreferWinter	Prefers processing beef in winter
PreferSpring	Prefers processing beef in spring
PreferSummer	Prefers processing beef in summer
TypicalFall	Typically processes beef in fall
TypicalWinter	Typically processes beef in winter
TypicalSpring	Typically processes beef in spring
TypicalSummer	Typically processes beef in summer
Difficulty	Degree of difficulty experienced when booking processing dates
Likelihood	Likelihood of processing at different times of year
Cooperative Processing	
ParticipateCP	Have you participated in cooperative processing?
CP	Willingness to experiment with cooperative processing
Potential benefits of cooperative processing	
MSU	Access to mobile slaughter units
cpAccess	Access to facilities owned and run by beef producers
cpOwnership	Opportunity for ownership and decision-making power
cpGrowth	Potential to grow beef sector
cpbCollab	Collaborating with other beef producers
Potential challenges of cooperative processing	
cpCost	Cost of investment
cpTime	Time commitment
cpRegs	Regulations related to cooperative processing
cpDemand	Maintaining sufficient demand year-round
cpcCollab	Collaborating with other beef producers
Facility	Processing facility logistics
Cooperative Marketing	
ParticipateCM	Have you participated in cooperative marketing?
CM	Willingness to experiment with cooperative marketing
Potential benefits of cooperative marketing	
cmAccess	Access to additional markets
Trucking	Combined/ shared trucking to processor
Comarket	Co-marketing and distribution support
Efficient	Improved efficiencies
Consistdates	Coordination of more consistent scheduling to book processing dates

Potential challenges of cooperative marketing	
cmCost	Cost of investment
cmTime	Time commitment
Commit	Commitment of collaboration from other beef producers
Reliability	Reliability of product availability in off-season
Uniformity	Uniformity of product/ accommodating different standards of production
FarmID	Loss of traceability/ farm identity
Assistance Needed to Participate in Cooperative Business Models	
Financial	Financial assistance or access to funding
Info	
	More information on benefits and challenges of cooperative business models
Research	Research on economics of cooperative business models
Education	Educational training on how to implement cooperative business models
Infrastructure	Infrastructure to support models
Connections	Connections to other producers
Access	Finding and accessing new market channels

Qualitative Analysis

Follow-up interview data were transcribed verbatim and entered into Microsoft Excel to keep data organized and record notes during analysis (Knetsch and Mckee, 2015; LeCompte, 2000). After transcription of interviews, data were reviewed and analyzed using inductive coding following a combination of methodologies outlined by LeCompte (2000), Ryan and Bernard (2003), and O'keeffe et al. (2015). Since the dataset was small, data were organized by question to look across all respondents and their answers so that consistencies and differences could be identified (LeCompte, 2000). Emergent themes or codes were identified based on the repetition or frequency at which topics were mentioned within the dataset. Colored coding was used within the Excel document to help visualize commonalities throughout the dataset.

Once the themes were identified, the number of unique responses to each theme was counted to further establish relative importance (LeCompte, 2000; O'keeffe et al., 2015). Data were reviewed a third time to identify specific quotes that added detail to the themes and addressed the

specific aims of the research objectives. Finally, qualitative responses were cross-referenced with the quantitative survey results to determine similarities and differences between the interview results and statistical analysis results. These comparisons helped create a narrative to describe the challenges, opportunities, and information needed to experiment with cooperative models.

CHAPTER IV

RESULTS AND DISCUSSION

Beef Producer Demographics

The survey received 174 responses, 161 that were completed sufficiently to be used in the analysis. Basic demographic data and farm characteristic highlights are presented in Table 3. In the targeted states, beef producers in New Hampshire had the highest response rate in the survey at 51% (n=82), Maine at 32% (n=51), and Vermont with the lowest at 17% (n=28). A total of 87 beef producers who took the survey identified as male (54%), 67 identified as female (42%), and 7 preferred not to say (4%).

Average herd size ranged from 1-10 head of cattle to as many as 100+ head. The majority of participants responded as having 1-10 head (26%), 21-40 head (25%), and 11-20 head (17%). The remaining 30% of respondents reported having 41-100 head of cattle with 2% (n=3) responding that they did not raise cattle. The 2%, a total of 3 responses, that selected "I do not raise cattle" were automatically sent to the end of the survey as the following questions would not apply to them. The number of years participants have been raising beef was an average of 6-10 years, but fairly evenly distributed from 1-5 years up to 30+ years, as seen in Table 3. Only a total of 4 respondents had been raising beef for less than one year, for a total of 3% (n=4) of the participant population. A total of 109, or 72%, of participants said they did not have paid labor, and a majority of the participants' gross annual income ranges between less than $10,000 and $40,000-$69,999 categories. Only 18% (n=25) of participants are grossing over $70,000 a year from their beef operations.

Table 3. Survey demographic data; producer characteristics (n=161).

Farm Location	N	%	Gender	N	%	Average Herd Size	N	%	Number of Years in Beef Production	N	%	Paid Labor	N	%	Gross Annual Income	N	%
New Hampshire	82	51	Female	67	42	1-10	41	26	Less than 1 year	4	3	Yes	43	0.28	Less than $10,000	51	36
Vermont	28	17	Male	87	54	11-20	28	17	1-5	36	24	No	109	0.72	$10,000 - $39,999	44	31
Maine	51	32	Prefer not to say	7	4	21-40	41	25	6-10	30	20				$40,000 - $69,999	21	15
						41-60	17	11	11-20	31	20				$70,000 - $99,999	10	7
						61-80	8	5	21-30	22	14				$100,000 - $149,999	7	5
						80-100	7	4	30+	29	19				More than $150,000	8	6
						100+	16	10									
						I do not raise cattle	3	2									

Table 4 highlights participant responses related to their experiences with processing. The average number of cattle participants would take to be processed each year, with 70% (n=107) of participants bringing 1-15 head a year. In addition, Table 4 shows the distribution of the type of facility participants used to process their beef in the last year. A majority used USDA inspected facilities, a total of 61% (n=88). Vermont and Maine have state inspected facilities, which made up for 9% (n=13) of responses.

Finally, when participants were asked to rate the degree of difficulty they experienced when booking processing dates, 79% (n=115) reported having an extremely difficult or somewhat difficult time booking dates, while 21% (n=30) reported having an extremely easy or somewhat easy time booking dates. Eighty-three percent (n=121) of participants are traveling an average of 1-60 miles one-way to truck their cattle to a processing facility, while only 17% (n=24) travel over 61 miles. When producers were asked whether the number of cattle they have processed has

increased, decreased or stayed the same in the last two years, 61% increased (n=90), 12% decreased (n=18), and 27% stayed the same (n=40).

Table 4 Survey processing data; producer experience with processing (n=161).

Average Number of Cattle Processed per Year	N	%	Type of Facility Used	N	%	Ease of Booking Processing Dates	N	%	Miles to Processor (One-Way)	N	%	Processing Trends	N	%
1-15	107	70	USDA Inspected Facility	88	61	Extremely Easy	10	7	1-20	34	23	Increased	90	61
16-30	22	14	State Inspected Facility	13	9	Somewhat easy	20	14	21-40	47	32	Decreased	18	12
31-60	13	9	Custom-cut Facility	16	11	Somewhat difficult	71	49	41-60	40	28	Stayed the same	40	27
61-100	3	2	Combination of USDA, State, and/or Custom	28	19	Extremely difficult	44	30	61-80	12	8			
100+	3	2							81-100	8	6			
I have not processed	4	3							100+	4	3			

Survey results for willingness to experiment in cooperative marketing and processing are presented in Figure 1 and Figure 2. Participants rated their willingness to experiment in cooperative business models on a scale of 1 = extremely unwilling, 2 = somewhat unwilling, 3 = somewhat willing, 4 = extremely willing. Results indicate that 70% (extremely willing and somewhat willing) of participants expressed a willingness to experiment with cooperative marketing and 80% (extremely willing and somewhat willing) expressed a willingness to experiment with cooperative processing.

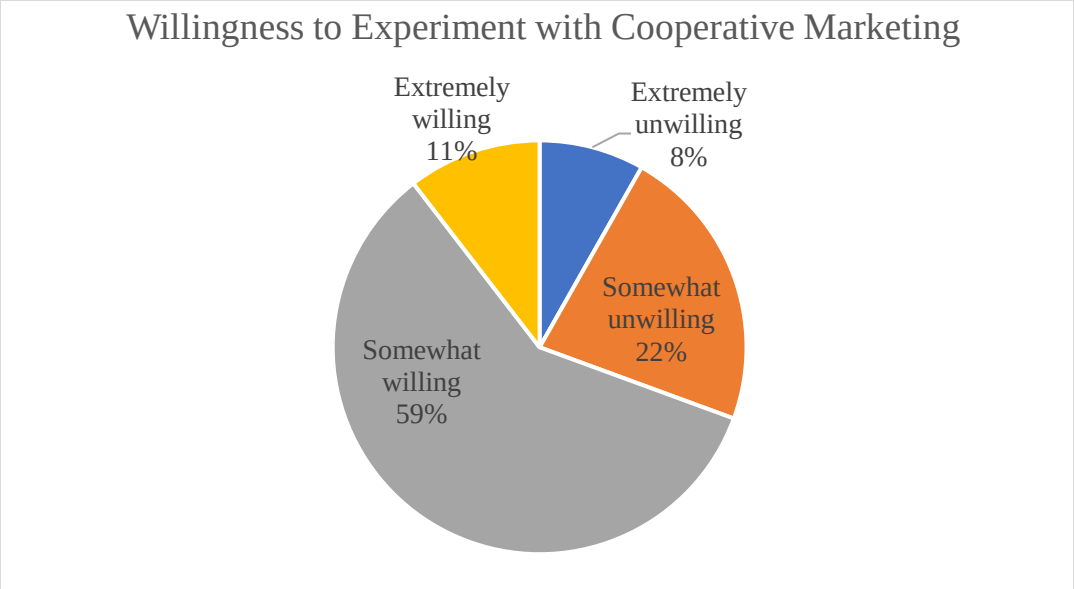

Figure 1. Percentage of beef producers that expressed a willingness or unwillingness to participate in cooperative marketing (n=161). Question asked, "How willing are you to experiment with cooperative marketing?" 1=extremely unwilling, 2=somewhat unwilling, 3=somewhat willing, 4=extremely willing.

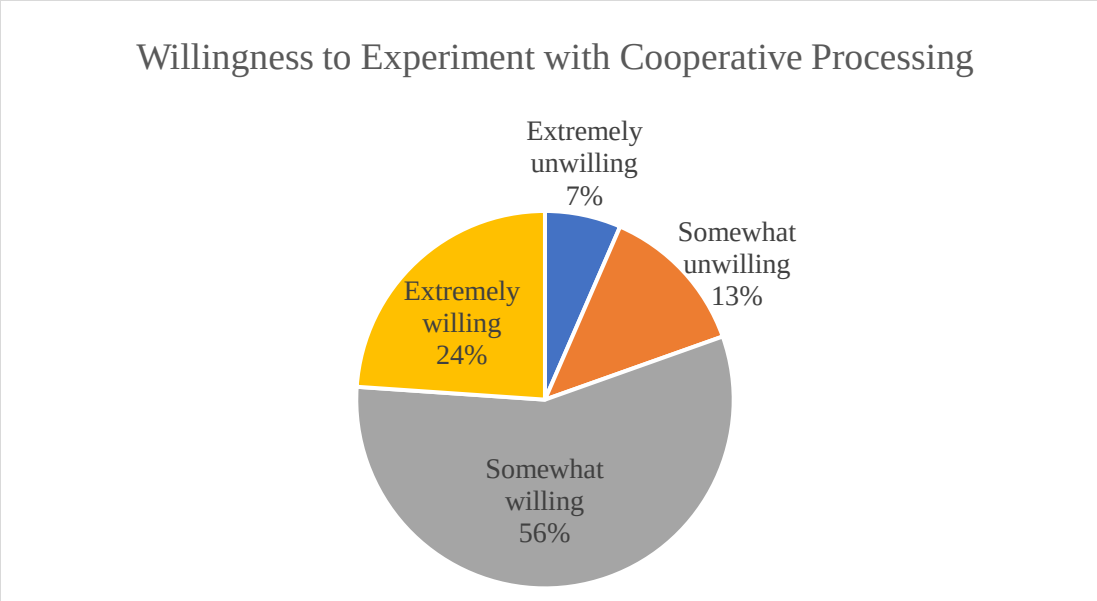

Figure 2. Percentage of beef producers that expressed a willingness or unwillingness to participate in cooperative processing (n=161). Question asked, "How willing are you to experiment with cooperative processing?" 1=extremely unwilling, 2=somewhat unwilling, 3=somewhat willing, 4=extremely willing.

Pearson Correlations

Pearson's correlation coefficients are presented in Table 5 for cooperative marketing and Table 6 for cooperative processing. Variables were considered significant if *P*-value ≤ 0.05.

Cooperative marketing was positively correlated with producer role on farm (Role), willingness to experiment with cooperative processing (CP), access to additional markets (cmAccess), co-marketing and distribution support (Comarket), improved efficiencies (Efficient), and coordination of more consistent scheduling to book processing dates (Consistdates). The highest correlation was 0.33 (CP) and lowest was 0.18 (Role). Cooperative marketing was negatively correlated with gross annual income of beef business (Income), previous experience with cooperative marketing (ParticipateCM), cost of investment for cooperative marketing (cmCost), time commitment of cooperative marketing (cmTime), and commitment of collaboration from other beef producers (Commit). The correlation coefficients ranged from -0.18 (Income) to -0.31 (ParticipateCM) (Table 5).

Table 5 Pearson Correlation Coefficients related to Cooperative Marketing.

Cooperative Marketing		
Variable	**r**	***P*-value**
State	0.10	0.23
Role	0.18	0.04
Gender	0.10	0.27
Head	0.02	0.85
Years	-0.10	0.26
Breed	-0.04	0.62
Labor	-0.12	0.16
Income	-0.18	0.05
Markets	0.07	0.43
NumProcessed	-0.03	0.73
ProcessTrend	0.06	0.52
FacilityType	-0.15	0.08
Miles	0.04	0.66
PreferFall	-0.01	0.91
PreferWinter	0.03	0.76
PreferSpring	-0.02	0.85
PreferSummer	-0.06	0.49
TypicalFall	0.01	0.95
TypicalWinter	0.04	0.65
TypicalSpring	-0.01	0.89

TypicalSummer	0.01	0.90
Difficulty	-0.13	0.13
Likelihood	-0.03	0.71
ParticipateCP	-0.13	0.14
CP	0.33	0.0001
MSU	0.12	0.22
cpAccess	0.00	0.97
cpOwnership	0.02	0.81
cpGrowth	0.12	0.22
cpbCollab	0.30	0.001
cpCost	-0.16	0.07
cpTime	-0.13	0.17
cpRegs	-0.24	0.01
cpDemand	-0.17	0.07
cpcCollab	-0.14	0.18
Facility	-0.22	0.02
ParticipateCM	-0.31	0.0003
CM	1.00	
cmAccess	0.23	0.01
Trucking	0.08	0.39
Comarket	0.23	0.02
Efficient	0.22	0.02
Consistdates	0.28	0.002
cmCost	-0.19	0.04
cmTime	-0.19	0.03
Commit	-0.23	0.02
Reliability	-0.03	0.76
Uniformity	-0.10	0.26
FarmID	-0.11	0.24
Financial	-0.18	0.05
Info	-0.02	0.84
Research	0.03	0.78
Education	0.18	0.06
Infrastructure	-0.02	0.83
Connections	0.06	0.54
Access	0.04	0.66

Cooperative processing was positively correlated with miles participants drove to a processing facility one-way (Miles), access to mobile slaughter units (MSU), access to facilities owned and run by beef producers (cpAccess), opportunity for ownership and decision-making

power (cpOwnership), collaborating with other beef producers (cpbCollab), and willingness to experiment with cooperative marketing (CM). The highest correlation of 0.44 was associated with access to mobile slaughter units (MSU) and lowest correlated was 0.19 related to miles to processing facility (Miles). Cooperative processing was negatively correlated with state farm was located in (State), number of years raising cattle (Years), degree of difficulty experienced when booking processing dates (Difficulty), cost of investment for cooperative processing (cpCost), maintaining sufficient demand year-round (cpDemand), and the challenge associated with collaborating with other beef producers (cpcCollab). The correlation coefficients ranged from -0.17 (State) to -0.31 (Years and Difficulty) (Table 6).

Table 6 Person Correlation Coefficients related to Cooperative Processing.

Cooperative Processing		
Variable	**r**	***P*-value**
State	-0.17	0.05
Role	0.14	0.10
Gender	0.09	0.30
Head	-0.13	0.13
Years	-0.31	0.0002
Breed	0.02	0.84
Labor	0.02	0.79
Income	-0.11	0.22
Markets	-0.12	0.17
NumProcessed	-0.13	0.12
ProcessTrend	-0.14	0.11
FacilityType	0.04	0.62
Miles	0.19	0.03
PreferFall	0.03	0.69
PreferWinter	0.06	0.51
PreferSpring	-0.02	0.79
PreferSummer	-0.03	0.74
TypicalFall	0.05	0.61
TypicalWinter	0.08	0.35
TypicalSpring	0.08	0.36
TypicalSummer	0.07	0.44

Difficulty	-0.31	0.0002
Likelihood	0.06	0.52
ParticipateCP	-0.08	0.35
CP	1.00	
MSU	0.44	<.0001
cpAccess	0.36	<.0001
cpOwnership	0.20	0.03
cpGrowth	0.08	0.37
cpbCollab	0.31	0.001
cpCost	-0.19	0.03
cpTime	-0.09	0.31
cpRegs	-0.14	0.13
cpDemand	-0.26	0.005
cpcCollab	-0.22	0.03
Facility	-0.15	0.10
ParticipateCM	-0.07	0.42
CM	0.33	0.0001
cmAccess	0.03	0.74
Trucking	0.29	0.003
Comarket	0.10	0.32
Efficient	0.08	0.40
Consistdates	0.23	0.01
cmCost	-0.24	0.01
cmTime	-0.20	0.03
Commit	-0.21	0.03
Reliability	-0.11	0.25
Uniformity	-0.24	0.01
FarmID	0.03	0.74
Financial	-0.11	0.26
Info	-0.09	0.34
Research	-0.07	0.43
Education	-0.07	0.47
Infrastructure	0.09	0.36
Connections	0.13	0.18
Access	-0.15	0.13

Survey: Cooperative Marketing (Model 1)

Two regression models were created to predict the willingness of beef producers to participate in cooperative marketing (Model 1) and cooperative processing (Model 2). The variables in the

model were significant at the 0.1 level and are expressed as an equation. These variables are described in Appendix D. Validation of the regression model used 9 participants who did not participate in the survey or follow-up interviews. Based on their answers to the variables in the equations, the corresponding numerical codes were entered into the equation. The equation calculated a number one through four (1 = extremely unwilling, 4 = extremely willing), which determines how willing a producer was to experiment with cooperative business models.

In Model 1, of the 35 variables in the backwards elimination regression, 13 variables were retained in the final model. The model developed delineates the typical beef producer who participated in the study and what factors theoretically influenced their willingness to experiment with cooperative marketing. The significant variables that could influence a beef producer's willingness to experiment with cooperating marketing are as follows: participant gender (Gender), whether a farm has paid labor or not (Labor), gross annual income of beef business (Income), miles participants drive to processing facility one-way (Miles), preference to processing beef in winter (PreferWinter), preference to processing beef in summer (PreferSummer), willingness to experiment with cooperative processing (CP), opportunity to access to facilities owned and run by beef producers (cpAccess), benefit of collaborating with other beef producers (cpbCollab), cost of investment for cooperative processing (cpCost), regulations of cooperative processing (cpRegs), maintaining sufficient demand year-round (cpDemand), and opportunity access to additional markets (cm Access).

The model developed is expressed as an equation that theoretically predicts beef producers who are willing or not willing to experiment with cooperative marketing (CM).

$$CM = 5.49204 + 0.36594 \times Gender - 1.25492 \times Labor - 0.26093 \times Income - 0.15527$$
$$\times Miles - 0.18090 \times PreferWinter - 0.24153 \times PreferSummer + 0.22906 \times CP - 0.37479$$

$$\times cpAccess + 0.26292 \times cpbCollab + 0.31960 \times cpCost - 0.61641 \times cpRegs - 0.18110 \times cpDemand + 0.28796 \times cmAccess>;\ r^2 = 0.7148.$$

To demonstrate the use of the equation in predicting the type of beef producer that would be willing or not willing to participate in cooperative marketing, here is a producer profile and the corresponding numerical code associated with their answers:

Producer "A":

- Female beef producer (2)
- Does not have paid labor (2)
- Her gross annual income for the beef business is >$10,000 (1)
- She drives on average 1-20 miles to her processing facility one-way (1)
- On a scale of 1-4, she somewhat prefers winter processing (2)
- On a scale of 1-4, she somewhat prefers summer processing (3)
- She is extremely willing to experiment with cooperative processing (4)
- The potential opportunity to access facilities owned and run by beef producers is of high interest (4)
- The benefit of collaborating with other beef producers is of high interest (4)
- The cost of investment in cooperative processing is somewhat concerning (2)
- The regulations associated with cooperative processing are somewhat concerning (2)
- The ability to maintain sufficient demand year-round is somewhat concerning (2)
- The potential opportunity to access additional markets is of high interest (4)

When these answers are applied to the question in model 1, CM = 3, which means Producer A is a beef producer that is likely to be willing to participate in cooperative marketing.

$$5.49204 + 0.36594 \times Gender\ (2, female) - 1.25492 \times Labor(2, no\ labor) - 0.26093 \times Income(1, >\$10{,}000) - 0.15527 \times Miles(1, 1\text{-}20\ miles) - 0.18090 \times PreferWinter(2) - 0.24153 \times PreferSummer(3) + 0.22906 \times CP(4) - 0.37479 \times cpAccess(4) + 0.26292 \times cpbCollab(4) + 0.31960 \times cpCost(2) - 0.61641 \times cpRegs(2) - 0.18110 \times cpDemand(2) + 0.28796 \times cmAccess(4) = 3$$

Survey: Cooperative Processing (Model 2)

In Model 2, of the 35 variables in the backwards elimination regression, 9 variables were retained in the final model. The model developed delineates the typical beef producer who participated in the study and what factors theoretically influenced their willingness to experiment with cooperative processing. The significant variables that could influence a beef producer's willingness to experiment with cooperating processing are as follows: state farm is located in (State), number of cattle a participant has on average (Head), gross annual income of beef business (Income), whether a participant increased, decreased, or stayed the same with the number of cattle processed in the last two years (ProcessTrend), preference to processing beef in winter (PreferWinter), preference to processing beef in summer (PreferSummer), willingness to experiment with cooperative marketing (CM), opportunity to access to mobile slaughter units (MSU), and opportunity for combined/ shared trucking to processor (Trucking). The model developed is expressed as an equation that theoretically predicts beef producers who are willing or not willing to experiment with cooperative processing (CP).

$$CP = 1.65408 - 0.18399 \times State - 0.13575 \times Head + 0.16976 \times \text{Income} - 0.36791 \times ProcessTrend + 0.17472 \times PreferWinter + 0.11618 \times PreferSummer + 0.27859 \times CM + 0.19455 \times MSU + 0.16003 \times Trucking>;\ r^2 = 0.6830.$$

Similar to model 1, to demonstrate the use of the cooperative processing equation in predicting the type of beef producer that would be willing or not willing to participate in cooperative processing, here is another hypothetical producer profile:

Producer "B":

- Vermont beef producer (3)
- Raises on average 41-60 head (4)
- Gross annual income for the beef business is between $10,000 and $39,000 (2)
- In the last two years, they have decreased the number of cattle they have brought to be processed (2)
- On a scale of 1-4, they somewhat prefer winter processing (3)
- On a scale of 1-4, they highly prefer summer processing (4)
- They are somewhat unwilling to experiment with cooperative marketing (2)
- The potential to access mobile slaughter units is of high interest (4)
- The potential to combine or share trucking to a processor is of moderately high interest (3)

Once again, when these answers are applied to the question in model 2, CP = 3, which means Producer B is a beef producer that is likely to be willing to participate in cooperative processing.

$$1.65408 - 0.18399 \times State\ (3, Vermont) - 0.13575 \times Head(4, 41\text{-}60\ head) + 0.16976 \times Income(2, \$10k\text{-}\$39k) - 0.36791 \times ProcessTrend(2, decreased) + 0.17472 \times PreferWinter(3) + 0.11618 \times PreferSummer(4) + 0.27859 \times CM(2) + 0.19455 \times MSU(4) + 0.16003 \times Trucking(3) = 3$$

Value of potential benefits, challenges, and assistance needed

Survey participants were asked to assign a value (1 = low value, 4 = high value) to a list of benefits, challenges, and potential assistance needed related to cooperative marketing and processing models. Table 7 depicts the ranked benefits and concerns producers shared regarding cooperative marketing, ordered from the most important to least important. Based on total counts, coordination of more consistent scheduling to book processing dates was the top ranked benefit with 42% ranking it a 3 and 20% ranking it a 4. The lowest ranked benefit was the idea of co-marketing and distribution support with 10% ranking it a 1 and 40% ranking it a 2. The top ranked concern of cooperative marketing was time commitment to participate with 34% ranking it a 3 and 21% ranking it a 4. The lowest ranked concern was reliability of product availability in off-season with 8% ranking it a 1 and 44% ranking it a 2. When considering participating in cooperative marketing, beef producers placed a high value on the potential benefit of being able to coordinate more consistent scheduling to book processing services. However, the time commitment and potential cost of investment involved with cooperative marketing are the biggest concerns.

Table 7 Ranked benefits and concerns beef producers have related to cooperative marketing.

Rank Order of Importance	Benefit of Cooperative Marketing	Total Count
1	Coordination of more consistent scheduling to book processing dates	118
2	Improved efficiencies	117
3	Access to additional markets	114
4	Combined/ shared trucking to processor	108
5	Co-marketing and distribution support	102
	Concerns of Cooperative Marketing	
1	Time commitment	121
2	Cost of investment	120
3	Uniformity of product/ accommodating different standards of production	119
4	Loss of traceability/ farm identity	118
5	Commitment of collaboration from other beef producers	112
6	Reliability of product availability in off-season	106

The ranked benefits and concerns producers had regarding cooperative processing are depicted in Table 8, ordered from the most important to least important. Based on total responses, access to facilities owned and run by beef producers was the top ranked benefit with 40% ranking it a 3 and 24% ranking it a 4. The lowest ranked benefit was the opportunity for ownership and decision-making power with 16% ranking it a 1 and 41% ranking it a 2. The top ranked concern of cooperative processing was cost of investment with 39% ranking it a 3 and 26% ranking it a 4. The lowest ranked concern was collaborating with other beef producers with 13% ranking it a 1 and 57% ranking it a 2. While beef producers placed a high value in the potential of being able to access facilities owned and run by beef producers, once again the potential cost of investment and time commitment were the biggest concerns associated with cooperative processing. In addition, due to the lack of information producers have with cooperative processing, understanding the logistics of running a cooperative processing facility were also a top concern.

Table 8 Ranked benefits and concerns beef producers have related to cooperative processing.

Rank Order of Importance	Benefit of Cooperative Processing	Total Count
1	Access to facilities owned and run by beef producers	127
2	Collaborating with other beef producers	120
3	Potential to grow beef sector	119
4	Access to mobile slaughter units	117
5	Opportunity for ownership and decision-making power	110
	Concerns of Cooperative Processing	
1	Cost of investment	126
2	Facility logistics	123
3	Time commitment	121
4	Regulations	120
5	Maintaining sufficient demand year-round	116
6	Collaborating with other beef producers	97

The survey asked participants what type of assistance they would require in order to participate in cooperative business models. Seven options were provided for participants to

assign a value of importance, Table 9 depicts the type of assistance from most important to least important. Based on total count, research on the economics of cooperative business models was ranked the highest importance with a total of 48.31% ranking it a 3 and 23.73% ranking it a 4. Assistance with finding connections to other producers was ranked as the lowest importance with 3.64% ranking it a 1 and 30.91% ranking it a 4. Overall, participants require more information on how cooperative business models would work financially before moving forward with participation. Research on the economics of cooperative business models for beef producers in New Hampshire, Maine, and Vermont, along with financial assistance or access to funding were important considerations.

Table 9 Ranked order of importance of type of assistance required for beef producers to participate in cooperative business models.

Rank Order of Importance	Assistance Required to Participate in Cooperative Business Models	Total Count
1	Research on economics of cooperative business models	118
2	Financial assistance or access to funding	116
3	More information on benefits and challenges of cooperative business models	115
4	Educational training on how to implement cooperative business models	115
5	Infrastructure to support models	115
6	Finding and accessing new market channels	112
7	Connections to other producers	110

Follow-Up Interviews

The study aimed to conduct 30 follow-up interviews after the survey but only received nine responses within the allotted timeframe. Figure 3, Figure 4, and Figure 5 show themes that were the most common responses that arose from the four questions asked during interviews, which were as follows: 1) What challenges would you be concerned about with cooperative production models? 2) What opportunities do you see with cooperative production models? 3) What do you

think would make it possible for cooperative models to work in New England for beef producers like yourself? 4) Do you have any other comments or insights to add?

Figure 3 addresses those characteristics participants expressed as perceived challenges of cooperative business models. The biggest challenge was the concern surrounding adequate follow-through and finding the right collaboration amongst producers to get a cooperative model started. This was related to the challenge of creating a sustainable model that would have longevity. Time and financial commitment were factors participants saw as a challenge that would keep them from participating in cooperative models. Whatever model existed it would have to have a positive return on investment for them to be interested. Loss of farm identity was somewhat of a concern for some of the participants. With the effort beef producers put into building their businesses they would want to ensure their products were adequately recognized. Uniformity and quality of product was also a perceived challenge. Having various production models in place across the states led some participants to believe this would be difficult to overcome. **Error! Reference source not found.**

Figure 3 Follow-up interview themes related to the perceived challenges producers felt were associated with cooperative business models (n=9).

Figure 4 addresses what participants expressed as perceived opportunities of cooperative business models. Participants felt that the greatest opportunity with cooperative business models was the ability to scale up their beef businesses and tap into new markets. Two participants mentioned improved communication among producers. This was specific to cooperative processing, with the belief that it would allow easier navigation in regard to process date booking. **Error! Reference source not found.** Participants mentioned the opportunity for i ncreased government support and transportation. The participant who mentioned transportation had been active in a cooperative and felt it was an excellent opportunity for saving money and streamlining the processing experience.

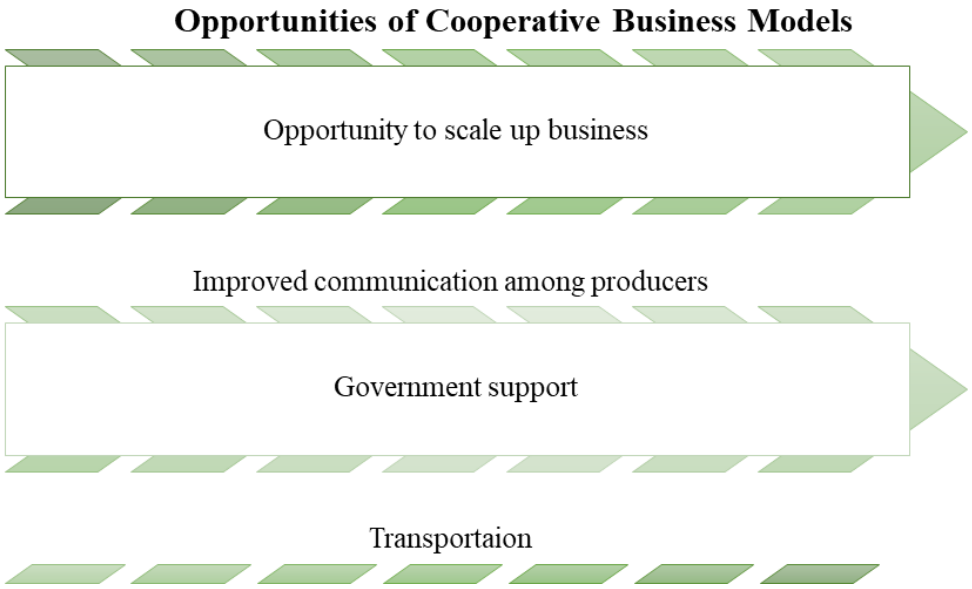

Figure 4 Follow-up interview themes related to the perceived opportunities producers felt were associated with cooperative business models (n=9).

Figure 5 depicts the factors that participants felt would make it feasible to have cooperative processing models work for them and northern New England. Participants said a financial return on investment was the most important factor in allowing them to participate. This was mentioned in regard to a return on investment and a financial investment to get a successful model in place.

Organization commitment and collaboration/ transparency in the organization were both mentioned as necessary to making cooperative models work. The follow-up interviews demonstrated the value participants placed on equality and ensuring a variety of perspectives during the set-up process. Quality and standardization of the products and processes were also mentioned as necessary to make participation possible for northern New England beef producers.

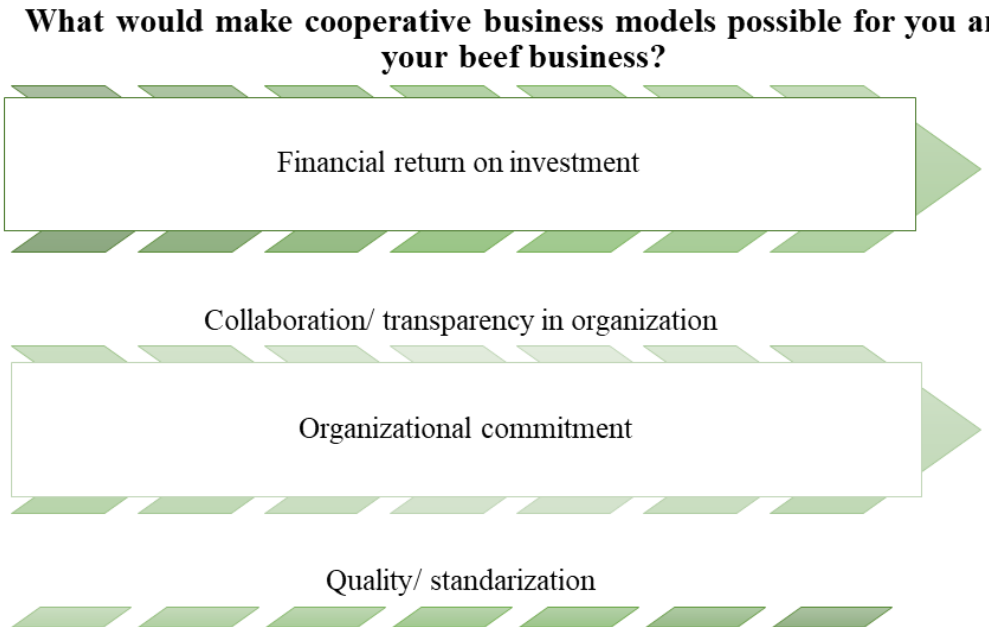

Figure 5 Follow-up interview themes that would make it possible for beef producers to participate in cooperative business models (n=9).

Relationships Between Cooperative Business Models and Demographics

The Pearson correlation coefficients showed there were several significant correlations between cooperative business models and demographic variables, however, all were fairly weak with correlations of $r < 0.7$. Willingness to participate in cooperative processing was positively correlated (0.33) and highly significant (*P*-value=0.0001) with a willingness to participate in cooperative marketing. This relationship was repeated in regression model 1, which had a strong correlation between variables (model 1, $r^2 = 0.7148$). Beef producers who were willing to

experiment in one type of cooperative business model, such as cooperative processing, would likely also be willing to participate in cooperative marketing.

Interestingly, there was a negative correlation between those that have or have not participated in cooperative marketing and a willingness to experiment with cooperative marketing (-0.31). The negative correlation signified that beef producers who had not participated in cooperative marketing were less willing to experiment with this type of production model. This could be attributed to the challenge addressed in follow-up interviews related to uniformity of products and potential loss of brand identity in cooperative marketing. For example, one producer said, “Being able to put a specific farm name on your meat is important, it’s how we are able to charge what we do” (personal interview, 25 March 2022). Another possibility was that beef producers might not associate cooperative marketing with improved processing capacity, which shows less interest in cooperative marketing specifically and more interest in cooperative processing.

Gross annual income (Income) had one of the weaker negative correlations (-0.18) related to cooperative marketing but was identified as a strong predictor in the cooperative marketing regression model (model 1). The higher gross annual income of a beef producer negatively influenced their willingness to participate in cooperative marketing. The more money a beef producer made, the more likely they were to have an established customer base, leading to more consistent market access and a stronger brand identity. With a strong business in place, these producers would not necessarily benefit from cooperative business models compared to a producer who makes less income annually, especially in a cooperative marketing model.

Examining cooperative processing correlation coefficients, the number of years in beef production (Years) had one of the stronger negative correlations with the willingness to

participate in cooperative processing (-0.31). This variable did not show up in the cooperative processing regression model, however years in beef production could be related to a producer's herd size which did show up as a predictor in regression model 2. The longer a beef producer was in operation and the higher their herd size, the less likely they were to want to experiment with cooperative processing. Years in beef production and herd size could also be related to income as seen in the cooperative marketing correlations and regression model. These are all characteristics that denote the scale of a beef producer's operation.

While years in production did not necessarily correlate with a greater herd size, the longer a beef producer had been in business the more likely they were to have an established commitment with a processor, allowing them to book processing dates more easily. Conversely, they could have been looking to downsize and not participate in new business models. Similarly, producers with a greater herd size were more likely to be established anchor customers for processors and could provide consistent volume and throughput. This was a desirable relationship for a processor and a key component to making the producer-processor relationship successful, as Gwin (2013) showed in their study.

A processor was more likely to prioritize booking dates with an established producer. As such, this producer would not place a high value on experimenting with cooperative processing since they may not have experienced the same challenges with booking dates as a smaller, unestablished beef producer. This thinking was also supported by another quote from a producer in follow-up interviews, "Small producers could have more opportunity to scale up if they can work collaboratively with others that can't necessarily raise enough" (personal interview, 25 March 2022). Of those interviewed, the smaller, part-time producers with fewer years in production showed much more interest in the idea of cooperative business models. Degree of

difficulty booking processing dates (Difficulty) was also negatively correlated with willingness to participate in cooperative processing (-0.31), signifying those producers who are struggling with booking processing dates, which had a higher coded value, are more likely to want to participate in cooperative processing.

Interest in mobile slaughter units (MSU) had the strongest, positive correlation related to cooperative processing (0.44). This relationship was supported in regression model 2 related to cooperative processing, which had a strong overall correlation (model 2, $r^2 = 0.6830$). Producers who ranked MSUs high as a potential benefit of cooperative processing were more likely to want to participate in cooperative processing. This could be attributed to beef producers desiring increased access to processing facilities. The idea of mobile slaughter units has shown high interest due to the convenience of a processor going to the producer. They may have been more financially feasible to start up than a brick-and-mortar facility which would theoretically give a quicker turnaround for producers to gain access to processing (Gwin et al., 2013; Johnson et al., 2014).

Predicting Beef Producer Participation in Cooperative Models

The predictor models for cooperative marketing (model 1) and cooperative processing (model 2) indicated where it was possible to identify those characteristics of beef producers who were interested in cooperative models with more confidence. Both of these models had extremely high r^2 values, model 1 = 0.7148 and model 2 = 0.6830. In model 1, gender positively influenced a beef producer's willingness to participate in cooperative marketing. While both men and women had a willingness to participate in cooperative marketing, the regression showed that women had a greater willingness than men. Labor was highly significant with a negative relationship to

cooperative marketing. Producers with no labor were less willing to experiment in cooperative marketing than those that did have labor. This could have been a result of concerns associated with time commitment in cooperative marketing. Time commitment was the top ranked concern of cooperative marketing in Table 7. If cooperative marketing required a greater time commitment, a producer without adequate labor was going to be less willing to participate in such a venture. Navigating this challenge would be a crucial element in order to gain participation for producers without labor.

A negative relationship existed between income and willingness to participate in cooperative marketing. As discussed previously, this was likely due to the fact that producers with a greater annual income had an established market and would not feel the need to participate in cooperative marketing. There was also a negative relationship between miles traveled to processor and willingness. Producers that were further away from processing facilities were less likely to experiment with cooperative marketing. This could be a result of the perception that cooperative marketing relies more heavily on a concentrated collaborative effort, which could result in a greater time commitment, as seen in a quote from one beef producer, “Initially when you have multiple different people trying to run and work through one facility, you’re going to have a lot of varying expectations of involvement” (personal interview, 29 March 2022). Producers in more remote areas that have to drive long distances to their processors were less willing to collaborate in this manner and perhaps less willing to collaborate in general.

The time of year beef producers prefer to process also predicted willingness to participate in cooperative marketing. A producer that preferred winter processing and summer processing was less likely to want to experiment with cooperative marketing. Conversely, those that processed in the spring and fall were more likely to want to experiment with processing. Waro (2019) stated

that most animals were finished and processed in the fall months, which correlated with when processing dates were the most difficult to book. A potential benefit of cooperative processing is increased access to facilities run and owned by other beef producers. Participants who desired this aspect of cooperative processing were less likely to be interested in cooperative marketing. On the other hand, participants who were excited about the opportunity to collaborate with other producers, which was a factor in cooperative processing, would also be more willing to participate in cooperative marketing. This was demonstrated in Table 7, where the top ranked benefit for cooperative marketing was the coordination of consistent scheduling to book dates, and Table 8, where one of the top ranked benefits for cooperative processing was collaborating with other beef producers. In addition, Table 9 showed that a top concern for producers related to cooperative processing was the cost of investment. The cooperative marketing regression models showed that the cost concern was a predictor that drives producers to be more willing to experiment with cooperative marketing.

There was a weak relationship between participants who were concerned about regulations and their willingness to participate in cooperative marketing, but it signified a slight influence. Producers that were concerned about maintaining sufficient demand year-round in cooperative processing models were also less willing to participate in cooperative marketing models. Finally, producers that were interested in increased access to additional markets were more willing to participate in cooperative marketing models.

In model 2, state of residence negatively influenced a producer's willingness to participate in cooperative processing. This is supported by the Pearson correlation in Table 6, although it is a fairly weak correlation of -0.17. Beef producers from Vermont were less likely to participate in cooperative processing when compared to Maine and New Hampshire, with New Hampshire

being the most willing to participate. While we cannot predict exactly how or why state was a factor that influenced willingness, data could have trended towards Vermont and Maine being less willing due to lower response rates from these states. This significance could also be a result of Vermont and Maine containing a greater number of processing facilities or due to having an established state inspection program. As discussed in the previous section, herd size negatively influenced a producer's willingness to participate in cooperative processing. The greater number of cattle a producer raised in a year, the less likely they were to want to experiment with cooperative processing.

In the previous section, it was discussed that a producer's gross annual income was negatively correlated to their willingness to participate in cooperative marketing, however, the opposite was true in regression model 2 related to cooperative processing. The more money a beef producer made, the more willing that producer was to experiment with cooperative processing. Greater income could drive a beef producer away from cooperative marketing due to the assumption that they likely had an established brand and marketing model. This same producer could be drawn to cooperative processing due to being more established and potentially able to take on more risk when it comes to investing in cooperative processing. Anecdotally, during follow-up interviews, the producers that noted themselves as being more established tended to speak more enthusiastically about the idea of cooperative processing versus cooperative marketing.

Whether the number of cattle a producer had processed in the last two years had increased, decreased, or stayed the same negatively affected their willingness to participate in cooperative processing. Model 2 predicted those producers who have not increased or decreased the number of cattle processed would be less likely to participate in cooperative processing. These producers were those who did not have issues with booking dates or were not looking to grow their beef

business at this point in time. Similar to model 1, except with a positive relationship, producers that preferred winter and summer processing were more likely to want to experiment with cooperative processing.

Constraints and Opportunity Assessment of Cooperative Models

Data from this study showed that participants were the most concerned with the cost of investment, time commitment, facility logistics regarding follow-through and collaborating with others, and uniformity of products. This was in agreement with what Jumars (2018) and Gwin et al. (2013) found in their studies. For cooperatives to succeed, significant involvement from and incentives for producers are required to keep everyone committed (Gwin et al., 2013; Jumars, 2018). In the follow-up interviews, one producer quoted, "No one ever follows through; my concern is getting something that lasts and has longevity. How do we inspire people to commit and stay active with this?" (Personal interview, 25 March 2022).

Jumars (2018) also found that setting agreed upon terms of business operations in cooperative models was critical. Clear outlines and understanding of expectations, financial returns, and financial commitment were identified in Jumars' (2018) research as major factors important to the success of cooperative models. In the current study, follow-up interview participants also placed a high value on clarity of expectations and financial returns in order to allow them to confidently participate in cooperative models, "… a really clear-cut set of guidelines or rules to set the standard for how things are. If people are going to buy into it there has to be a benefit, as a small farmer it would have to be easy" (personal interview, 6 April 2022). Another participant mentioned the importance of financial returns, "Making sure I get a fair marketing value for my

beef, that is always the biggest thing. Some people aren't always in it for the business aspects, so they don't understand or care about input costs" (personal interview, 29 March 2022).

While there are barriers to navigate in order to implement cooperative business models for beef producers, this study found participants were enthusiastic about the potential and opportunity to address challenges faced with processing. One participant quoted, "In general, anything we can do to expand our processing abilities up here is worth discussing" (personal interview, 10 April 20220). Data from Tables 7 and 8 illustrate that producers were most interested in the potential to coordinate a more consistent schedule to book processing dates, improve efficiencies, access additional markets and processing facilities, and collaborate with other beef producers. These results aligned with studies done by Ellsworth (2015), Quanbeck (2015), and Park et al. (2019) when looking at the benefits of cooperative business models.

Ellsworth (2015) and Park (2019) both explicitly mentioned the opportunity for cooperative models to improve efficiencies in production and increase access to additional, consistent markets through the power of having a collective voice. This supports data reported from the current study that smaller producers tended to be more willing to participate in cooperative business models compared to larger, established beef producers. Smaller producers did not have the bargaining power or economies of scale to give processors the consistent throughput they desire (Gwin et al., 2013), therefore they would likely have more opportunity to benefit from cooperative models compared to larger producers. Interestingly, while collaborating with other producers was listed as a top benefit, follow-up interviews also mentioned this as the top challenge in Figure 3. While beef producers were excited about and recognized the need to collaborate, there were still concerns around the actual implementation of collaborative efforts.

Another opportunity cited within the current study was the opportunity for shared trucking. This was a significant predictor of willingness to participate in cooperative processing, as seen in regression model 2. Beef producers that valued shared trucking as a benefit of cooperative marketing were more likely to want to participate in cooperative processing. This was a potential way to close the gap on unfilled or open processing dates. Shared trucking was also noted as a potential opportunity of cooperative business models in follow-up interviews, with one producer stating, "If there are spots going to waste because people don't communicate, it would be great to have more communication…we could really help one another accessing dates and support" (personal interview, 20 April 2022). Another producer quoted having experience participating in shared trucking stating, "Transportation has been a great way to save money" (personal interview, 29 March 2022). Ellsworth (2015) and Quanbeck (2015) also reported shared transportation as an opportunity worth exploring for producers interested in cooperative models. While shared trucking requires organizational effort, there was potential to limit time and costs associated with accessing facilities outside of a producer's immediate area (Ellsworth, 2015). However, even though shared trucking was noted as a potential opportunity, survey participants ranked it only a 4 out of 5 in Table 7.

Findings from the current study further report what Jumars (2018) found related to collaborative trucking as well. Jumars (2018) explored producer interest in cooperative trucking as a way to improve access to processing facilities, noting that it was a key suggestion made by the Niche Meat Processors Assistance Network. The study found that 75% of respondents were willing to participate in cooperative trucking. However, Jumars (2018) reported the results as inconclusive due to low response rates. The study also raised concerns related to chain-of-

custody and frozen storage that would need to be addressed if cooperative trucking were to be successful (Jumars, 2018).

Limitations and Future Research Needs

Without a complete directory of the target population, it was difficult to make major generalizations about the entire population when utilizing non-probability sampling. However, snowball sampling was used in an effort to increase the response rate and ensure representation of the widest range of producer characteristics and producers outside of the research team's personal networks. A major limitation of this study was the lack of funding and time. This study was conducted with no external funding. Future studies could utilize funding to access contact lists from government agencies to gain a complete list for direct requests for participation. Funding could have also improved survey response rates by providing mailed copies of the survey to beef producers or by providing financial incentives for participation. The survey platform was strictly online, which biases this study toward those that have access to the internet and feel confident with conducting activities online.

If this study were to be repeated, the follow-up interviews should be conducted concurrently with the survey. By the time interviews were conducted, many participants had forgotten how they had responded to the initial survey, and it became increasingly difficult to schedule interviews due to the time of year. Producers quickly became unavailable at the beginning of April, which made it challenging to schedule as many interviews as originally planned within the given data collection timeframe. In addition, if time were not a limiting factor, focus groups could have been a beneficial alternative or supplement to the follow-up interviews to provide

even more in-depth information to help understand the driving factors of willingness to participate in cooperative business models.

Throughout this study, the context of processing capacity changed quickly as a result of the evolving pandemic and shifting economic climate. Within the last year, New Hampshire alone lost access to two of its four USDA processing facilities, which put a burden on existing facilities in the state and facilities in neighboring states. Thus, the issue of processing capacity likely changed within the timeframe of this study. Whether the region still has adequate capacity to process the number of livestock produced in northern New England would be worth looking into once more.

A complete ranked list of assistance that would be required for beef producers to participate in cooperative business models can be found in Table 9. Research on the economics of cooperative business models came out on top, but financial assistance and access to funding were other important opportunities. Fortunately, many states and government agencies were already putting this in motion since the start of the pandemic (Thilmany et al., 2021). Beef producers tend to work independently and do not have much experience working collaboratively. In follow-up interviews, when asked what would make it possible to participate in cooperatives, one participant said, “Having a variety of different voices making decisions is important, transparency is important and some kind of long game. Who else has done it and what went well, what didn’t go well, and make sure there are a variety of perspectives in the process” (personal interview, 21 April 2022). Once the economics are understood, it would be critical to provide technical assistance and education for the actual implementation of cooperative business models in order to ensure success for all involved.

CHAPTER VI

CONCLUSIONS

This study utilized both qualitative and quantitative assessments to show it is possible to theoretically predict what type of beef producer would be willing to experiment with cooperative processing and cooperative marketing. There was a willingness to participate in cooperative processing and cooperative marketing models of production among beef producers in New Hampshire, Maine, and Vermont, especially if it could alleviate some of the constraints faced when booking processing dates. However, there is still a lot of uncertainty due to the unfamiliarity of the business model for many producers and the concern with making a return on investments.

There were certain characteristics of beef producers that had a significant role to play in their willingness to experiment with cooperative business models. This could help understand how to target participants when conducting future research, but these characteristics of beef producers should be further explored in future studies. Many variables and attributes contributed to a beef producer's willingness to experiment with cooperative business models. Overall, larger and more established beef businesses, in terms of income, years of experience, and herd size, were less willing to want to experiment with cooperative business models. However, larger producers tended to be more interested in the opportunities provided by cooperative processing compared to cooperative marketing. Smaller beef producers were more likely to want to participate in cooperative business models overall in order to access the opportunity to scale up their business and improve their ability to access processing dates by utilizing economies of scale. Therefore, focusing on small beef producers would be the first step in understanding their specific needs in regard to opportunities for developing cooperative business models.

Access to facilities run and owned by beef producers, consistent scheduling to book processing dates, collaboration, and the opportunity to scale up were the most important factors that excited beef producers about cooperative business models. On the other hand, cost of investment, time commitment, clear communication, and facility logistics were among the biggest concerns that gave producers pause when considering cooperative business models. Mobile slaughter units and collaborative trucking were two specific models that should be explored in more detail, particularly for beef producers selling direct to consumers. It is essential that future research focuses on the economics and governance structures of cooperative business models, specifically for beef producers, in order to successfully move forward with exploring the development of cooperative business models.

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APPENDICES

Appendix A: University of New Hampshire Institutional Review Board Approval Letter

University of New Hampshire
Research Integrity Services
51 College Road, Durham, NH 03824
research.integrity@unh.edu

Nov 19, 2021 9:51:53 AM EST

Elaina Enzien
Food and Agriculture, Agriculture, Nutrition,& Food Systm

Study Title: Assessing Cooperative Business Models of Beef Production to Address Harvest Capacity Constraints in New Hampshire, Maine, and Vermont.
IRB #: IRB-FY2022-186
Approval: November 19, 2021

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Exempt as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 104(d). Approval is granted to conduct your study as described in your protocol.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, Responsibilities of Directors of Research Studies Involving Human Subjects. Please read this document carefully before commencing your work involving human subjects.

Upon completion of your study, please submit a study closure form through Cayuse IRB/Human Ethics along with a report of your findings.

If you have questions or concerns about your study or this approval, please feel free to contact Melissa McGee at 603-862-2005 or melissa.mcgee@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

Julie F. Simpson
Director

Appendix B: Qualtrics Survey Questions

Assessing Cooperative Business Models for Beef Production

Q1

Consent Form For Participation in a Research Study *Assessing Cooperative Business Models of Beef Production to Address Processing Capacity Constraints in New Hampshire, Maine, and Vermont*

The purpose of this research study is to identify interest of beef producers in cooperative business models, what attributes would make cooperative business models successful, and assess the feasibility of cooperative models for northern New England beef producers as a way to address harvest capacity constraints. Compensation will not be provided, but your contribution will aid in the development of resources, programs, and networks to support the expansion and sustainability of beef businesses like yours. Your participation will also help in the development of future research to test the economic feasibility of cooperative business models for livestock producers in the region.

This research study is being conducted by Elaina Enzien for her masters in agricultural sciences at the University of New Hampshire. You are being asked to participate in this survey because you were identified as a beef producer that resides in New Hampshire, Maine, or Vermont and sells USDA inspected, State inspected, or Custom processed meat direct to consumers. The anticipated number of participants who will be involved in the survey are 300, but our goal is to reach as many as possible. By completing the survey, you are consenting to participate in this research. Although we hope that you will answer every question, you are free to skip any questions. Your participation is voluntary, and you may withdraw your consent and discontinue participation at any time. The survey will take approximately 15 minutes to complete. If you would like to provide additional feedback or information on the topics addressed in the survey, you may volunteer to submit your contact information for the researcher to contact you.

Based on the nature of the questions asked, risk is minimal. The primary risk to participants would come from a breach in confidentiality. To minimize risk, beyond agreeing to participate, your name will not be tracked when data is collected. You will not be individually identified, and your responses will be used for statistical purposes only.

Thank you in advance for your participation. If you have any questions pertaining to the research you can contact Elaina Enzien at elaina.enzien@unh.edu, (603) 679-5616 or Drew Conroy at andrew.conroy@unh.edu, (603) 862-2625 to discuss them. If you have questions about your rights as a research subject, you may contact Melissa McGee in UNH Research Integrity Services at (603) 862-2005 or Melissa.McGee@unh.edu to discuss them.

By clicking "I Agree" you are agreeing to participate in this study (IRB-FY2022-186).

I agree to participate in this study. (1)

I do not agree to participate in this study. (2)

Q2 In what state is your operation located in?

- New Hampshire (1)
- Maine (2)
- Vermont (3)

Q3 What is your role on the farm?

- Owner (1)
- Employee (2)

Q4 What is your gender?

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- Prefer not to say (4)

Q5 How many head of cattle do you have on average?

- 1-10 head (1)
- 11-20 head (2)
- 21-40 head (3)
- 41-60 head (4)
- 61-80 head (5)
- 81-100 head (6)
- 100+ head (7)
- I do not raise cattle (8)

Q6 How long have you been raising beef?

- ○ Less than 1 year (1)
- ○ 1-5 years (2)
- ○ 6-10 years (3)
- ○ 11-20 years (4)
- ○ 21-30 years (5)
- ○ 30+ years (6)

Q7 What types of beef cattle do you raise?

- ○ Bos taurus/ European breeds (for example: Angus, Hereford, Belted-Galloway, Lowline Angus, Simmental, Wagyu, etc.) (1)
- ○ Bos indicus breeds (Zebu, Brahman, etc.) (2)
- ○ Dairy cross (3)
- ○ Combination of dairy crosses and beef breeds (4)
- ○ Other (5)

Q8 How are you feeding your cattle? Select all that apply.

- ☐ Grass/ forage from pasture (1)
- ☐ Grain supplement (2)
- ☐ Hay (3)
- ☐ Corn silage (4)

- [ ] Hay Silage (5)
- [ ] Concentrate (corn, soy, barley, wheat, oats, sorghum, etc.) (6)

Q9 Do you have paid farm labor?

- ○ Yes (1)
- ○ No (2)

Q10 What is the average gross annual income of your beef business?

- ○ Less than $10,000 (1)
- ○ $10,000 - $39,999 (2)
- ○ $40,000 - $69,999 (3)
- ○ $70,000 - $99,999 (4)
- ○ $100,000 - $149,999 (5)
- ○ More than $150,000 (6)
- ○ I don't know (7)

Q11 Where are you selling your beef products? Select all that apply.

- [ ] Farmers markets (1)
- [ ] Online (website, social media, etc.) (2)
- [ ] Farm Store or Stand (off-farm) (3)

- [ ] Farm Store or Stand (on-farm) (4)
- [ ] Restaurants (5)
- [ ] Groceries (6)
- [ ] Institutions (hospitals, schools, etc.) (7)
- [ ] Through word-of-mouth (8)
- [ ] Other (9)

Q12 Are there market opportunities for your beef products that you cannot currently access due to harvest date availability?

- ○ Yes (1)
- ○ No (2)
- ○ Yes, but not because I can't get harvest dates. (3)

Q13 On average, how many cattle do you take to be processed each year?

- ○ 1-15 (1)
- ○ 16-30 (2)
- ○ 31-60 (3)
- ○ 61-100 (4)
- ○ 100+ (5)
- ○ I have not processed (6)

Q14 In the last two years, have the number of cattle you've processed increased, decreased, or stayed the same?

- ○ Increased (1)
- ○ Decreased (2)
- ○ Stayed the same (3)

Q15 In the past year, what type of facility did you use to process your beef?

- ○ USDA Inspected Facility (1)
- ○ State Inspected Facility (2)
- ○ Custom-cut Facility (3)
- ○ Combination of USDA, State, and/or Custom (4)

Q16 On average, how many miles do you travel to get to your processor (one-way)?

- ○ 1-20 miles (1)
- ○ 21-40 miles (2)
- ○ 41-60 miles (3)
- ○ 61-80 miles (4)
- ○ 81-100 miles (5)
- ○ 100+ miles (6)

Q17 What time of year would you **prefer** to process your beef?

Rank 1 to 4 (1 = least preferred, 4 = most preferred)

_____ Fall (1)
_____ Winter (2)
_____ Spring (3)
_____ Summer (4)

Q18
What time of year do you **typically** process your beef?

Rank 1 to 4 (1 = never process, 4 = process most often)

_____ Fall (1)
_____ Winter (2)
_____ Spring (3)
_____ Summer (4)

Q19 Do you find it difficult to book harvest dates during the time of year you typically process? Please rate the degree of difficulty you experience.

	Extremely difficult (1)	Somewhat difficult (2)	Somewhat easy (3)	Extremely easy (4)
Booking harvest dates has been: (1)	○	○	○	○

Q20 How likely are you to process your beef at different times of year?

	Extremely unlikely (1)	Somewhat unlikely (2)	Somewhat likely (3)	Extremely likely (4)
I am... (1)	○	○	○	○

Q21 **Cooperative Processing**—*when producers form a cooperative to offer slaughter and/or processing services to its members. The goal of this model is to improve immediate access to slaughter and processing for cooperative members.*
This may be accomplished by: acquiring mobile slaughter units acquiring facilities to

conduct processing of USDA slaughtered beef acquiring permanent infrastructure to conduct both slaughter and processing

Q22 Have you participated in cooperative processing?

- ○ Yes, I currently participate in cooperative processing (1)
- ○ Yes, I used to participate in cooperative processing (2)
- ○ No (3)

Q23 How willing are you to experiment with cooperative processing (see above definition)?

	Extremely unwilling (1)	Somewhat unwilling (2)	Somewhat willing (3)	Extremely willing (4)
I am... (1)	○	○	○	○

Q24 Which of these potential benefits of cooperative processing interest you the most? Assign a value to each.

	Not interesting at all	Slightly interesting	Very interesting	Extremely interesting
	1	2	3	4
Access to mobile slaughter units ()				
Access to facilities owned and run by beef producers ()				
Opportunity for ownership and decision-making power ()				
Potential to grow beef sector ()				
Collaborating with other beef producers ()				

Q25 Which of these are the most concerning to you when thinking about participating in cooperative processing?
Assign a value to each.

	Not concerning at all	Slightly concerning	Very concerning	Extremely concerning
	1	2	3	4
Cost of investment ()				
Time commitment ()				
Regulations ()				
Maintaining sufficient demand year-round ()				
Collaborating with other beef producers ()				
Facility logistics ()				

Q26
Cooperative Marketing—*when a group of producers sell under a regional or local brand that coordinates and aggregates the supply. The goal of this model is to improve access and throughput to harvest facilities by providing consistent business year-round and to improve access to larger regional markets.*
In this model, the cooperative could: be formed and owned by the producers be a cooperative owned by an independent company provide support with obtaining slaughter dates, marketing, customer service, and shared transportation include the option to sell the finished animal to the central brand entity to alleviate the logistics of procuring harvest dates and marketing altogether

Q27 Have you participated in cooperative marketing?

- Yes, I currently participate in cooperative marketing (1)
- Yes, I used to participate in cooperative marketing (2)
- No (3)

Q28 How willing are you to experiment with cooperative marketing (see above definition)?

	Extremely unwilling (1)	Somewhat unwilling (2)	Somewhat willing (3)	Extremely willing (4)
I am... (1)	○	○	○	○

Q29 Which of these potential benefits of cooperative marketing interest you the most? Assign a value to each.

	Not interesting at all	Slightly interesting	Very interesting	Extremely interesting
	1	2	3	4
Access to additional markets ()				
Combined/ shared trucking to processor ()				
Co-marketing and distribution support ()				
Improved efficiencies ()				
Coordination of more consistent scheduling to book harvest dates ()				

Q30 Which of these are the most concerning to you when thinking about participating in cooperative marketing?
Assign a value to each.

	Not concerning at all	Slightly concerning	Very concerning	Extremely concerning
	1	2	3	4

Cost of investment ()	
Time commitment ()	
Commitment of collaboration from other beef producers ()	
Reliability of product availability in off-season ()	
Uniformity of product/ accommodating different standards of production ()	
Loss of traceability/ farm identity ()	

Q31 What kind of assistance would be most important for you to consider participating in cooperative business models in the future?
Assign a value to each.

	Not at all important	Slightly important	Very important	Extremely important
	1	2	3	4
Financial assistance or access to funding ()				
More information on benefits and challenges of cooperative business models ()				
Research on economics of cooperative business models ()				
Educational training on how to implement cooperative business models ()				
Infrastructure to support models ()				
Connections to other producers ()				
Finding and accessing new market channels ()				

Q32 Would you be willing to do a possible follow up phone interview with the researcher to provide more context and further discuss your perspectives?

- ○ Yes, I consent to provide my contact information to be contacted for a follow-up interview. (1)
- ○ I decline to participate in a follow-up interview. (2)

Q33 Please provide the best way to reach you for a follow up interview below.

- ○ Name (1) _____
- ○ Phone (2) _____
- ○ Email (3) _____

Appendix C: Follow-up Interview Questions and Informed Consent Statement

Opening Comments

Thank you for sharing your time to participate in our project. I look forward to hearing your ideas and perspectives during the interview. Before we begin, I need to briefly inform you about the project and your rights as a participant:

****Researcher Reads the following "Informed Consent Statement"**

You are being asked to participate in this research study to share your thoughts on cooperative business models of beef production to address harvest capacity constraints in New Hampshire, Maine, and Vermont. The purpose of the study is to identify interest of beef producers in cooperative business models, identify what attributes would make cooperative business models work, and begin to assess the feasibility of cooperative models for northern New England beef producers as a way to address harvest capacity constraints.

The interview should last about 20 minutes. I will make an audio recording to make sure I don't miss anything. There are no reasonably foreseeable risks or discomforts associated with your participation in this research. However, I have taken precautions in the event that one emerges. Your personal information will not be disclosed to anyone outside of the study. The notes and recording from the interview will not be associated with your name, address, phone number, or other personal information.

The benefit to you is having your opinion heard in regard to new models of production for beef producers in Northern New England. The long-term benefits could include the development of

future research to test the economic feasibility of cooperative business models for livestock producers in the region.

If you refuse to participate or withdraw consent, there will be no penalty to you or loss of benefits to which you are otherwise entitled. Your participation is voluntary, and you may refuse to proceed at any time, but your perspective will be a great help in learning the particular challenges or opportunities for cooperative business models.

**** BEFORE STARTING THE INTERVIEW, RESEARCHER ASKS:**

1) Do you have any questions before we start?

2) Are you willing to participate, and do I have your consent to begin?

Interview Questions:

1. What challenges would you be concerned about with collaborative production models?
2. What opportunities do you see with collaborative production models?
3. What do you think would make it possible for coop models to work in New England/for beef producers like yourself?
4. Do you have any other comments or insights to add?

Appendix D: Significant Variable Codes and Descriptions for Regression Models 1 & 2

Model #	Variable	Scale (if applicable)	Description/ Question asked
1	Gender	n/a	What is your gender?
1	Labor	n/a	Do you have paid farm labor?
1 & 2	Income	n/a	What is the average gross annual income of your beef business?
1	Miles	n/a	On average, how many miles do you travel to get to your processor (one-way)?
1 & 2	PreferWinter	1 = least preferred, 4 = most preferred	What time of year would you prefer to process your beef? Rank 1 to 4
1 & 2	PreferSummer	1 = least preferred, 4 = most preferred	What time of year would you prefer to process your beef? Rank 1 to 4
1	CP	1 = extremely unwilling, 4 = extremely willing	How willing are you to experiment with cooperative processing?
1	cpAccess	1 = low value, 4 = high value	Access to facilities owned and run by beef producers/ Which of these potential benefits of cooperative processing interest you the most? Assign a value to each.
1	cpbCollab	1= low value, 4 = high value	Collaborating with other beef producers/ Which of these potential benefits of cooperative processing interest you the most? Assign a value to each.
1	cpCost	1 = low value, 4 = high value	Cost of investment/ Which of these are the most concerning to you when thinking about participating in cooperative processing? Assign a value to each.
1	cpRegs	1= low value, 4 = high value	Regulations/ Which of these are the most concerning to you when thinking about participating in cooperative processing? Assign a value to each.

1	cpDemand	1 = low value, 4 = high value	Maintaining sufficient demand year-round/ Which of these are the most concerning to you when thinking about participating in cooperative processing? Assign a value to each.
1	cmAccess	1= low value, 4 = high value	Access to additional markets/ Which of these potential benefits of cooperative marketing interest you the most? Assign a value to each.
2	State	n/a	In what state is your operation located in?
2	Head	n/a	How many head of cattle do you have on average?
2	ProcessTrend	n/a	In the last two years, have the number of cattle you've processed increased, decreased, or stayed the same?
2	CM	1 = extremely unwilling, 4 = extremely willing	How willing are you to experiment with cooperative marketing?
2	MSU	1= low value, 4 = high value	Access to mobile slaughter units/ Which of these potential benefits of cooperative processing interest you the most? Assign a value to each.
2	Trucking	1= low value, 4 = high value	Combined or shared trucking to processor/ Which of these potential benefits of cooperative marketing interest you the most? Assign a value to each.