Using Qualitative Study to Explore the Impact of Refrigeration for Beginning Farmers

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This research paper encompasses and specifically focuses on the farmer interviews conducted as part of the larger "Farm to Fridge" project.

Abstract

The impact refrigeration has on the lives of beginning farmers in Minnesota is largely unstudied. The purpose of this qualitative investigation is to understand how beginning farmer experiences with refrigeration access impact perceived business success. Perceived business success, for the purpose of this study, is defined as how farmers understand their own business stability, measured by the three legs of sustainability. Semi-structured interviews were conducted with four beginning farmers of differing ages and life stages, and the impact of refrigeration on the beginning farmers' perception of success was analyzed using the framework of sustainability, or the nexus of prosperous community, economics, and environment to achieve long-term stability. Findings show that refrigeration impacts beginning farmer lifestyle and interactions with community (social), profitability of the farm (economic), and farm practices and food waste (environment). Further, the interviews collected indicate a strong beginning farmer perception that refrigeration aids farm business success. While these findings are context-dependent due to the nature of the study, they demonstrate the need for further research to understand the trade-offs beginning farmers make which prevents the addition of refrigeration on farm, and a need for future programming that can help support these farmers, such as grants assistance and programming specific to beginning farmers.

Introduction

Imagine a farmer at the end of a farmers market day with unsold boxes of fresh strawberries that were cooled in water but not refrigerated. The strawberries lost their "plumpness" and now have a shorter shelf life because the farmer did not have access to refrigeration; considered non-marketable culled produce, the farmer cannot make a sale. This scenario is not hypothetical; as a current University of Minnesota Extension employee I have seen multiple Minnesota farmers also have this experience. The impact of refrigeration access on beginning produce farmers perceived business success in Minnesota is currently unknown; there is a dearth of research about current usage of refrigeration in beginning Minnesota produce farmer postharvest handling practices, and the impact it has on the lives of beginning farmers in largely unstudied (Klodd & Hoidal, 2019).

The purpose of this investigation is to understand how beginning farmer experiences with refrigeration access impact perceived business success. Refrigeration is defined as the use of mechanical or other cooling techniques to extend produce life and maintain produce quality. The objective of this study is to use the lived experiences collected from interviews with three beginning produce farmers to inform the direction of a larger research study about postharvest handling and refrigeration access for beginning Minnesota produce farmers (see figure 1).

The methods of this research were detailed through a research activity journal. Data was analyzed to identify common themes to understand how beginning Minnesota produce farmers experience refrigeration on their farm. This information will inform a larger Master's thesis project, as well as potential Extension programming for beginning farmers around postharvest refrigeration.

The central research question, "How do beginning farmer experiences with refrigeration access impact their perceived business success," is best addressed using qualitative study and the theoretical framework of sustainability. The use of qualitative study allows for deeper understanding of this issue and offers an opportunity to empower minority voices (Creswell & Poth, 2018, p. 42-45). This

ultimately leads to the ability to make a call for change, such as potential programming to support increased beginning farmer access to refrigeration. As the Principle Investigator, I solicited four participants located in Minnesota that met the United States Department of Agriculture (USDA) criteria of "beginning farmer, "or a farmer who has been farming for less than 10 years. All four farmers discussed elements of sustainability, or the nexus of prosperous community, economics, and environment to achieve long-term stability, as they related to their farms and access to refrigeration. Stability is a key component of perceived success. Therefore, it was a natural fit to structure the data into the three legs of sustainability.

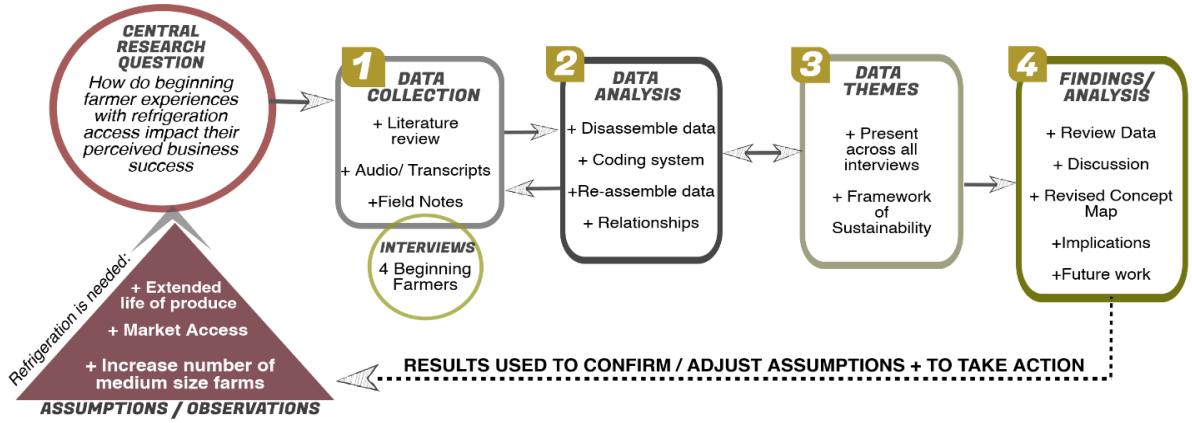

Figure 1. Initial Concept Map

Theoretical Framework of Researcher

As the researcher, I approach the research question with a transformative framework (Creswell & Poth, 2018), because I want my research to center the voices of farmers. My intention is to use the information collected to improve the lives of the farmer participants. I also incorporate feminist theory, with the goal to establish collaborative relationships, to avoid objectification, and to conduct research that is transformative. I continually acknowledged my biases throughout the research process, for example, my values for a local food system over a global food system and my bias for sustainable-oriented methods of food production.

Ethical Considerations

Thorough consideration for ethical data collection was made prior to interviewing participants. The three guiding principles for ethical research, including respect for persons, concern for welfare, and justice, were applied to the research conducted (Creswell & Poth, 2018, p. 149). The focus of the study is on the farm business, not sensitive personal information. The anonymity of the participants were protected through the use of aliases, with the knowledge of original names held only by the principal researcher. Signed consent forms that outlined the project and project intentions were collected, and I made sure to take measures to ensure anonymity.

Methods and Procedures

This study uses a qualitative phenomenological approach to gain a better understanding of beginning farmer experiences with one central phenomenon, refrigeration. The role of phenomenological research, according to Creswell and Poth (2018), is to "reduce individual experiences with a phenomenon to a description of the universal essence." A rigorous phenomenological approach allows the research to describe four beginning farmer experiences with refrigeration. This section provides an overview of the philosophical foundations of phenomenological research design, a rationale for the specific study design including the population, how the sample was recruited, data collection, trustworthiness, limitations and analysis procedures.

The participants in this study are four beginning produce farmers located in Minnesota (see table 1). For the purpose of this study, the term "beginning" aligns with the USDA definition as someone who has operated a farm for less than 10 years (Beginning Farmers and Ranchers, n.d.). As the Principle Investigator (PI), I solicited three participants who met the criteria of beginning farmer through the use of the University of Minnesota Small Farms Team network, recommendations from Extension Educators who work directly with beginning farmers, and solicitation through the UMN sustainable agriculture "Sustag" listserv (sustag@lists.umn.edu).

The first and third interviews took place at the farm at the request of the participants, the most convenient location for the participants. The second interview was conducted via Google hangouts, and

although it was informative and fruitful, it proved challenging due to technological difficulties with the participant's camera, which ended up not showing the participant's face. The participant was, however, able to see my face.

Participants were compensated for their time through a $25 stipend, provided by the NC-SARE Graduate Research Grant previously secured by PI. An interview protocol was developed and reviewed by DES 8103 instructor Dr. Marilyn Bruin ahead of the interviews. The first question, "Can you tell me about your farm and your experience with farming" was intentionally broad and served to "open the floodgates," a method described by Rubin and Rubin (2012, p. 123) with the goal to "obtain a broad overview that suggests what needs to be explored in depth later." For the first interview, the second question was "What is your experience with refrigeration on your farm?" After completing the first interview, I made the decision to move what had been question #4, "What challenges or barriers do you face with your farm and farm business?" to be the second question. This gave an opportunity for the farmers to talk more broadly before centering on the topic of refrigeration. All other questions remained in the same order for all three interviews (see Appendix A). Interviews were recorded using the application "VoiceRecorder" and field notes were taken by the PI to help describe the interview setting and capture initial data.

"Name"	Age Category	Years Farming + Selling Produce	Size of Farm
Ethan	20-35	4	20 acres of land, >2 acres of production
John	20-35	4	20 acres of land, >2 acres of production
Linda	50-65	3	3 acres of production
Corey	35-50	2	40 acres of land, <1 acre of production

Figure 2. Interview Participant Summary Chart

Data Analysis

All interviews were transcribed verbatim and verified through a second listening to check the recording against the transcript, ensuring that no content was omitted. The first and second interviews

were recorded and transcribed by the PI, word for word, using "Express Scribe," which allowed for the recording to be slowed down to ensure accuracy and efficiency while transcribing. The third interview, also recorded, was transcribed using a free version of the online transcription service, "Temi." The results of the online transcription were verified, word-for-word, against the interview recording twice. Personally identifying information, such as city names and names of the farmer participants, were excluded to ensure confidentiality.

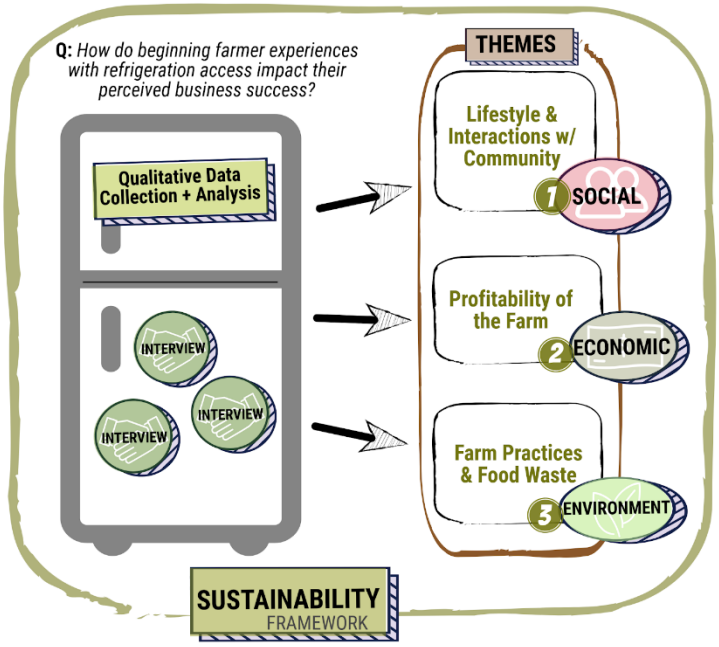

FIGURE 3. Emergent Theme Concept Map

The printed transcripts were used for thorough and complete data analysis. A modified version of the "Data Analysis Spiral" process outlined by Creswell & Poth (p.186, 2018) was followed, which included: 1) becoming immersed in the data through data organizing; 2) developing a coding system (see Appendix B) and assigning codes by analyzing the data for significant statements surrounding the central phenomenon of refrigeration; 3) revising the codes for the building of categories through the use of a data matrix program, "MindMup" (see Appendix E); 4) assessing interpretations and looking for deviant cases through re-reading the transcripts/codes/categories to build subcategories; 5) developing the categories into emerging themes; 6) reassessing the themes through a final review of the data; and 7) writing a final analysis with a discussion of findings and representing the themes in a concept map (see Figure 3). A hierarchy was assigned (Yin, 2016) with major emerging themes defined as those present across all three interviews, and minor themes as present in at least two of the interviews. The framework of sustainability was used to help identify patterns and relationships as they related to the three content areas of society/community, economics, and environment.

Limitations

Methodological limitations of the study stemmed from the context-dependent nature of the study, as well as the focus of the study to provide "on the ground" insight of beginning farmers in relation to refrigeration access and usage. While the study followed the scientific process of phenomenological qualitative research methodology, the study reflects only the opinions, situations, and experiences unique to four different beginning farms in Minnesota.

Analysis: Results and Findings

To best analyze the impact of refrigeration on beginning farmers' perceived business success, the sustainability framework was used. Three main themes emerged using deductive coding (Creswell & Poth, 2018) based upon the theoretical framework of sustainability, in which sustainability is defined as the nexus of prosperous environment, community, and economics to achieve long-term stability (WCED, 1987; see figure 4). For the purposes of this study, perceived business success is defined as how farmers understand their own business stability, measured by the three legs of sustainability.

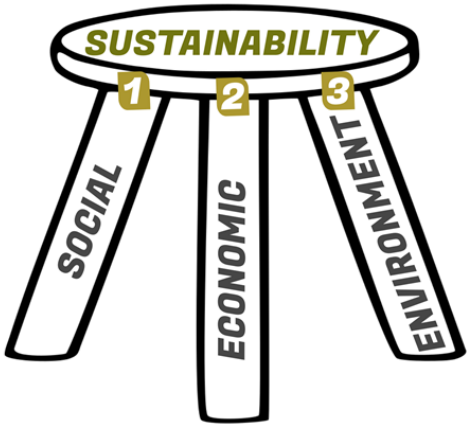

Figure 4: The Three Legged Stool of Sustainability (adapted from WCED, 1987; created by Ren Olive)

Using the lens of sustainability provides a deeper understanding of how refrigeration can impact stability and sustainability of the farm and resulted in three themes of analysis. The themes include the impact of refrigeration on perceived business success as it relates to 1) Social/Community: Lifestyle and Interactions with the Community 2) Economics: Profitability of the Farm, and 3) Environment: Farm Practices and Food Waste. The three themes were present in all interviews and are presented in the order reflective of the amount of data that aligns with each area of sustainability.

Participants

All four participants identified as beginning farmers, as defined by the USDA definition of a farmer who has operated a farm for less than 10 years. Although all farmers were introduced to farming

practices as they grew up, three of the four grew up on an actual farm, their paths to becoming farmers varied greatly. The four farmers are currently at different life stages, ranging from just beginning careers to recently retired. The first interview participants, Ethan and John, are in their late 20s and are just starting their working careers. John quit his job to farm full time, of which Ethan reflected, "Yeah, we have kind of half-assed it all, you know, all four years we have been here because we both had jobs, […] John was a full time carpenter up until just a couple of weeks ago [….] so if we can get someone who is focused on the business full time, I think we could probably make a good go of it." The second participant, Lori, retired within the past three years and sees farming as a part-time passion-filled job, "I'm recently retired, the last couple of years. It's allowed me to do this, you know, full time, but it's like part time." The final participant, Corey, works full time off the farm and farms for "enjoyment […] and experimentation," stating, "It's the whole thing that just keeps my interest. And I love animals."

Theme 1) Social: Lifestyle and Interactions with Community

The impact of refrigeration on lifestyle and community connection had the highest presence across all three interviews and, thus, is the first emergent theme. Although there are variations in exactly how each farmer adapted to the lack of refrigeration, all participants noted the effect it had on their lives. Each of the farmers discussed at length actions they took which were directly related to not having access to refrigeration. Further, they all saw ways in which refrigeration could benefit their farm business success and lifestyle.

Ethan and John discussed the impact that refrigeration could have on their farm business and lifestyle in terms of the amount of time it would save them during harvesting. They recognized the role that postharvest handling has on the quality of produce, and because they do not have access to large scale refrigeration on their farm, they ensure their produce is of the highest quality by often harvesting at midnight on Friday, or at 4:00 a.m. before farmers market days for items that are more perishable:

> "That's the biggest problem, it we are pickin' produce at midnight Friday night…. Or like Kale and herbs, that's the day of. We are getting up before 4am in the morning. So if we had a walk in refrigerator, then we could save all those, you know, we could save so much time, really." - John

Ethan and John also saw the potential for refrigeration to allow their business to support the community and other farmers, as they currently buy and re-sell excess produce from other farmers that doesn't sell at the farmers market:

> "There are other business ventures we could get into with more storage space […] If we had more refrigeration, we could do more of that buying and selling, that's we are very good at that. […] And it's been really, I wouldn't say profitable, but it's been really good for the community. They get excited about that." - Ethan

The second farmer interviewed, Lori, also does not have access to refrigeration on farm, and purposefully plants her crops to stagger when the produce comes in. This causes her to alter her lifestyle and produces significant stress, also evidenced by the strain in her voice as she discussed:

> "I think that it [refrigeration] would help my operation and the fact that when the tomatoes come on, when the beans come on, all those fresh produce and it always seems to come on the same time or I try planting a little bit so it varies, I won't have to do that so much. I won't have to be worrying about that so much. I could just, you know, have it in the refrigeration and keep them fresh." – Lori

Lori also communicated the impact that refrigeration could have on expansion of her farm. Lori saw the addition of refrigeration and expansion as an element that would add to her business success and also allow her to more directly connect her farm to the community:

> "I think that's the biggest thing is, and around here they are trucking all these vegetables that come up from different [places], southern Minnesota, or around, and we don't have a lot of edible vegetables around here. We have a lot of the grains and so forth, sugar beets for sure, but not edible vegetables. And then it's so expensive when you have to track it from such a distance away. So locally for our community, I can see where it's just the high valued to have refrigeration system of some sort. -Lori

Corey, the third farmer interviewed, placed less importance on providing for the community as evidenced by several statements, including his comment, "I get a lot of enjoyment out of it [farming]. I don't, it, it's not for seeing people eat the food that I produce." Corey recognized the impact refrigeration could make on his lifestyle because he works full time and is planning to expand his operation. He is limited by labor and refrigeration space:

> "I think I'm going to need going to need room for refrigeration. Because I also work full time. I have only have so much time and where the hell am I going to put all this stuff." - Corey

Based on the experiences of all four beginning farmers, it is clear that procuring on farm refrigeration would improve not only perceived business success, but also farmer lifestyle. Further, three of the four farmers saw refrigeration as a way to support the community through the ability to sell more produce indicating that farmer access to refrigeration is directly related to the social sustainability of farm businesses.

Theme 2) Economics: Profitability of the Farm

The second emerging theme, aligned with the second leg of sustainability, economics, is the profitability of the farm. This includes selling more produce beyond farmers markets and addressing issues of labor. All fours farmers discussed the potential to expand their operations to meet the wide gap between supply and demand – in all three farm communities, the farmers saw a much higher demand from businesses than current farmers could supply. Further, they understood refrigeration as a key component of expanding their farm and increasing their farm profitability.

John and Ethan noted economic sustainability as a key component to growing their business, recognizing that, for them, the economic leg of sustainability was crucial:

> "We have always been honest with, you know, being a business owner, you have to follow where the money is. That is part of the pillars of sustainability. If you want to be sustainable, you have to be profitable as well." – John

John and Ethan saw labor as a large barrier to economic sustainability, as Ethan stated, "Labor is another issue. It is very had to uhm get everything done that needs to be done when it needs to be done in an economical fashion." Beyond labor, Ethan and John expressed that refrigeration was part of their business plan and that, with refrigeration, they could grow larger quantities of perishable produce, which, for them is more valuable in price, ultimately aiding their overall profitability:

> "We need a walk in cooler, whether it is homemade or…" – John
> "We might even think about getting a refer [refrigerated] truck this summer if we really need it. As we do business planning, we are growing more and more the perishables, 'cuz that's where we realized the dollars are at. We want to do lots of greens, lots of herbs, uhm, lots of broccoli, cauliflowers, kales, and cabbages." – Ethan

Lori is unsure about the economic sustainability of her farm, and does not know if she will be able to keep expanding beyond this year. Lori plans to add flower production to her farm this summer, and she sees refrigeration as a crucial component to keeping her farm operating, stating:

> "I think right now, like I said, we're investigating in a refrigerator, some kind of refrigeration. Because of this we're just starting the U-pick flowers. I can see where it's [refrigeration] going to be vital, a real significant need for that. It would probably, it would be a do or die, you know, if we're not going to be able to make profit of it this year. I don't know how much we'll be doing next year, so we might have to change our whole plan." - Lori

Corey saw more profitability, and thus perceived business success, in continuing to plant a majority of crops that were less perishable. If Corey was going to grow more perishable produce items, he envisioned himself as being able to be flexible, reflecting, "Screw it, I've got to have refrigeration because this stuff, it's going to wilt and look like crap in a matter of no time," and he discussed how buying refrigeration would be affordable enough for him and something he would "buy for $100 off a craigslist kind of thing." Corey was more concerned about labor. He currently does not hire other people to work for him, but recognizes that his future business success may be hindered by a low labor workforce:

> Labor, labor is the big one. And even if I haven't tried it, I'm guessing that even if I did, even if I offered money, I'm not going to get anybody. Because it's hard work. It isn't really, to me." - Corey

All four farmers discussed the impact farmers markets, a direct market, have on their profitability, giving insight to their perceived success. The farmers primarily sell to farmers markets because there not as stringent quality and produce longevity requirements as compared to strategic partner markets like wholesale (Bower et al, 2010) which often require access to immediate refrigeration. Ethan and John had mixed feelings about farmers markets because while farmers markets in their community are profitable, they are disorganized, with several of the local farmers markets falling apart:

> "We would all come back [from the farmers market] and we are all exhausted, and fighting 'cuz we have to unload and put things in different spots and upload and figure it all out. It's like oh my god, this is crazy. But we are going to do it again. But, you know, that's where we make our money at, is the farmers market, by and large." – Ethan

Lori also had mixed feelings about farmers markets in her community. She explained that she does not usually sell all of the produce she brings to the farmers market. This which leaves her feeling concerned

and it negatively impacts her perceived business success:

> "Farmers markets around here… they don't always, you know, it depends on whether people come out. It depends on the days that they're offering it, which impacts how I can get rid of a lot of the produce too. So yeah, always being concerned about that." - Lori

Selling at farmers markets was less profitable for Corey as compared to the other farmers. Corey was also less optimistic and almost cynical in his tone and body language when discussing his view of farmers markets, stating:

> "We're all doing this and we're feeling good about it. Gosh darn it. We're all a bunch of a bunch of hippies and we're raising our plants. We've got our high tunnels and we're at our farmer's markets and nobody's showing up and it's raining. And I still got to be here. -Corey

When produce did not sell at the farmers market, the farmers were forced to find a secondary channel, such as through friends, family, neighbors, or the food shelf. And, if produce did not sell through the secondary channels, the produce was given to animals or added to the compost pile, a strategy that wastes energy and time, as well as profit.

Theme 3) Environment: Farm Practices and Food Waste

The third leg of sustainability, environment, encompasses the third emergent theme: farm land practices and food waste. This theme is ordered as the third theme because it was not as strong as the first two themes with the amount of interview data evidence. The four farmers discussed ways in which their farm operates and handles food waste to create minimal impact upon the land and environment.

While reducing waste through refrigeration is primarily an economic driver, creating perceived business success in all farms, it is also a means to reduce food waste. Further, by caring for the land, the farmers fulfilled a personal value, causing them satisfaction. For example, although Corey's farm is not certified organic, he uses practices that align with organic farming, stating, "I've always, I'm not organic, only because I'm not certified organic. I don't use pesticides. I don't use anything because I eat this stuff too." Ethan and John also use what they consider as organic practices, "So yeah, I [Ethan] came from conventional agriculture and now I am doing that weird hippy thing that my family thinks is crazy." Although Lori did not label her farm as organic or organic-adjacent (meaning certain environmentally

friendly land management and production strategies are followed), she did talk about the impact her farm business has upon the land, stating:

> "I mean, we can't show them [community members] if we don't have the tools to show them how viable it is to grow it up here, you know, it's not sustainable if we don't have refrigeration being one of it, one of the things. But it's how to take care of the land and everything. Yeah." -Lori

While all of the farmers use practices that are ecological in nature, they saw the impact that a lack of refrigeration made on shortening the length of produce life, causing more waste. Ethan talked at length about the amount of produce that was unsellable because they did not have a way to store the produce that encouraged longevity. They recognized that refrigeration would allow them to reduce the amount of produce they composted or fed to animals:

> "Two years ago we had a bizillon onions, we probably had, I don't even know how many onions, probably a hundred pounds, or three hundred pounds. We pretty much lost almost all of it, just 'cuz we did not have the proper refrigeration. And same this year." - Ethan

At Lori's farm, she also experienced a high volume of produce that she was unable to sell at the farmers market, and was unable to store for a longer period of time because she does not have refrigeration on farm for produce. Lori pieced together ways to distribute her excess produce:

> "Basically what we ended up doing is giving it [unsold produce] to the neighbors, friends, anybody else that would like to take it off our hands. And then there's always the food shelf. They don't have very much refrigeration now, either, so they can only handle so much. But otherwise we compost. So, lot of that went into the compost too. – Lori

Corey does not see as much waste on his farm because his farm is smaller in size and he doesn't grow very many perishable crops. However, he does see the potential for even less waste on farm with the use of refrigeration:

> "Well, [if I want] to sell more? You know, it'd be less throwaway and at my, at my size, honestly, that I can just, I don't see myself getting any more than just a large refrigerator." - Corey

All four farmers perceive business success with the addition of refrigeration to their farm, through benefits to their lifestyle and community with increased production, increased business profitability, and lower on-farm food waste. Addressing the three legs of sustainability, social, economic, and environmental, leads to greater farmer stability. In turn, greater stability allows for a solid foundation from which to grow and find business success. Essentially, an increase in perceived

business success is vital to retaining beginning farmers and strengthening local and regional food systems.

Interpretation: Discussion and Implications

A Minnesota House Representative recently posed the question "How can we get 10,000 more farmers on the land." While complex and certainly not answerable through one qualitative research project with four farmers, beginning to address components of this question, such as beginning farm resource and refrigeration infrastructure needs, can help propel greater movement towards solutions. Using a sustainability framework (WCED, 1987), addressing the three legs of society, economics, and environment, provides a clear and useful platform to understand the implications of the central research question, "How do beginning farmer experiences with refrigeration access impact their perceived business success." Based upon responses from the four beginning farmers, the implications of perceived business success include complex trade-offs in decision making, impacts on market access-- options of where to sell produce, and an overall imbalance of farmer sustainability (see figure 5).

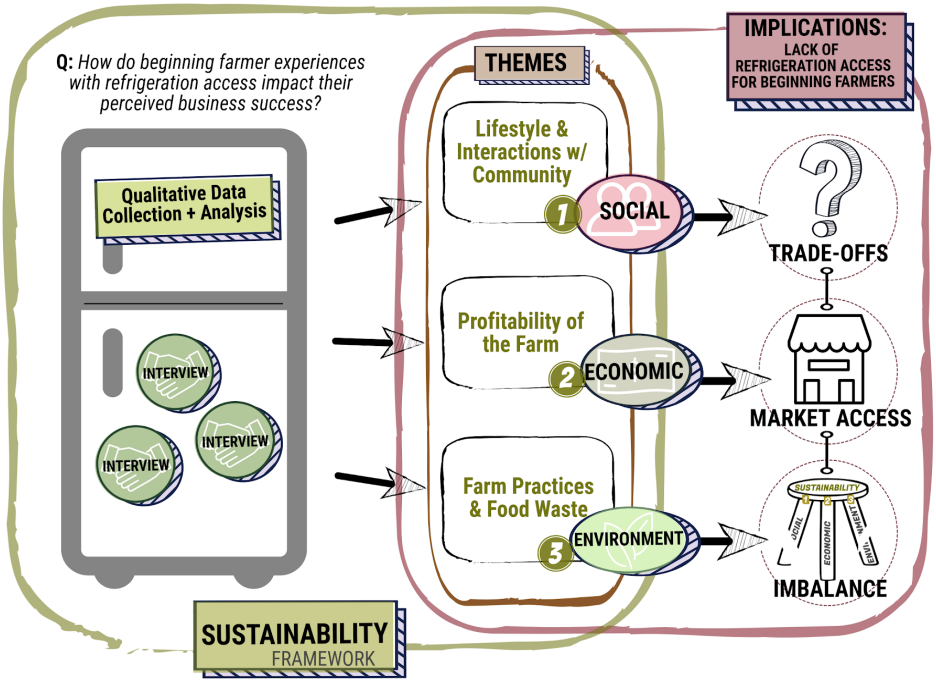

Figure 5. Revised Concept Map with Themes and Implications

1) Social: Trade-offs

The interview evidence suggests that access to refrigeration influences not only the fundamental nature of how beginning farmers farm, but also the quality of life for beginning farmers. At a time when American farmer suicides are at an alarming all-time high (Weingarten, 2018), with on-farm income plummeting - down 50% since 2013 (Litkowski & USDA ERS, 2019), the need to understand stressful trade-offs beginning farmers face becomes ever more urgent. Without understanding the challenges, complex decisions, and trade-offs facing beginning farmers the goal of adding 10,000 more farmers becomes even more distant.

The beginning farmers interviewed discussed stress they face as a result of altering their lifestyle to accommodate harvesting produce without having access to refrigeration on farm. The alterations in lifestyle were due, in part, to trade-offs such as: saving money to fix the barn roof instead of purchasing on-farm refrigeration; setting aside personal interests on Friday nights when perishable produce needs to be harvested before market (because there is not a large refrigeration unit to store produce a day or two prior); and working off-farm fulltime to supplement on-farm income.

It is not uncommon for beginning farmers to work off farm. Beginning farmers, defined as having fewer than 10 years of experience operating a farm, were included in the United States Census of Agriculture for the first time since the Census was established in 1840 (Trelogan, 1969). Taken once every five years, the Census of Agriculture counts farms, inquires about farm ownership, production, characteristics, demographics, and income/expenditures. All sizes of farms are surveyed, so long as they are "growing fruit, vegetables or some food animals [...] if $1,000 or more of such products were raised and sold, or normally would have been sold, during the Census year" (USDA NASS Census of Agriculture, 2019). The 2017 Census found beginning farmers, who are an average age of 46.3 years old, operated smaller farms than average and were 27% of U.S. producers in 2017 (908,274 total). Of particular importance, 72% (655,005) of beginning farmers worked off-farm. Working off-farm often means working two (or more) jobs at once. This can be stressful, as evidenced by John and Ethan's mixed feelings of relief that John planned to work full time on the farm for the first season.

Three of the four beginning farmers interviewed communicated their desire to support and feed their community; they saw themselves as successful members of society because of their produce contributions. Refrigeration, to them, is a way to increase the amount of produce available to the community. However, supporting the community can become a trade-off: the farmers interviewed value being care-takers for people and the planet, which, based upon the emphasis made in the interviews, seemed at times to come at the expense of personal care and stability. Ethan and John bought and sold other farmers' excess produce, which they said was ultimately more of a "good" thing to do for their community than a way to make a profit. The experiences the beginning farmers interviewed shared are in alignment with experiences I have heard from other produce farmers; I have never heard someone say they became a farmer solely for profit. Further investigation is needed to gain a greater understanding of the trade-offs beginning farmers face and the ways in which these trade-offs can be lessened.

2) Economics: Market Access

In addition to impacting quality of life, a lack of refrigeration storage capability often impacts market options, such as making selling to buyers like wholesale produce dealers unattainable. This is because there are often buyer-driven requirements for quality, and refrigeration use helps meet those conditions by providing conditions that maximize produce quality and freshness (Fields, 2018). The use of refrigeration provides produce farmers a longer sale window, allows them to "scale up" in size, and broadens market access to include wholesale and other larger markets. The experiences of the beginning farmers interviewed reflect the challenge of meeting buyer demand in that all of the farmers said they could not keep larger produce buyers supplied. The barrier of not having a place to store produce was compounded by a lack of labor, resulting in an inability to meet demand and overall lower perceived business success.

Farmer's markets and Community Supported Agriculture (CSA) shares are all "direct producer to consumer sales" markets, which tend to be easy access points for small and medium-sized farmers (see Figure 7, Bower et al., 2010). All four farmers noted the untapped opportunity to sell produce to "strategic partners" such as restaurants, grocery stores, and wholesalers, including Corey who

articulated, "...you can't keep them supplied. That's all there is to it. Even just restaurants, even if you, you're a farmer and you pick two restaurants, you're going to have to have an awfully big farm to keep those guys supplied."

To sell to markets that are beyond direct consumer markets (such as CSAs or selling at farmers markets), refrigeration is a necessary component. As evidenced by the beginning farmer interviews, fewer market options can mean less income, the potential need to work off-farm, the challenges of a smaller customer base, and the dynamic and often exhausting nature of direct marketing. While all three farms sold the majority of their produce at farmers markets, they planned to expand this coming season. This added another layer to their perception of success: they recognized refrigeration as a crucial element for scaling up in farm size.

Frustration with farmers markets resonated across all four beginning farmer interviews. Corey drove the point home in his statement, "We're all doing this and we're feeling good about it. Gosh darn it. We're all a bunch of a bunch of hippies and we're raising our plants. We've got our high tunnels and we're at our farmer's markets and nobody's showing up and it's raining. And I still got to be here." This frustration is not unique to Minnesota farmers markets and beginning farmers. According to the USDA, farmers markets increased by over 330.00% (from 2,000 in 1994 to more than 8,600 in 2019) nationwide (USDA, 2018). This combination led to a deficit of farmers to fill the market as well as too few farmers market shoppers (Helmer, 2019). The beginning farmers saw potential for greater business success beyond farmers markets, and refrigeration a means to access those larger markets.

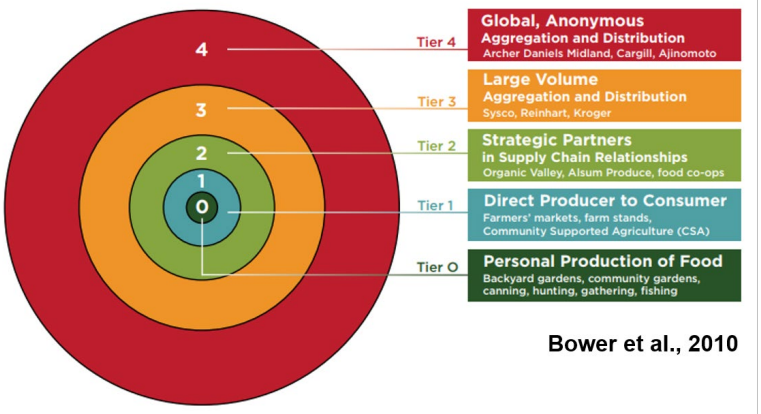

Figure 6. The Tiers of the Food System (Bower et al. 2010)

3) Environment: Imbalance

While each farm touched on the different elements of sustainability, including society, economics, and environment, each farm interviewed leaned towards a particular leg of the three-legged sustainability stool. The first farm interviewed made statements that were aligned with the economic leg, the second farm community, and the third a softer lean towards the environment leg. Although food waste and a concern for the land were themes present across all farms, there was not a farm that fully integrated environmental sustainability into their narrative. This may be, in part, due to the nature of the interview question asked and that the central research question addresses perceived business success -- which makes a natural favoring towards economics and society. The smaller presence of environmental sustainability can create an imbalance, leading to weaker overall farm stability.

The main themes that match the environmental leg of sustainability were farm practices and food waste, as discussed in the findings section of this paper. Food waste was most discussed, likely because it has a more natural tie to profitability and access to refrigeration. The combination of too few customers and not enough produce refrigeration leads to a very unprofitable compost pile, as evidenced by the beginning farmer experiences. Ethan noted on his farm they "have dropped hundreds of pounds of onions in the compost [...] we are kind of waste free in a way, cuz we compost it, but it is wasted money, wasted effort."

Food waste caused by farm production is being addressed nationally, ranging from the USDA (Stulberg, 2016) to the National Resource Defense Council (Gunder, 2012) to hunger relief organizations (Share Fresh, 2018). A Minnesota Department of Agriculture task force found lack of postharvest refrigeration a leading cause for food loss in the Minnesota food system (MDA, 2010). Incorporating cooling helps ensure the loss of field heat, reducing the potential for bacterial growth, leading to slower decay of the produce and thus longer lasting produce. Access to refrigeration is a food waste reduction and thus a potential farmer profit strategy that warrants further attention.

The three legs of sustainability need to be equally addressed or imbalance and lack of stability can worsen. The threat of lost stability is not conducive to keeping beginning farmers, let alone the aforementioned need to add 10,000 farmers to the land.

Implications

The findings from this phenomenological qualitative research project indicate a strong perception among the interviewed beginning farmers that refrigeration aids farm business success. While these findings are context-dependent due to the nature of the study, they demonstrate the need for further research. Such research needs to, first, include further investigation to understand a more complete picture of the trade-offs beginning farmers make which prevents the addition of refrigeration on farm. Second, the experiences of beginning farmer access to markets also warrants further study; refrigeration can help beginning farmers scale up in size to access larger markets such as wholesale and restaurants. Finally, if Extension and other farm support organizations are to answer the call to add 10,000 more farmers to the landscape, the imbalance of beginning farmer sustainability needs to be addressed. Future programming that can support beginning farmer access to refrigeration might look to state and national grant programs and other programming/training specific to beginning farmers.

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Definitions

Beginning Farmer - aligns with the USDA definition as someone who has operated a farm for less than 10 years (Beginning Farmers and Ranchers, n.d.).

Community Supported Agriculture (CSA) - USDA definition, "Community Supported Agriculture consists of a community of individuals who pledge support to a farm operation so that the farmland becomes, either legally or spiritually, the community's farm, with the growers and consumers providing mutual support and sharing the risks and benefits of food production." (Alternative Farming Systems Information Center USDA, 2019)

Farm - United States Department of Agriculture definition of a business that grows fruit, vegetables or some food animals with $1,000 or more of such products raised and sold in a calendar year.

Farmers Markets - A location where multiple farmers sell produce and goods produced on farm directly to customers.

High Tunnel - Method of growing produce or other crops outside, but enclosed in a large, long tunnel that acts like a greenhouse with a more controlled environment. High tunnels are common in areas that have shorter growing seasons as the tunnel creates a warmer environment that can be used for season extension.

Market Access - The channel or means for farmers to connect to options by which their products are sold.

On-Farm Income: Income that only comes as a result of farm business production.

Perceived Business Success - For the purposes of this study, perceived business success is defined as how farmers understand their own business stability, measured by the three legs of sustainability.

Refrigeration - the use of mechanical or other cooling techniques to extend produce life and maintain produce quality.

Sustainability - The nexus of prosperous community, economics, and environment to achieve long-term stability.

Tiers of the Food System - Direct Produce to Consumer: Tier 1, farmers markets, farm stands, and community supported agriculture (Bower et al. 2010).

Tiers of the Food System - Strategic Partners: Tier 2, supply chain food system participants such as restaurants, grocery stores, and wholesalers (Bower et al. 2010).

Wholesale Produce Buyer: An entity that buys and sells generally large produce quantities to other institutions, businesses, retailers, wholesalers, etc -- to anyone besides sale of produce to the end consumer.

APPENDIX CONTENTS

APPENDIX A

INTERVIEW PROTOCOL

Interview Protocol Project: Minnesota Beginning Farmer Experience with Refrigeration
Time of Interview:
Date:
Place:
Interviewer:
Interviewee:
Position of Interviewee:
Welcome and thank you for participating in this discussion. My name is Ren Olive, and I am a graduate student at the University of Minnesota, enrolled in a qualitative methods class. I also work with the UMN Extension - Regional Sustainable Development Partnerships on sustainable agriculture and food systems work. The information you share today will help me complete a research paper for the class on the topic of access to refrigeration. I invited you to participate in this interview because you align with the USDA definition of "beginning farmer."
I am interested in your thoughts and opinions. There are not wrong answers, only points of view. Your opinions are important to me, please to not worry if you are the only one who thinks a certain way. I am interested in understanding your points of view.

Explain consent form. Any questions? Okay, let's begin – I am going to begin recording now.

1. Tell me about your farm and your experience with farming? *(probe questions below)*
    a. Why do you farm?
    b. Of all the things you talked about on your farm, what do you treasure most? Why?
    c. How do you envision your future in farming?

2. What challenges or barriers do you face with your farm and farm business?

3. What is your experience with refrigeration on your farm?
    a. How much food waste does your farm produce? And How is "waste" handled on your farm?
    b. Have you considered renting refrigeration space as an alternative? Or, how have you shared tools or other equipment with other businesses or farmers before?

4. Compare how your workday on the farm would be different if you had access to larger-scale, affordable refrigeration. How would it change your workday? How would it change your overall operation? Goals?
    a. How would the use of refrigeration as part of your farm operation enable you to enact other sustainable practices on your farm?

5. From where do you get your information about farming?

6. Do you know any other farmers who do not have access to refrigeration on farm?

This is the first time I am interviewing on this project, is there anything else you would like to share with me? Are there questions you think that I should be asking that I have not?

Thank you for your time!

APPENDIX B

Consent Form

This document is a consent form for participation in a semi-structured interview as part of the qualitative research methods class beginning farmer experiences with refrigeration research project led by Ren Olive with the University of Minnesota Extension's Regional Sustainable Development Partnerships (RSDP). Your participation is voluntary. Feel free to ask any questions you have about the information on this form. Your decision about whether to participate will not in any way affect your role or relationship with RSDP, the University of Minnesota, or Ren Olive.

Purpose:
The purpose of this investigation is to understand how small and beginning farmer experiences with refrigeration access impact perceived business success. At this stage in the research, refrigeration is defined as the use of mechanical cooling techniques to extend produce life and maintain produce quality.

Procedures:
Interviewer Ren Olive will ask you to reflect on several questions related to your farming experience. A recording device will be used to record the conversation for later analysis of key themes that emerged; you may request the interviewer to stop the recording at any point of the interview. Also, you may leave the discussion at any time without consequence.

Confidentiality:
Interview results will be summarized and shared with the UMN Qualitative and Mixed Methods Research Design Class (DES 8103) and the Sustainable Agriculture and Research Education (SARE) organization (funder of the project), as well as RSDP communication pieces. Your name will not be associated with any of your comments unless you explicitly provide permission for us to do so on this form.

Questions:
Contact RSDP Program Associate, Sustainable Agriculture, and Food Systems Ren Olive at rolive@umn.edu or 612.701.3256 (cell).

❑ **I voluntarily agree to participate in this interview.**

_____ _____

Printed Name Date

_____

Signature