

Evaluating and Addressing the Transportation Challenges of Small-Scale Farmers and Ranchers in Regional Food Systems

by

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CHAPTER 1: Introduction

1. Introduction and Motivation

During the last 20 years, there has been a significant increase in US consumers' interest in local food (Thilmany and Woods, 2018; Zumkehr and Campbell, 2015). At the same time, there is substantial potential demand for crops produced by local small and mid-size farmers and ranchers whose market channels are short distance distributions (Halweil, 2002; Hincrichs, 2003; Morrison et al., 2011; Christian J. Peters et al., 2009; Rose et al., 2008). Although there is a variety of definitions for local food, it often refers to direct-to-customer market channels for farmers and ranchers, including farmers' markets and Community Supported Agriculture (CSA), as well as distribution through local businesses like restaurants, grocery stores, as well as local institutions such as hospitals and schools.

According to the USDA Agriculture Transportation Open Data Platform, food in conventional supply chains travels 1500 to 1700 miles on average from farm to table (Christian J Peters et al., 2009). Regionalizing food systems can potentially reduce food miles.

Reducing food miles has many advantages including: 1) *a significant decrease in greenhouse gas emission*, which is due to the fact that fresh and perishable, and frozen products usually need refrigeration in transit (Pelletier et al., 2011), 2) *substantial reduction in carbon foot print*, due to less required travel distance for food distribution, 3) *lower food wastes*, which is due to the shorter distribution stream from farm to table (Dawson and Hilton, 2011), 4) *cost reduction*, which is due to involving farmers who are in close proximity of consumers, 5) *higher local community engagement* in food production and distribution systems, and 6) *consumers' higher access to the local fresh and healthy food*, which would improve the health condition of people who are suffering from and struggling with diet-related diseases such as obesity, diabetes, high blood pressure, and heart attack.

However, small and mid-size farmers and ranchers that make up regional food systems (RFSs) are facing particular challenges with regard to transporting their products to their customers. Typically, these farmers and ranchers are geographically located far from the urban customers. The majority of small and mid-size farmers and ranchers lack an appropriate logistics infrastructure which further limits their access to urban markets. Therefore, this study attempts to shed light on potential solutions for addressing farmers' and ranchers' transportation challenges.

1.1. Conventional Food and Regional Food Systems

Conventional food systems (CFSs), which are well-known for their horizontally and vertically integrated structure of agri-food supply systems, made every effort to redesign for small-scale sales, long-haul transportation networks, and just-in-time demand fulfillment. This enables them to make their production flows continuous (Hobbs, 2020). However, the CFSs' structure of pre-defined package sizes and infrastructure designed for wholesale buyers are considered inflexible and vulnerable especially when the demand has fluctuated, and supply is disrupted (Clancy and

Ruhf, 2010; Dahlberg, 2008; United Nations, 2006). Due to the fact that CFSs are designed to maintain lower inventory for the sake of being cost-efficient, prevents them to satisfy the demand especially when there is an unexpected disruption in their demand or supply (Hobbs, 2020; Simchi-Levi and Simchi-Levi, 2020).

In contrast, RFSs, which have few intermediaries between producers and consumers, are characterized by decentralized logistics infrastructures. Their logistics systems are designed for sourcing food from farmers and ranchers who are located in geographic proximity to their consumers. RFSs are designed for short-distance transportation, and seasonal and regional production, with customized package sizes and infrastructure intended for retail sales and last-mile transportation networks.

1.2. Why Regional Food Systems Are Important

The decentralized logistics infrastructures of RFSs allow potential risk to be mitigated by distributing the risk among numerous miscellaneous food producers. As a result, RFSs regional self-reliance increases, and the adverse effects of a food supply disruption will be mitigated (Dahlberg, 2008). In fact, food systems that are designed for short-distance transportation, and seasonal and regional production may be a proper strategy both during normal situations and any potential unexpected phenomenon (Elbein, 2020; FAO, 2020).

1.2.1. Resilient and Flexible

RFSs have proved to be quite quick in their response to demand sudden disruptions; in particular during the COVID-19 pandemic. For example, as farm-to-table restaurant demand disappeared, many small-scale farmers, ranchers, and distributors were able to rapidly pivot to sell directly to consumers by increasing their staff and acquiring additional delivery vehicles to provide contact-free home deliveries and curbside pickups (Broyles, 2020; Heil, 2020). Therefore, the COVID-19 pandemic emergent could be perceived as an eye-opening prospect to re-evaluate and re-design the current practices and restructure existing agri-food systems, transitioning to new kinds of systems that support rural development and healthy diets for all society members, protect the environment, and better align food production and consumption to the principles of sustainable development (Mollenkopf et al., 2020; United Nations, 2020).

1.2.2. Promoting Sustainable Development Goals

The potential of RFSs to bring the principles of sustainable development to food production and consumption is based on the idea that regionally-produced food can be more economically, environmentally, and socially sustainable than conventionally-produced food (Giame Berti and Mulligan, 2016). Indeed, many consumers seek out RFSs for perceived benefits that include fresher, safer, and/or more nutritious food, reduced reliance on fossil fuel consumption, and the ability to support the local economy (Feldmann and Hamm, 2015; Martinez et al., 2010; Schnell, 2013). As such, RFSs have the potential to support several UN Sustainable Development Goals (SDGs), principally: zero hunger (SDG 2), good health and well-being (SDG 3), decent work and economic growth (SDG 8), sustainable cities and communities (SDG 11), and responsible consumption and production (SDG 12).

1.3. Regional Food System's Challenges Regarding Logistics and Transportation

Although RFSs are more resilient, flexible, and sustainable as compared to CFSs, to accomplish the long-term objectives toward sustainability and resilience, the ability of RFSs to constantly deliver food efficiently must be boosted. For RFSs to be scaled up sufficiently to meet consumer demand, scale-appropriate transportation strategies are necessary (FAO, 2020). Transporting food, especially refrigerated or frozen food, from geographically dispersed farm locations to distant urban demand centers is often cost-prohibitive (Miller et al., 2016). Most small and mid-sized farmers and ranchers do not have the necessary logistics infrastructure to support efficient transportation to reach urban demand centers, and they often lack the expertise, capital, and access to credit to acquire and implement such systems (Jensen, 2010). Therefore, their distribution networks tend to be fragmented and less efficient than the centralized distribution networks of CFSs (Gebresenbet and Bosona, 2012). This makes RFSs less economically sustainable (Ohberg, 2012). As such, RFSs must adopt efficiency-enhancing logistics best practices.

1.4. Addressing Regional Food Transportation Challenges

1.4.1. How to Address the Challenges

1.4.1.1. Adoption of logistics best practices

The long-standing sustainability and resilience of RFSs can be enhanced by employing some transportation best practices making food systems more efficient (Rogoff, 2014). As pointed out by (Mittal et al., 2018), some of the logistics best practices that have been employed by regional food supply chains are related to transportation management and improved efficiency. Some logistics best practices that have been employed by RFSs are: 1) *Efficient vehicle utilization*, 2) *Vehicle selection*, 3) *On-time and frequent deliveries*, 4) *Outsourced transportation*, and 5) *Horizontal collaboration*.

Although some recommended logistics best practices have been implemented by RFSs, still there is a huge gap in logistics best practices recommendations and implementations which makes more rooms for significant improvements in transportation area. This is due to the fact that the majority of RFSs logistical inefficiencies happen at the beginning and end of the distribution, in which several first and last-mile hauling increases transportation cost (Miller, 2013). Moreover, usually transportation coordination is more challenging in the RFSs, which is due to the lack of infrastructure to implement scale-appropriate vertical integration (Woods et al., 2013).

For instance, *storage*, in the RFSs is a significant challenge. In particular, products safety and efficient storage and handling of highly perishable products that need specific temperature control is challenging and expensive (Advisors, 2015) and is one of the major concerns of producers. In this regard, some best practices for maximizing the efficiency of storage for RFSs recommended by Mittal et al., 2018 were 1) having some mid-point aggregation points by defining the right distribution radius, which could also resolve the products safety and temperature control and 2) collaboration and sharing storage resources.

Moreover, *inventory management*, which refers to warehouse inventory tracking and management system, food safety, and supply and demand matching via demand forecasting (Blanchard, 2010; Opara, 2003) should be implemented by RFSs, since it enables producers to accurately satisfy their customers' delivery schedule and update their products inventory.

1.4.1.2. Leverage scale-appropriate information and communication technology (ICT) solutions to facilitate collaboration

Businesses' logistics have been revolutionized with the help of ICT, through which the collaboration of goods and sharing of information to the right place at the right time are facilitated (Mladenow et al., 2015). CT enhances the efficiency of businesses' logistics by promoting business-to-business (B2B) collaboration and information sharing, making trading activities more resilient, and improving resource utilization rates. This enables businesses to significantly reduce their transaction costs and time (Belk, 2014; Gansky, 2010; Taeihagh, 2017).

Some basic requirements are necessary for an effective digital business strategy. As pointed out by Bharadwaj et al., 2013; Pavlou and El Sawy, 2011, an efficient digital business strategy should offer an innovative marketing and distribution structure and stakeholders' networks that promote businesses' and producers' capabilities and implement value-focus business models.

Digital technology is actually introducing a reshaped market relationship by prohibiting the centralized intermediaries and offering a decentralized producer-focused strategy to create new bridges between producers and consumers.

According to the literature by Kramer and Porter (2011, p.66), Eckhardt and Bardhi (2015), and Schor and Fitzmaurice (2015), there are several amazing advantages to implementing digital business strategy as listed below:

- 1) ***Innovation and shared value***: digital business strategy focuses on shifting from short-term Economic Profit to long-term Shared Value. A digital food hub is an example of offering a digital business model that enables small and mid-size producers to build a distribution of shared value.
- 2) ***Access Economy (Collaborating, networking, and distributing)***: digital business strategy is a new method that allows consumers to utilize other underutilized services over a specific time period for a fee. As such, per Eckhardt and Bardhi, 2015, "*Sharing Economy isn't really a "sharing" economy at all; it's an Access Economy*".
- 3) ***Shifting from competitive to cooperative business strategy***: according to Ostby et al., (2016), digital business strategy enables small and mid-size producers to reconnect virtually to offer a regional food system that is more resilient and focused on localized supply chains. It helps producers to modify their natural mindset of "compete to survive" to "cooperate with competitors".

Shared value is an operating practice that shifts small and mid-size producers from competitive strategy toward cooperation strategy.

Clearly, due to the complex nature of perusing different and sometimes conflicting objectives, producers cannot completely rule out the competition. That is, via coopetition, producers cooperate in one kind of activity and compete in another. For instance, in their growing stage producers could share experience and knowledge with each other to yield higher quality and healthier products, and then in their selling stage, compete with one another to reach out to more customers and increase their market access.

As pointed out by [Porter \(1996\)](#), coopetition is one driving factor for producers with close geographic proximity. Having many local competitors, forces producers to shift from the conventional strategy of competition towards the innovative coopetition strategy by building a reformed relationship with their business peers.

The revolutionized concept of peer-to-peer coopetition offers two common relationship structures:

- 1) ***Horizontal Structure***, in which producers cooperate in sharing information, knowledge, and experience, enabling them to improve their production chains to gain competitive advantages over their business peer competitors.
- 2) ***Vertical Structure***: in which producers and buyers and/or distribution service providers cooperate and share resources to reach out to their market channels.

As pointed out by [Galdeano-Gómez et al. \(2015\)](#), it is worth mentioning that vertical structures sometimes reinforce competition among producers who are cooperating via horizontal structure. This is due to the fact that buyers and/or distribution service providers have a better understanding of consumers' preferences.

1.4.1.3. Implementing a crowd logistics approach

Crowd logistics —also known as crowdsourcing and crowd-shipping— is collaborative logistics and transportation approach with the concept of making collaboration happen between transportation services requesters (also known as senders or shippers) and transportation service providers (also known as carriers). This collaboration happens through logistics and delivery platforms that connect a group of individuals and companies as senders/shippers to a variety of carriers whose vehicle capacity and spare time are mostly underutilized.

Last-mile deliveries are the most expensive part of supply chain transportation ([Morganti et al., 2014](#)). As pointed out by ([Bubner, N., Bubner, N., Helbig, R. and Jeske, 2014](#); [Chen and Pan, 2016](#)), crowd-shipping (which is a package or parcel delivery method with the help of a group of individuals who use their underutilized vehicles and transport and deliver packages or parcels on their way to the drop-off points) has been known as a potential solution for addressing the challenges for the last-mile and long-haul deliveries. This is due to the fact that crowd-shipping offers more efficient method for those deliveries by enabling transportation service providers offering more flexible delivery schedules (i.e., the delivery time that matches the best with customers preferred times like after business hours or weekends) and utilizing their maximum distribution capacity. This making them capable of offering transportation services at a fair price ([Bubner, N., Bubner, N., Helbig, R. and Jeske, 2014](#)) without being forced to sacrifice their profit

margins. The crowd-shipping approach may have fewer negative environmental impacts (i.e., diminishing the CO₂ emissions) by employing individuals who are commuting the same route at the appropriate time anyway (Carbone et al., 2017; Rougès and Montreuil, 2014). Those individuals have extra (underutilized) vehicle capacity, time, as well as financial and social incentives (i.e., earning extra money in their spare time and also providing opportunities to meet new people and socialize with them).

In general, several benefits have been realized for crowd-shipping practices (Carbone et al., 2017; Mladenow et al., 2015; Rougès and Montreuil, 2014), including:

- 1) For customers: reduction in cycle time and price, the flexibility of delivery time, drop-off location, negotiable delivery price (by having access to multiple delivery offers), and instantaneous access to brand new products
- 2) For merchandizers (i.e., small and mid-size farmers and ranchers): lower distribution costs and lower operation costs, and simply being able to compete with larger-scale businesses (i.e., large-scale farmers and ranchers) that already have vertically and horizontally integrated logistics and transportation infrastructures
- 3) For society: fewer negative environmental impacts in terms of less CO₂ emissions and traffic congestions by retaining individuals with underutilized time and vehicle capacity who are traveling anyway, assisting individuals financially by giving them opportunities to earn extra money during their spare time

Given the fact that large-scale businesses like large-scale farmers and ranchers are different from small and mid-size farmers and ranchers in terms of their logistics and transportation infrastructure, selecting a scale-appropriate platform is a critical factor. In contrast with large-scale farmers and ranchers who benefit from their highly integrated (i.e., both vertically and horizontally integrated) and facilitated logistics supply chain systems, small and mid-size farmers and ranchers own fragmented logistics and transportation infrastructures which prevent them from being able to distribute their commodities to their customers in a cost and time-efficient manner. As a result, the suitability of logistics and delivery platforms should be evaluated efficiently by taking the size of businesses into account. One approach is to investigate and evaluate those platforms based on four characteristics (Frankenberger et al., 2013; Rougès and Montreuil, 2014):

- *Who* – refers to the customers, senders/shippers, and carriers. As pointed out by (Rougès and Montreuil, 2014), customers are commodity buyers, senders/shippers are sellers or producers who need transportation services, and carriers are commuters, travelers, drivers (both professional and non-professional)
- *What* – refers to the services and features that businesses offer. It is basically focused on two dimensions:
 - 1) The benefits that crowd-shipping offers to all stakeholders (i.e., customers, businesses as senders, and carriers as drivers). The benefits differ for each stakeholder.
 - Customers benefit from different perspectives:
 - Time flexibility to send or receive packages/parcels (i.e., after business hours and/or weekends)

- Financial incentives: lower delivery price, extra earnings for individual carriers during their spare times
 - Environmental benefits include fewer CO2 emissions by using the underutilized capacity of individuals who travel to the same destination anyway.
 - Operational advantages include reliability (i.e., on-time delivery) and safety (i.e., fewer lost or damaged packages/parcels)
 - Service-related benefits include real-time package tracking, in-app chat with carries, 24/7 support system
 - Geographical accessibility refers to being able to offer and purchase products that are not available in the customers' location.
- 2) Trust: Offering peer-reviewed rating and reviews feature: to help senders select their carriers based on their performance and service level quality.
- *How* – refers to the fundamental processes and capabilities, the approach/process, technology, and location.
 - 1) *Approach/process* refers to the match-making approach. The sender could be automatically being matched with carriers by selecting the most suitable one, senders have the option to select their carries, carriers can select their senders, senders can announce their delivery requirements, and carriers can post their availability and vehicle capacity, type, size, and equipment and wait for their request being accepted by the other parties, or customers can order their products on-line without having the chance to select their carriers.
 - 2) *Technology* refers to the ability of a platform to offer services like in-app transactions, in-app chat with carries, real-time tacking of packages/parcels, peer review and rating systems for both senders and carriers, 24/7 support system.
 - 3) *Location* refers to the area where a platform offers transportation services including intra-urban (i.e., within city/county), inter-urban (i.e., outside city/county), or global deliveries (i.e., international or outside the country).
 - *Why* – refers to the cost and revenue strategy. Cost refers to the price that customers pay for carriers' delivery services (which could be fixed and calculated by the platform or negotiable between senders and carriers) and platform fee. Revenue refers to the dollar amount of money earned by carriers.

1.5. Research Questions

RQ1: What are small and mid-size farmers' and ranchers' main transportation-related challenges? This question refers to challenges like high transportation cost and/or time, lack of appropriate vehicles, and being far from their distribution markets.

First, what are their transportation requirements? This question refers to the transportation characteristics that are necessary for distributing their products to their customers safe and intact. Some examples could be refrigerated vehicles, and multiple stops/deliveries at the same time. Secondly, what are their transportation preferences? This question refers to the transportation characteristics that are preferred by the farmers and ranchers but are not a requirement. Some examples of the transportation preference could be 1) having the same driver for their particular customers, 2) dress code requirements for the drivers, 3) drivers with high social and communication skills, and 4) drivers who have some agricultural knowledge or background.

RQ2: What are viable solutions to address these challenges?

- 1) Three options will be considered: Collaboration with other farmers in terms of product aggregation and/or transportation sharing
- 2) Outsourcing transportation to third-party organizations like 3PLs and/or food hubs
- 3) Outsourcing transportation to anonymous individuals

RQ3: Are existing delivery platforms suitable for small and mid-size farmers and ranchers?

The suitability of existing delivery platforms can be evaluated based on the following factors:

- Distribution channels
- Travel distance
- Distribution areas
- Shipment size
- Number of deliveries stops
- Equipment needed

1.6. Research Contribution

One contribution of this research study is a better understanding of the small and mid-size farmers' and ranchers' transportation challenges, requirements, and preferences. This could help to define and reach a consensus on a set of regional food transportation system functions that are necessary to address existing shortcomings.

Another contribution is to realize the extent to which the potential solution of collaboration and/or outsourcing transportation services to third-party organizations can address the farmers' and ranchers' transportation challenges in terms of cost, time, trust, and products safety. As many consumers seek out locally produced food for the expected benefits of being fresher, safer, and/or more nutritious food, reduced reliance on fossil fuel consumption, and the ability to support the local economy, the collaboration and/or outsourcing of transportation services to scale appropriate third-party organizations would offer several benefits which are aligned with UN Sustainable Development Goals. The benefits include *zero hunger, good health and well-being, decent work and economic growth, sustainable cities and communities, and responsible consumption and production.*

Finally, evaluating the suitability of the existing online platforms in terms of factors like *distribution channels, travel distance, distribution areas, shipment size, number of delivery stops, and required equipment* could answer the question if there is a need for developing and designing an online

transportation platform from scratch or some of the existing platforms can be used as a starting point and being modified to be suitable for small and mid-size farmers' and ranchers' transportation requirements and preferences.

1.7. Research Framework

This dissertation seeks to understand small and mid-size farmers' and ranchers' transportation-related challenges and explore, evaluate, and propose a scale-appropriate transportation platform to facilitate solving small and mid-size farmers' and ranchers' transportation-related challenges. As such, in “CHAPTER 2”, a comprehensive study was conducted on a systematic qualitative data analysis method for conducting a focus group study for the small and mid-size farmers and ranchers. in “CHAPTER 3”, then a comprehensive study is performed on exploring and evaluating the existing delivery platforms to see whether the existing platforms are suitable for small and mid-size farmers and ranchers. Finally, in “CHAPTER 4” the discussion, conclusion, and future research are explained.

CHAPTER 2: Focus Group Study

1. Introduction:

To provide a better understanding of Texas farmers' and ranchers' transportation capabilities, needs, and challenges, six focus groups were conducted with producers located throughout Texas, including North, Central, West, and South Texas. This research study is part of the Sustainable Agriculture Research and Education (SARE) project focusing on Regional Food Transportation for Texas Farmers which is funded by the United States Department of Agriculture (USDA). The SARE project seeks to explore and investigate the transportation-related challenges and issues faced by Texas farmers and ranchers. The overall goal of the SARE project is to design, develop and pilot a transportation management tool (a scale-appropriate transportation platform) that enables small and mid-size farmers and ranchers to form collaborative regional food transportation networks.

2. Research Questions

The study sought to answer the following research questions:

RQ1: What are small and mid-size farmers' and ranchers' main transportation-related challenges?

RQ2: What are viable solutions to address these challenges?

3. Research Framework

To increase the understanding of small and mid-size farmers' and ranchers' transportation-related challenges, the structure of this chapter is as follows. First, a literature review of the focus groups study as qualitative data analysis is presented. This section includes the qualitative data analysis method, goals for using focus groups use, the history of using focus groups studies in agriculture and farming area and other areas, and several steps involved in the planning and research design for focus groups. Second, the method used in this study for conducting focus groups study is explained in the "Method" section. Next, the method used for analyzing the focus groups' data is explained in detail in the "Data Analysis" section. Finally, the research results are discussed in the "Discussion and Conclusion" section.

4. Literature Review

4.1. Focus Groups as a Qualitative Data Analysis Method

According to [Morgan \(2012\)](#), qualitative methods are categorized into two main principal approaches which are 1) group data collection (i.e., focus groups), which is based on a group of participants' observations, knowledge, and experiences, and 2) individual data collection (i.e.,

individual interviews), in which information and inputs would be provided by individuals in one-on-one interviews.

According to [Morgan \(2012\)](#), “focus groups are basically group interviews, although not in the sense of an alternation between a researcher’s questions and the research participants’ responses. A focus group is a research technique that collects data through group interaction on a topic predetermined by the researcher.”

Each approach has its own benefits and none of them could be replaced by the other. Focus groups cannot substitute for the research studies conducted through individual one-on-one interviews, in which valuable inputs are provided by each individual. Some of the advantages of individual interviews over focus groups are: 1) higher amount of control that the interviewer has for potential follow-up questions to ensure minimizing any possible misunderstandings and poor interpretations, and 2) more time could be assigned to each person which leads to a greater amount of information from everyone. By contrast, focus groups require more attention from the facilitator to monitor the time and to prevent participants to go off-topic, resulting in less detail and deep information would be provided by each participant due to the time limits.

Similarly, focus groups cannot and should not be replaced with individual interviews since focus groups provide forms of data that cannot be revealed simply from one-on-one interviews.

One advantage that focus groups have as compared to one-on-one interviews is that the discussion among participants, with different backgrounds and experiences, results in richer and more informative information as inputs from each participant are different from others ([Runhaar et al., 2016](#)). [Morgan \(2012\)](#) contends instead of the traditional method of one-on-one interviews, conducting focus groups could benefit researchers by enabling them to observe the group interaction. This gives researchers insights that would not be accessible in traditional interviews. Focus groups enable participants to share their knowledge, standpoints, and experiences which results in a deeper and more informative discussion. Another advantage of focus groups over individual interviews is the ability of focus groups to gather greater amounts of data concentrated on the topic of research interest.

4.2. Goals for Focus Groups

As [Dilshad and Latif \(2013\)](#) and [Morgan \(2012\)](#) contend, there are three main uses for focus groups in the academic and scholarly research area. First, focus groups could be used as a *self-contained* method, in which focus groups serves as the main methods for collecting qualitative data. This includes participants’ individual observations, knowledge, ideas, and experiences and requires a solid match between the research goals and careful research design. Second, focus groups could be used as a *supplementary* method, in which the participants' group interaction and discussion are mostly used as preliminary data in an early qualitative research study. As a result, focus groups could be used either for creating survey questionnaires or as a qualified source for follow-up interviews to ease the process of misunderstandings or poor interpretations of survey results. Third, focus groups could be used as a *multimethod approach*, in which the focus groups would provide additional inputs to the data collected from other qualitative methods such as one-on-one interviews. This includes combining data from other qualitative methods with focus groups in a unique way that significantly depends on the goals, limitations, and opportunities of the research under study.

4.3. The History of Using Focus Group Studies

The literature shows a significant growth in the implementation of focus groups in academic journals ([Morgan, 2012](#)).

According to the literature, several research studies have been conducted using focus group methodology and qualitative analysis methods have been used to analyze the focus groups data. Some of the agricultural-related studies that used focus groups are described below.

[Johnson, Sue Ellen, Marion Bowlan, Jane McGonigal, Kathryn Ruhf \(2001\)](#), implemented the focus groups research study conducted by a network of Northeast new farms in 2001 to explore the new farmers' needs. The authors determined that as beginning farmers gain experience, their needs and requirements change.

[Rabiee \(2004\)](#) provided a comprehensive guideline for a technique of conducting focus groups studies. The focus group is defined by [Thomas et al., 1995](#) as “a technique involving the use of in-depth group interviews in which participants are selected because they are purposive, although not necessarily representative, sampling of a specific population, this group being ‘focused’ on a given topic”. Second, the author explained the data analysis techniques focus groups as qualitative research. Third, the practical steps for managing and sorting out data are presented. Fourth, the way that focus groups' data could be interpreted is explained. Fifth, the method for framework development is introduced.

In another study, to engage potato producers, crop insurance companies, and lenders in an educational risk management project, focus groups study have been conducted ([Gustafson, 2006](#)). The authors contended that the focus groups suggested more productive methods for enhancing the potato producers' insurance.

[Onwuegbuzie et al. \(2009\)](#) provided a new qualitative framework for collecting and analyzing focus group data. The framework included three steps which were 1) classifying the collectible data type for focus groups, 2) classifying focus groups' qualitative data analysis, and 3) micro-interlocutor analysis, in which the method of collecting, identifying, analyzing, and interpreting each participant's response to each question as well as characteristics of participants' responses was explained.

[Moretti et al. \(2011\)](#) described the several steps of conducting focus group research. The authors performed a content analysis on 27 focus groups conducted in the Netherlands (Utrecht), the UK (Liverpool), and Italy (Verona). Four steps were used for the analysis of the conducted focus groups as listed below:

- 1) Classifying/categorizing the participants' responses
- 2) Reaching an agreement on the categories
- 3) Creating rules for coding the focus groups data including categories and subcategories
- 4) Proposing a method to identify and revise unreliable categories

The proposed coding procedure showed how focus group data could be systematically analyzed which might be useful for other focus group research on different issues.

As [Dilshad and Latif \(2013\)](#) pointed out, a focus group interview is one of the suitable methods for collecting and analyzing qualitative data. The author evaluated the various forms of focus groups, moderator qualifications, and responsibilities. The authors believed that focus groups studies conducted by well-trained team members may result in a better understanding and several perspectives on a specific issue. The authors provided a guideline for the technique of conducting focus groups studies and explained the principles for efficient focus groups.

[Nyumba et al. \(2018\)](#) reviewed the literature on the focus groups studies applications from 1996 to 2017. Their research introduced a brief explanation of the use of focus groups studies as a qualitative research technique for first-time users. They also used Scopus and provided an in-depth discussion about the focus groups application methods extracted from a structured literature review. The authors illustrated the qualitative research design process as shown below and explained each stage in detail. Several steps introduced by the authors were: 1) research design, 2) data collection, 3) analysis, and 4) results and reporting.

4.3.1. The History of Using Focus Groups Studies in the Agriculture and Farming Area

To explore and evaluate the correlation between the educational level, educational needs, and young beginning farmers' and ranchers' programming preferences in Montana, ([Bailey et al., 2014](#)) conducted focus groups and presented their findings concerning their focus groups participants. Their study can be a starting point and guideline for future studies in a similar area.

[Belage et al. \(2019\)](#) attempted to find out the Ontario dairy farmers' perspectives and behaviors towards challenges of implementing the recommended milking practices (RMP) to explore the inducements that changed the milk producers' behaviors concerning milking hygiene. The authors conducted four focus groups and the major RMP adoption challenge was classified into two groups which were: 1) Intrinsic challenges — which referred to milk producers' individual preferences and convenience and lack of information and education, 2) physical challenges including labor training, time, financial issues. Using a qualitative analysis method, the authors found four themes which were: 1) helping milk producers to realize the importance of implementing RMP, 2) developing necessary educational programs, 3) reevaluating the current milking practices, and 4) establishing new best practices.

Another study, [Travlos \(2019\)](#) conducted a focus groups study to explore the major barriers that new farmers were facing. The author classified the barriers as time, program awareness, program resources, and program requirements and eligibility.

[Dik et al. \(2021\)](#) proposed an assessment framework for classifying the professionalization degree of farmers' collectives concerning their impacts on Agri-environment schemes (AESs). To gain insight into a professionalization degree, Dutch farmer collectives working with AESs have been selected as participants for their focus groups. They introduced three professionalization classes which were; organizational, systematic, and occupational. They revealed that in addition to directly impacting the ecological goal achievement, these three classes enable agricultural systems to supervise and evaluate agrobiodiversity, provide education, and propose ecological qualifications for the AES stakeholders.

5. Planning and Research Design for Focus Groups

Considering focus groups methodology as qualitative research, it is necessary to follow the main four phases of qualitative research introduced by [Kirk and Miller \(1986\)](#) which are: 1) planning, 2) observation, 3) analysis, and 4) reporting.

▪ **Planning:**

Since focus groups include the participation of several individuals, specific attention should be devoted to who the participants are and how the researchers will interact with them as a group. Focus groups are significantly affected and constrained by factors such as 1) participants' geographical location, 2) determining the number of focus groups — based on rules of thumb introduced by [Morgan \(2012\)](#), total of three to five groups per project would be sufficient), 3) defining the size of the group (i.e., number of participants in each focus groups session) — based on rules of thumb introduced by [Morgan \(2012\)](#), the best number of participants would be 6 to 10 people per group, 4) budget limit (i.e., budget assigned for participation financial reward for their time they spend in focus groups sessions, travel expense either for participants or research team for visiting sites, rental of research sites), 5) time (i.e., focus groups conducting schedule, focus groups duration, recruitment of participants, Institutional Review Board (IRB) approval time), 6) defining focus groups research team members and their responsibilities (i.e., as a facilitator, note takers, recorders, transcribers, data analysts), 7) focus groups questions, 8) focus groups Institutional Review Board (IRB) approval, and 9) defining the procedure of focus groups recording, transcribing, anonymize the transcriptions, extracting data, analyzing and reporting data.

▪ **Observation:**

[Morgan and Hoffman \(2018\)](#), introduced four criteria for the focus groups observation which are: 1) range, 2) specificity, 3) depth, and 4) personal context.

- **Range:** refers to focus groups' range of topics that not only should include the issues and challenges that researchers already being aware of their importance but also must consider the issues and challenges that researchers might overlook but are more likely for participants to bring up.
- **Specificity:** refers to the capability of the focus groups facilitator to direct the focus groups discussions toward solid and detailed information provided by the participants regarding a specific topic. Since it is highly possible for participants to drift off into generalization, it is the focus groups facilitator's major responsibility to prevent this from happening by emphasizing hearing out the participants' specific opinions and experiences about a specific topic. This could be handled by spending more time on a specific topic and encouraging participants to share their opinions and suggestions.
- **Depth:** refers to ensuring that participants are completely involved in the topics they are discussing and help them to avoid any kind of vague generalizations. The depth of information could be guaranteed by making participants more involved with the topic

by emphasizing to participants the importance of generating a high level of depth information by sharing their personal experiences with the whole group.

- **Personal Context:** refers to the question of “why a particular participant reveals or expresses a subject in a particular way?”. [Morgan and Hoffman \(2018\)](#) pointed out that “*Perspectives and personal contexts may be based on the social roles and categories that the participants occupy; they may also be rooted in more individual experiences*”.

- **Analysis:**

To be able to report the focus groups’ findings efficiently, the research team members should implement a systematic analysis technique to generate detailed outputs from focus groups' data. As pointed out by [Morgan \(2012\)](#) one of the most efficient and systematic techniques for analyzing qualitative data would be divided into two steps which are: 1) coding the data, and 2) interpreting the data.

- **Coding the data:**

As [Morgan \(2012\)](#) contends, the unit of analysis in coding is one of the major concerns. As such, the most effective way of coding the focus groups’ data would be considering the group, not the individual, as a basic unit of analysis. The research team members have to make a balance between the information and inputs at the individual and group levels. [Morgan \(2012\)](#) introduced three popular strategies of coding qualitative research like focus groups transcripts which are 1) include all information that is mentioned for a specific code, 2) distinguish individual information from the group information, and 3) explore if a specific code is mentioned in each group’s conversation. The majority of the time these three strategies could be nested within each other which enables the researcher to determine if a specific issue was pointed out by a particular individual in a particular group or both. Moreover, using combination of these three strategies, benefits researchers in term of ease the process of coding in both individual and group level. Therefore, using qualitative analysis software, research team can generate report that distinguishes, for any given code, which individual participant and which focus group brought in which portion of the topic as well as compare all different groups and specify how often, if any, a given topic has been mentioned in each group.

- **Interpreting the data:**

The focus of the data interpretation is determining what issue has attracted participants’ interest the most. In this regard, [Morgan \(2012\)](#) introduced three main factors that affect the number of emphasis participants gave to a given issue. The factors in exact words are “1) *how many groups mentioned the topic*, 2) *how many people within each of these groups mentioned the topic*, and 3) *how much energy and enthusiasm the topic generated among the participants*”.

It is very common for the researcher team to use a combination of these three interpretation factors which is known as “group-to-group validation”. As pointed out by [Morgan \(2012\)](#),

group-to-group validation for each given issue shows the amount of participants' interest concerning that issue and the amount of time they assigned to discuss that specific issue.

▪ **Reporting:**

An important factor that must be considered is that a justifiable balance should be made between the summary of the focus groups discussions and the participants’ direct quotations. Too much summary and too many quotations both reduce the quality and effectiveness of the focus groups report.

Figure 1 shows the flow chart of steps for conducting and analyzing focus groups.

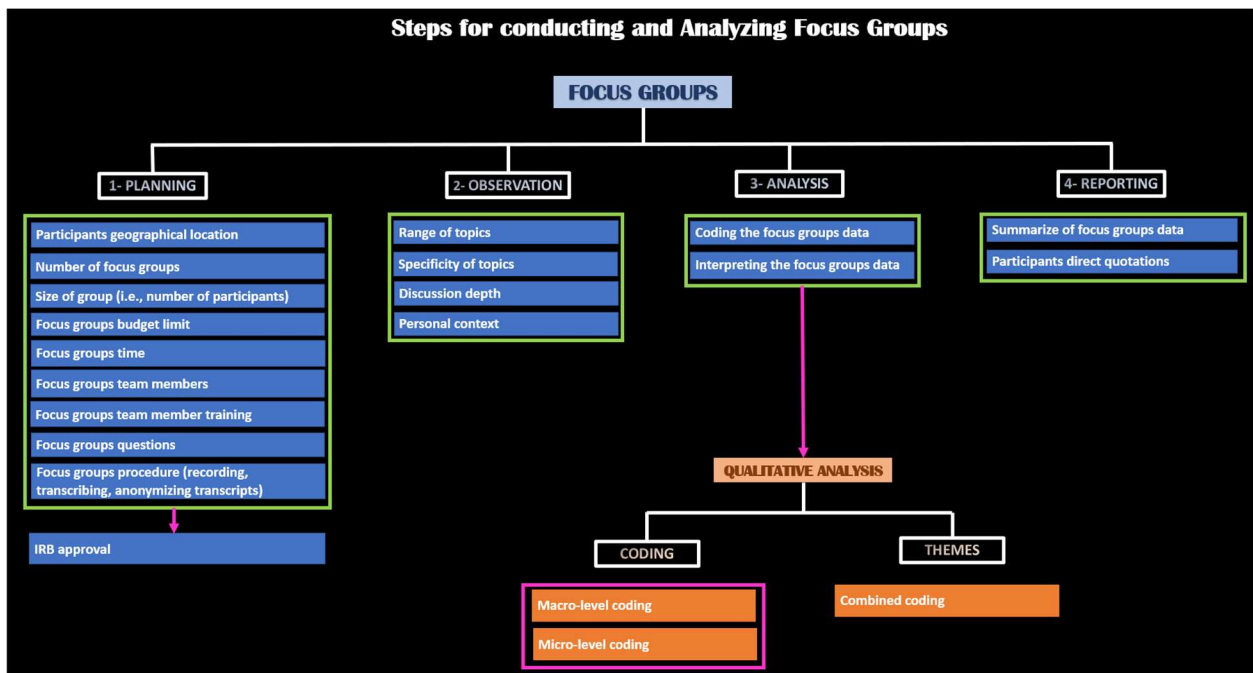


Figure 1. Flow chart of steps for conducting and analyzing focus groups

In another study conducted by Nyumba et al. (2018), the qualitative research design process was divided into four main steps and several sub-steps. The four steps introduced by the authors were: 1) research design, 2) data collection, 3) analysis, and 4) results and reporting. The *research design* step was divided into three sub-steps including: 1) defining the focus group purpose, defining a list of key questions, and exploring the clearance of ethics, 2) identifying and recruiting the focus group participants, ensuring the gender, education level, and language, defining the number of focus groups, defining the number of participants in each group, assigning a facilitator and assistant for taking note, recording, 3) identifying the suitable location for focus groups.

The *data collection* step was divided into two sub-steps including: 1) pre-session preparation which referred to being familiar with group dynamics, equipment operation, and duration of each focus group, and 2) defining the facilitation procedure during the focus group meeting which referred to introducing the focus group research team member, ground rules, discussion process, tracking the questions and asking follow-up questions, and closing and acknowledging participants.

The *analysis* step was divided into 1) ranking the participants' answers, 2) coding (main ideas, themes), 3) content analysis, 4) discourse analysis, and 5) conversation analysis.

Finally, the *result and reporting* step referred to the targeted audience of the research study and divided them into 1) academics, 2) policy makers and practitioners, and 3) participants of the research study.

6. Methods

In this research study, as a part of the SARE project introduced earlier in this paper, six focus groups were conducted in which the farmers and ranchers located in the North, Central, West, East, and Southern area of Texas — as a representative of Texas regional food stakeholders who have first-hand knowledge and experiences in regional food transportation in Texas — were the targeted participants.

The research team was of UTA and non-UTA team members. UTA team members included two UTA faculty members as principal investigator (PI) and co-principal investigator (Co-PI), one Ph.D. student, and one master's student responsible for actively recruiting subjects or answering questions about the study, obtaining subject consent, and having access to identifiable focus groups information, transcribing the focus groups and analyze the data. Non-UTA team members included the Texas Center for Local Food (TCLF) manager and National Center for Appropriate Technology (NCAT) responsible for moderating the focus groups and actively recruiting subjects or answering questions about the study, obtaining subject consent, and having access to identifiable focus groups information.

The tasks that I was responsible for included writing the focus groups' questions, taking notes and transcribing the conducted focus groups' discussions, cleaning the focus groups' transcripts by removing any specific farmers' and farms' names, and extracting and classifying the focus groups' data, defining the overarching themes, and writing reports.

During the focus groups participants have been asked the following questions which are based on a collaborative effort with help from Texas Center for Local Food (TCLF) and National Center for Appropriate Technology (NCAT) as cooperative partners in this research:

- 1) **What are your transportation challenges, and what factors prevent you from reaching urban buyers?**
 - a. What are your top three “pain points” with respect to transportation?
 - b. Describe your current storage and transportation equipment and how does the current equipment you have impact your transportation?

- c. Other barriers?
- d. What, if anything, would help you reach urban markets better?

2) How do you feel about collaborating/outsourcing for transportation?

- a. How do you feel about outsourcing your transportation to other farmers? What would it take to make you feel good/better about collaborating with other farmers?"
- b. How do you feel about outsourcing your transportation to private distribution companies? [privacy, reliability, trust...?]
- c. How do you feel about outsourcing your transportation to other individuals?
- d. Other ideas and thoughts?

3) How do you think the transportation problems could be solved?

6.1. Institutional Review Board

The University of Texas at Arlington's (UTA) Institutional Review Board (IRB) requires studies that involve human subjects to undergo a restricted assessment to ensure the research is being conducted ethically to assure that no significant risk comes to the participants and to guarantee the safety and privacy of the participants. To certify the integrity and participants' privacy, participants were given a consent letter (created by QuestionPro, provided by UTA). In the consent letter, participants were provided with information regarding the study's purpose, procedures, participant risks, and benefits, criteria to ensure their privacy, and their ability to stop participating in the focus group at any point during the study with no penalty and negative consequence. The way that each focus group session would be recorded and transcribed, and the potential publications and reports in a way that guaranteed participants were not directly identified when publishing results were explained to participants.

6.2. Protocols

To increase the efficiency of the focus groups, before the IRB approval process, the validity and quality of the focus group questions were reviewed and revised by all project team members in an iterative process. The revisions included rephrasing questions to make them clear and simple to help participants completely understand what they are being asked, removing unrelated questions, and changing questions in cases they were not triggering the desired conversations.

There would be some follow-up interviews with some of the farmers and ranchers who have participated in the focus groups to reach an agreement regarding the transportation-related challenges and issues that farmers and ranchers are struggling with. The follow-up questions will be approved by UTA's IRB before conducting any interviews.

6.3. Focus Group Procedure

In total, six focus groups with a total of seventeen Texas farmers and ranchers have been conducted in the North, Central, West, East, and Southern area of Texas as shown in Figure 2. Each focus group meeting lasted about 90 minutes. Two types of researchers were involved: one facilitated the meeting and the second observing and taking notes. At the beginning of each focus group session, the facilitator welcomed the participants and introduced herself. Then all the research members introduced themselves. Following the welcome and introduction, the facilitator explained the objectives of the study and informed the participant one more time that the meeting is being recorded and after notes were taken the recording would be deleted. To facilitate the meetings, the facilitator set some basic rules for participants. As pointed out by [Runhaar et al. \(2016\)](#), it is more likely that one or more participants dominate the discussion or are off-topic. As a result, the facilitator did her best to avoid the above-mentioned issues and ask for direct and topic-related input from participants and make the intermediate conclusion to assure consensus among participants and researchers. Before asking questions, participants were asked to introduce themselves and briefly explain their operations and business scales.

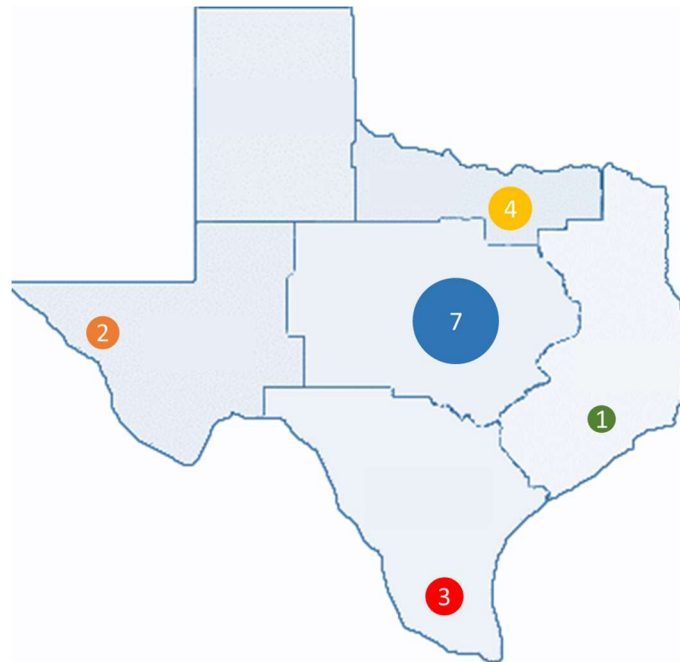


Figure 2. Six focus groups with a total of seventeen Texas farmers and ranchers

6.4. Focus Groups Transcription Process

The focus groups recordings were transcribed using the transcribe feature in the “Dictate” tab of the word document. As promised in the focus group IRB protocol, to respect the participants' privacy, the name of participants has been replaced with P#, and participants' operations/farms name, and any persons' name mentioned by the participants during the focus groups have been deleted. The cleaned version of focus groups transcripts then has been shared with other project team members for further analysis. All the project team members also took the Human Subject Training modules and were approved by the IRB.

7. Data Analysis

To be able to analyze the focus groups data, first, each project team member extracted data from participants' inputs based on their point of view from the cleaned version of transcribed focus groups and entered the data into an excel file. Based on the questions asked in the focus groups, an excel file was created which included different sheets.

The first sheet called “*FG_questions*” included the focus group questions. The second sheet called “*reponse_summary*” included the focus group questions presented in different columns. The third sheet called “*quotes_operational_requirements*” included inputs regarding the operational requirements pointed out by participants. The fourth sheet called “*quotes_six_affordances*” included the transportation platform affordances. The affordances that were extracted from a comprehensive review paper in sharing economy area written by [Sutherland and Jarrahi \(2018\)](#) included;

- 1) Flexibility: background screening / registration documents for transportation providers
- 2) Matchmaking: options to select transportation providers (e.g., single best match, list of all providers).
- 3) Extending Reach: network size (regional, statewide, or nationwide)
- 4) Transaction management: value-added features and miscellaneous functionalities (e.g., in-app transaction, routing)
- 5) Trust building: peer review and platform perform quality control through reviews
- 6) Collectivity: other participants are within/outside a farmer's social network

All of these Excel file sheets are illustrated in Figures 2-4.

One of the most popular methods for analyzing focus groups study is qualitative data analysis. As pointed out by [Merriam and Tisdell. \(2015\)](#), a basic component of qualitative research and analysis is that each participant constructs and reveal their knowledge based on their own experiences.

After data was collected and the major points were extracted from participants' inputs, as the next step the patterns that could classify the data were identified. As revealed by [Merriam and Tisdell \(2015\)](#) “*the analysis of data involves identifying recurring patterns that characterize the data. Findings are these recurring patterns or themes supported by the data from which they are derived*” (p. 25)”. In the qualitative data analysis method, identification of the pattern in data is referred to as coding.

Following the qualitative analysis approach, in this study first, the high level of coding, which is classifying data based on the high-level category has been used. To increase the quality of the results and analysis, the high-level categories were broken down into the lower-level categories referred to as sub-categories. For example, vehicle issues were mentioned by a majority of participants as a major transportation challenge. So “*Vehicle*” has been considered one high-level code. More specifically, based on the detailed inputs provided by the participants, some farmers are struggling with their vehicle size. That is, their vehicle does not have enough capacity for their routine deliveries. Others complained about not having a refrigerated vehicle, which prevents them from keeping their products at an appropriate temperature while in transit. So, *Vehicle size* and *Vehicle infrastructure/equipment* are assigned as sub-categories for Vehicles.

FG No.	Team Member Name	Transportation Challenges		Other challenges		Ideas on how reach out more urban buyers	Farmers about collaborating/outsourcing		Advantages of collaboration/outsourcing		Disadvantages of collaboration/outsourcing		Specific app used			Other solutions/ suggestions to solve transportation problems
		Summary/Quotes	Category	Summary/Quotes	Category		Summary/Quotes	Category	Summary/Quotes	Category	Summary/Quotes	Category	Name of the Apps	Benefits of using the app	Shortcomings of using the app	

Figure 2. Data collections excel file- sheet 2

FG No.	Team Member Name	Multiple deliveries/ stops	Transportation distance required (within/outside county)	Package size (packages/ parcels/ Pallet loads)	Willingness to have a long-term delivery contract	Appropriate vehicle size (personal /commercial truck)	Refrigeration required	Cargo insurance required for carriers	Willingness to use a platform if it offers a different delivery driver every time	Others

Figure 3. Data collections excel file- sheet 3

FG No.	Team Member Name	Flexibility (background screening/ registration documents for transportation providers)	Extending reach: network size (regional, statewide or nationwide)	Transaction management: value-added features and miscellaneous functionalities (e.g., in-app transaction, routing)	Trust building: peer review and platform performs quality control through reviews	Collectivity: other participants are within/outside a farmer's social network	Matchmaking: options to select transportation provider (e.g., single best match, list of all providers)

Figure 4. Data collections excel file- sheet 4

8. Results

The results discussed in this chapter are extracted from careful data analysis by the research team. After extracting and grouping the data from conducted focus groups, reoccurring themes were identified and then combined into overarching themes. The identified themes represent the transportation challenges for small and mid-size farmers and ranchers in Texas including the farmers’ and ranchers’ pain points in reaching urban markets, their ideas on how to overcome pain points, their views on collaboration and outsourcing for transportation, and potential solutions to overcome transportation challenges. The summary of the identified themes is presented in Figures 5 and 6.

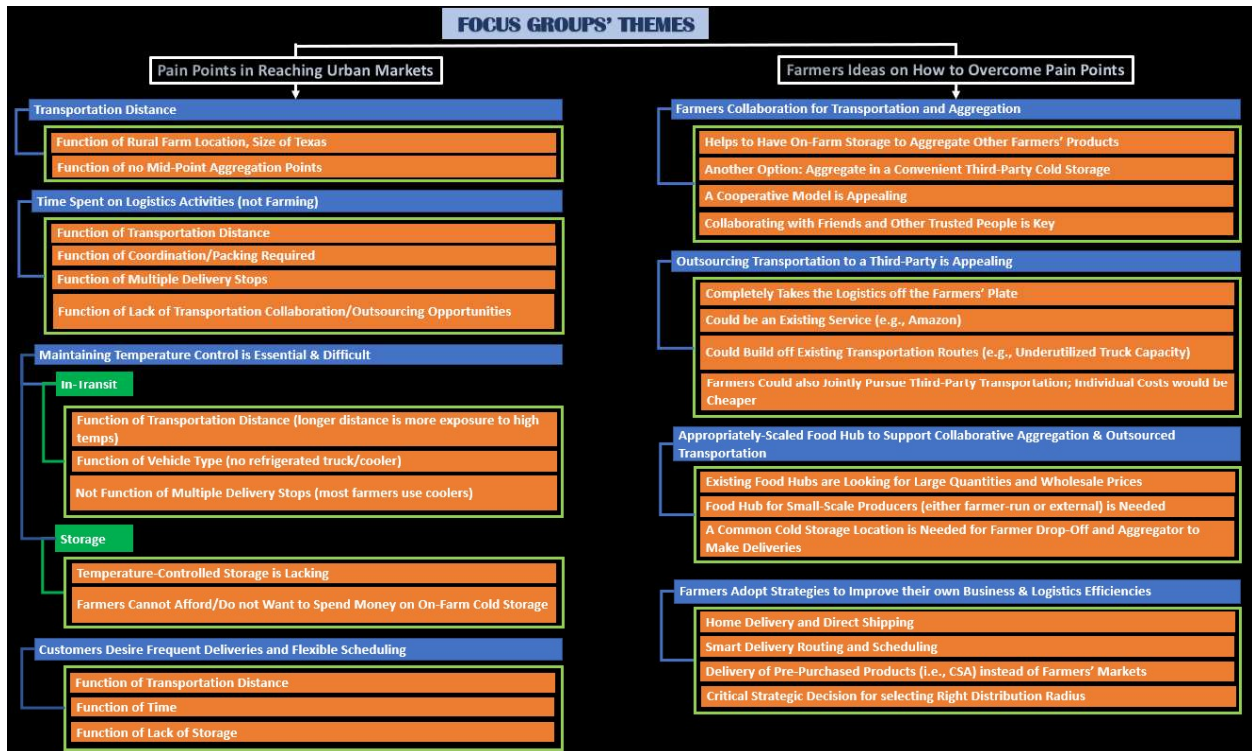


Figure 5. Summary of identified themes - 1

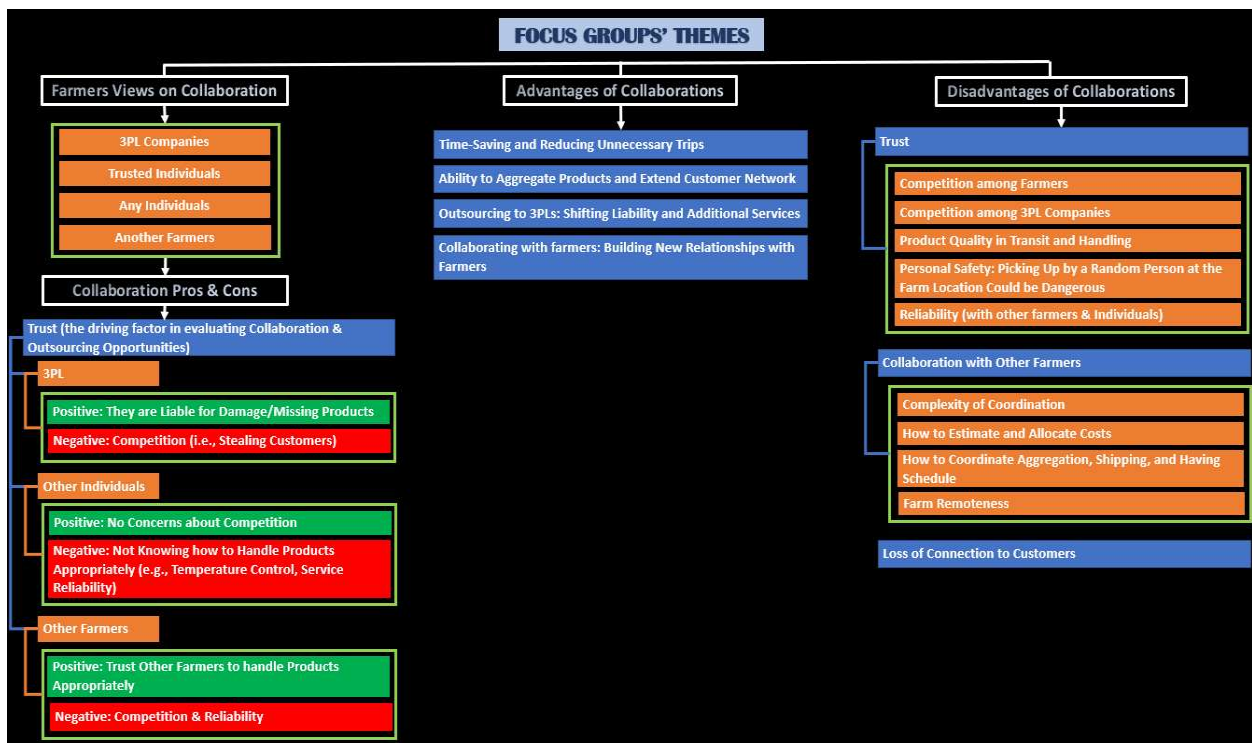


Figure 6. Summary of identified themes – 2

8.1. Farmers' and ranchers' challenges in reaching urban markets:

Four themes were identified that summarized the main challenges that farmers and ranchers experienced in reaching urban markets: 1) transportation distance, 2) time spent on logistics activities, 3) maintaining temperature control, 4) and customer desire for frequent deliveries, and flexible scheduling.

▪ **Transportation Distance:**

According to focus groups participants, one of the major challenges perceived by small-scale food producers is that the transportation distance from farms to urban markets is long. This issue is a function of two factors:

- 1) Rural farm location considering the size of Texas State
- 2) Lack of mid-point aggregation points

Focus group participants' quotes:

Regarding the transportation distance, which is the *function of rural farm location*, the following are some participants' quotes:

“Right now, the main issue here is that sometimes we have markets outside El Paso and that’s become an issue. I’m sure we can sell way more in different parts of Texas, but we don’t have the transportation for San Antonio or Austin. You know, that’s I don’t know like 9-10 hours from El Paso. It’s kind of long time.”

“If I wanted to drive to Austin, I could have a lot bigger market. But it takes me an hour to get to Austin.”

Regarding the transportation distance which is the *function of no mid-point aggregation point*, the following is one of the participants' quotes:

“So, a friend of mine started one of those in North Carolina. Same thing refrigerated vans in a bit of a refrigerated warehouse. He moved down here a couple of years ago, but his advantage in North Carolina was that in a 40-mile radius he could stop at 150 farms. We have the inverse in 150 mile radius. You’re lucky if you can get 40 farms, so our distance is probably our greatest barrier.”

▪ **Time Spent on Logistics Activities:**

Time spent on logistics activities was viewed as a time not spent on farming activities and was a function of four factors:

- 1) Transport distance
- 2) Coordination/packing
- 3) Multiple delivery stops
- 4) A lack of transportation collaboration/outsourcing opportunities

Focus group participants' quotes:

Regarding the time spend on logistics activities not farming activities one participant said:

“It takes a lot of time to deliver from one side of the Valley to the other and then I'm not dedicating that time or energy to the farm itself and I primarily work alone.”

Regarding the time spend on logistics activities which is the function of transportation distance, the following are some participants' quotes:

“But like the main thing that's the problem is just time, like just time. That's all the biggest problem with everything on our farm is having enough time to do everything and delivering stuff takes a lot of time for us, which is also why I said, we sell mostly to restaurants just in Wimberley If I wanted to drive to Austin, I could have a lot bigger markets. But it takes me an hour to get to Austin even driving to deliver to the Co-op 's drop point. As in Martindale, which is 45 minutes away, so that's 45 minutes to an hour each direction.”

“Two of us work during the day, so one of the farms is kind of had to take over, uh, some of the daily things. But then weekend markets and those of us that can't do the weekday activities try to help out a little bit more on the weekends and whatnot. Of course, it becomes a fine balance of time with the family. And for us, harvesting and whatnot, because harvesting vegetables seems to take a lot more time than doing anything with meats and other type of farming aspects. So, I'd say that's been one of our biggest challenges. There is just the time management aspect of it.”

Regarding the time spent on logistics activities which is the function of coordination/packing required, the following is one of the participants quote:

“I'm actually borrowing a friend's mini yesterday to go to the processor. I can put you know, 2 Big coolers in the back in my car which you know is again kind of brings in the time thing because I have to organize those cooler. Just pull orders out and you know kind of in the delivery order. And so, it's kind of a logistical pain. And you know, not only do I have the time to drive, but I have the time to pack the orders into you know bags or boxes packs and then just the cooler. Pack them into the car, unpacked them from the cooler from the car. Walk up to somebody's doorstep. You know, I think probably each delivery, not counting drive time, probably takes me about 15 to 20 minutes of time to sort of get everything organized.”

Regarding the time spent on logistics activities which is the function of multiple delivery stops, the following is one of the participants' quotes:

“We tend to work with, you know, small quantities, but just a lot of them, right? So, a lot of different delivery stops, so we just try to make sure that on our delivery route that if someone calls up and says hey, I want to start working with you, we gotta make sure that it's not actually going to eat into our schedule. So, we'll make sure to actually pick up a new customer on the on the same delivery route if it fits, and if not then it will go to another day.”

Regarding the time spend on logistics activities which is the function of a lack of transportation collaboration/outsourcing opportunities, the following are some participants' quotes:

“I think here locally we're so different than everywhere else in the state because you know you've got the major produce hubs with both what's grown locally, and then what's coming across from Mexico. And you know when you look at transportation, they've got all of the advantages there with the major hubs that us as smaller growers have to figure out something different.”

“You know I had worked with a bunch of Mennonite communities the last four years up in Iowa, and they have a massive produce auction that you know we this is small growers here in anywhere in Texas that I've seen just don't have that things like that as a resource to help us move product when we have excess that needs to needs to get moved.”

▪ **Maintaining Temperature Control:**

According to focus groups participants, one of the biggest issues is maintaining the appropriate temperature for each product is essential and difficult. The temperature issue happens in transit and/or in the storage stage.

The temperature control issue in transit was found to be the function of two factors:

- 1) Transport distance (i.e., the longer distance is more exposure to high temps)
- 2) Vehicle type (i.e., no refrigerated truck)

Regarding the challenge of maintaining temperature control in transit, the following are some participants' quotes:

“Since I have frozen meats, one of my challenges is: well, let's start with I have live animals. I have a choice, I can either transport live animals 6 hours getting processed that they are basically, a local delivery or I can have the animals harvested in West Texas process there and then transport frozen meat. As you know, in the heat of the summer when it's 100 degrees outside it's hard to keep the meat frozen and you know, not spoil.”

“In the summertime, once you start getting 90-100 degrees, it's very hard to keep that food cool or frozen. You know when I'm moving 600 pounds of meat from the from the processor and I'm on like hour and a half away, I try to avoid doing it summertime but without that type of infrastructure it's very hard to make sure you have the safety and following safety and quality.”

“And yeah, eggs are a challenge 'cause we sell eggs as well. It is mostly frozen meat and then eggs and so trying in the in the warmer months to keep the eggs cold without getting the boxes wet is a fun little experiment because you know, it's also humid so we have condensation.”

“The biggest challenge for me is, I'm just driving so far off distance whether it be with a live animal or frozen items. If I didn't have frozen items, the game changes, because I don't have

to worry about the heat. In winter, I don't have much problems at all. So, it limits me to where I can only basically do local deliveries.”

The temperature control issue in the storage stage was found to be the function of two factors:

- 1) Temperature-controlled storage is lacking
- 2) Farmers cannot afford/do not want to spend money on on-farm cold storage.

Regarding the challenge of maintaining temperature control in the storage stage, the following are some participants' quotes:

“Our biggest problem is we don't have onsite cold storage right now mostly due to like local policy issues and zoning that we're working on. So, what we've been doing right now is using our refrigerated truck for storage. So, you know we were able to get this refrigerated truck through a USDA microloan because that was one of the requirements of one of the buyers that we have here is to. It has to be delivered and a refrigerated truck. So last season that was a big issue. So, we had to invest in getting that. So, now we do have a refrigerated truck and we can make the deliveries but the biggest struggle is like keeping it on while we're harvesting and in sometimes, like if they want it on a certain day like we'll have to keep it on overnight to deliver on the next day. So, there's cost involved in that and not having like the cold storage.”

“The biggest transportation or work and access barriers to me are just sort of startup capital expense related to cold storage and cold chain, so I don't have a refrigerated truck I don't have a walk in. I've kind of toyed around with design ideas of doing like a mobile wash pack with like a mobile cooler setup. I'm on a temporary land kind of situation. I don't own the land, so I'm not in a position to sort of like build fixed infrastructure.”

“The location where I met does not have electricity. So, that is also a huge kind of like structural and engineering barrier, and I've often wondered about like is there some way that we could have like a solar powered refrigeration that doesn't? It doesn't have to get down to 40 degrees, but just something that's like not 105. I don't know how to build that stuff, but even if it got it down to like 80 degrees, that would be great.”

▪ ***Customer Desire Frequent Deliveries and Flexible Scheduling:***

As focus groups pointed out they have an issue with matching their harvesting time with customers' delivery schedule preferences. This issue was found to be the function of four factors:

- 1) Transportation distance
- 2) Time
- 3) Lack of storage
- 4) Farmers' desire to keep reliable customers happy, is though because it is usually a challenge for farmers to be consistent with minimum orders for those reliable customers.

Below are some participants' corresponding quotes:

“I've had the biggest struggle with the wholesale is finding someone who's going to like, for example to Austin on the same day that the buyer wants the product. So, sometimes I have product ready and they'll say, oh, I need a Monday delivery but the shipping company that I'm using I'm piggybacking on someone else's order and they say, well, we're not gonna ship out until Tuesday, so I've had orders counseled because they're not gonna get there on time that the buyer wants it. So, it's still a struggle to sometimes it works out, sometimes it doesn't, but I have lost orders because of that.”

“You know time to deliver because I have heard from a few customers that they would like to place an order, but they wish my delivery day was Monday instead of Wednesday or Thursday instead of Wednesday or Friday. It's just, you know, any days but Wednesday, right? And they're so accustomed to being able to go and order groceries and get up. You know, tomorrow or the next day. I obviously I can't go to town every day. It's you know, two hours round trip for me to do that and a lot of people are not placing big enough orders.”

“We have the added layer of customers wanting things at their convenience. And so, if you say yes, I can get you chickens, but I can't get you chickens until Tuesday, when you know someone comes to town, You know, then your customer might say oh OK, I mean, that's good I guess, but maybe I'll find somebody who can get me a chicken faster, right? How do we deliver to customers in a timely but also cost-effective fashion?”

“But like having to spend the money on gas for those orders that are out, you know, and people will say well, why don't you just set a \$50 order minimum? Well, yes, except if somebody is not going to order because they can't spend \$50, then I either have \$25 or I have no dollars, and which do I pick?”

“So right now with us is 22 restaurants and 3 grocery stores. We gotta divide people up on 2 different delivery days like we just say. Hey, sorry, we'd love to give it to you on Thursday, but unless you can take a delivery at 5:00 or 6:00 PM when we can go back and then load back up again, and do the whole thing over again.”

8.2. Participants' ideas on how to overcome transportation challenges:

Four main themes describe participants' ideas about how to overcome transportation challenges: 1) collaboration, farmers can collaborate for transportation and aggregation, 2) outsourcing transportation to a third party, 3) an appropriately-scaled food hub, and 4) changing business and logistics strategies.

▪ Farmers Collaboration:

Farmers generally believed that they should consider the idea of collaboration for transportation and aggregation. In particular, a cooperative model is appealing in which collaborating with friends and other trusted people is a key factor.

In this regard, one participant said:

“Part of my vision is to try and figure out how to create like a cooperative network amongst those farmers. Uh, where I can organize them in like a one-type way or other types of way and then maybe have a wholesale contract with them? So, I have this vision that I would create a cooperative amongst the rural farmers who can't direct market easily and then the ones that start to build community as more and more of them buy-in we build some like crown jewel flagships and some incubators like the one I was talking about before and that to me is nationwide.”

Another participant said:

“I think for it to work we need to have someone (an aggregator) that we can trust and that we could set up a schedule that of routine and you know, maybe the app can help with that, coordinating the deliveries and who has what and where it needs to go... We did actually hire an aggregator who would actually go to each farm and pick up the product and it would be stored at one farmer's farm and their cold storage, and if everything was gathered together, she would go and do the deliveries...the key was that just having that reliable person that she didn't miss a delivery”

Another option was aggregate in a convenient third-party cold storage (e.g., restaurant, convenience store).

▪ ***Outsourcing Transportation to a Third Party:***

Outsourcing transportation to a third party is appealing. It completely takes the logistics off the farmer's plate, could be an existing service (e.g., Amazon), could build off existing transportation routes (e.g., underutilized truck capacity), and farmers could also jointly pursue third-party transportation by which the individual costs would be cheaper.

In this regard, one participant said:

“I could see where a group of farmers could share in a delivery company or delivery service for every farmer. I think the thing that I see working the best is some sort of a delivery service that comes around and picks up and takes everyone stuff at one time. In a perfect world, what we would do is take that off of all of the farmers, and there would be you know a company or a person or a company that's created to handle it, and each of the farmers pays you know whatever needs to be paid to pay that person to do that job and that person picks up from all the farmers and takes it to people.”

▪ ***An Appropriately Scaled Food Hub:***

It would support collaborative aggregation and outsourced transportation. A food hub for small-scale producers (either farmer-run or external) is needed as existing food hubs are looking for large quantities and wholesale prices. Possibly all that is needed is a common cold storage location for farmer drop-off and an aggregator to make deliveries.

In this regard, one participant said:

“The cold storage is a great idea. So, what you could do is build a model, a logistics hub that basically has cold storage. Basic types of facilities in Houston, Austin, San Antonio, and Dallas. Now how do we get it distributed from the cold storage in that city? The destination city to the end customer? Ask them if they would be willing to set up some type of a local distribution, either through their own transportation systems or have people be able to come into an office area and pick up the product. if you take the CEO of Hardee's words, he actually started Houston cold storage. I can almost guarantee you that man could find a way logistically, for small farmers to be able to find a centralized hub and then eventually find someone else who would be willing to come pick up their products and use his gianormous 80,000 square feet of cold storage.”

▪ ***Changing Business and Logistics Strategies:***

Participants suggested that farmers should adopt strategies to improve their own business and logistics efficiencies. In this regard, some options could be considered; 1) home delivery and direct shipping (e.g., UPS), 2) smart delivery routing and scheduling would help, as well as a customer minimum order size, and 3) delivery of products that are already purchased (pre-ordered, CSA, etc.) which is more efficient than farmers' markets, in terms of time and transport.

However, a critical strategic decision for farmers would be “*defining the right distribution radius for their business*”.

Below are some participants' corresponding quotes regarding *changing business strategy*:

*“There are certain people who came in and had business sense and approached their farm like a business from the beginning.
I would like to see the next generation follow the farming more as a passion and a business because they could avoid many mistakes and have much bigger of an impact on what they're trying to do.”*

“We had a lot of people coming to the farm. In my experience, direct marketing, when available, was the easiest and best route. If you can direct market and get people to come to the farm or as close to community to sell as much of what you have, that's obviously the ideal when you're talking about local and organic and building community, right?”

“And that's you know that's why we did the mail or two was. The idea was that we could target in the neighborhood and simply not get multiple sales in one neighborhood so that our deliveries would be primarily clustered and then if I did have those little out of the way, Once they would be such a big deal 'cause it just being one CQC's and everything else would be in one area, but so far that hasn't worked out.

My hope is always that you know when I'm going to these neighborhoods that are a little further out that people will be talking to their neighbors and telling them about us and that's worked

in a couple of areas like I go to circle. And I went from one circle feed customer should I think that three or four now?"

Regarding changing logistics strategy, one of the participants said:

"We deliver in those trucks by zip code so we have, like 3. Zip codes on Saturday that are around Lakeline Mall. We will deliver to them. After the after the market there and then we do. Other zip codes say, Mayner Elgin is one day. I believe it's Wednesday and then another group of zip codes every day of the week. So, we're not we're at least kind of grouping them together and not just you know going to all these wild unrelated points so."

8.3. Participants' views on collaboration and outsourcing for transportation:

The participants were given three options for collaboration and outsourcing their transportation as listed below:

- 1) Other Anonymous Individuals
- 2) Other Farmers
- 3) Third-Party Transportation Service Providers (i.e., 3PLs, and food hubs)

The overarching themes for each three presented collaboration and outsourcing transportation options are explained below.

1) Outsourcing transportation to other anonymous individuals:

▪ Time Savings:

Another finding was that hiring an anonymous individual for transport was not viewed as a suitable option. In this regard, only one participant mentioned *time savings* as an advantage.

In this regard, one of the participants said:

"But delivering to all the neighborhoods or here in when really. I would think it would be fantastic to have a company like Uber or some private driver who would want to do that instead of me. It usually takes around 3 hours of my time to do all of it."

▪ Cost Savings:

No participants mentioned *cost savings* as an advantage (which was expected); in fact, one participant mentioned it was "*expensive*" which was surprising.

Regarding outsourcing transportation to other individuals being expensive, one of the participants said:

“As for the third parties like Uber and all those other companies, those companies are not financially viable, they're just backed by either Wall Street or they eventually get brought up like H-E-B brought one of them and brought that in house. But those numbers just don't work either. They charge too much. I know some of the breweries who use that service. Those guys take like a 30-40% cut to do that and that just hurts your bottom line.”

Trust is the driving factor in evaluating outsourcing transportation opportunities.

Regarding outsourcing transportation to anonymous individuals, the **positive** point is that there are no concerns about competition. However, the major concerns were not knowing how to handle products appropriately, including concerns about temperature control, as well as concerns regarding service reliability and personal safety (e.g., farmers worried about getting robbed).

Below are some of the participants' quotes regarding the above-mentioned disadvantages of outsourcing transportation to other individuals:

▪ ***Lack of Trust:***

“Yeah, I don't know I've never tried it and I can't even imagine what that would actually look like. 'cause it makes me nervous to get into other people's cars. So, I don't Uber eats, and I don't Uber drive around. So, I don't know about that.”

“Yeah, we need to have some kind of review process. I'm thinking built-in 'cause even a great person, you know. You know good people go bad I guess. Well, and you want real-time consequences, too.”

▪ ***Knowledge of Handling:***

“I don't know how I feel about a stranger. Has an Uber delivery guy doing it? I don't know that I could do that. I don't think there would be an understanding of how vegetables needed to be treated. That would seem a little iffy to me. I think there has to be some kind of training about how to handle food and how to store food? All of those things that we have to know. I don't know.”

▪ ***Temperature Control Requirements:***

“If I'm trusting someone else to take my frozen meat into Austin, I want to know that they haven't decided to stop and have lunch in 105 degrees and all my ice melts on the way there to the people to the destination. You know, if I can monitor that, there were inserts. You can put in the package that will say no if the temperature ever rose above freezing and the customer can look at it and take a picture. You know a date time stamp picture and if that thing is flagged then. You go after the driver.”

According to the focus group participants' points of view, the top two primary advantages of collaboration and outsourcing transportation were; 1) time savings, and 2) the ability to aggregate products for better coverage/reach.

Time-saving and reducing unnecessary trips were mentioned nine times for all three options, which makes sense, given the biggest farmer pain point was time.

Participants quotes:

- ***Time Saving:***

“I had the experience of working with friends with farmers friends to make deliveries. So, we take turns to deliver to 12 to 15 different restaurants in El Paso and that's how we kind of solve their delivery transportation issue. Because honestly, we invest like 3-4 hours per month each in delivery and if we do it by ourselves, is going to be like 12 - 15 hours per month. So, that's kind of how we solve.”

- ***Reducing Unnecessary Trips:***

“When you're communicating with the new community, you can come in sort of agreement to sending product with each other so only one of them get to attend to the market which is a transportation eliminator.”

“Like P3 said, she's driving out to. I'm going to guess Dubarry Hills farms to have her chicken process. She's driving within 2 miles of us and you know there's there's got to be some. Some synergy there that we could all tie this together and not all be driving around in circles around each other.”

Ability to aggregate products and extend customer network eight times mentioned primarily for farmer collaboration but also 3PL. Farmers view the idea of pooling (for complimentary products/seasons) as a beneficial business strategy.

In this regard, some participants said:

“Locally, we do work with another farmer to sell to a restaurant and at the same time you know she would take her product as well. But we do have a trust have been working together for three years and sometimes they grow the same products, but sometimes I have extra, we'll pop them in each other. We don't have enough. You know we put enough product to meet the demand. So sometimes if you do have good stress with another grower it will work out to where you can use another farmer and not worry that they're gonna cut into your in your market.”

“It's worked out well for us because each grower hits different markets that are happening usually on the same day that we wouldn't be able to manage, and we don't want to try and run around and do right now with our family and everything. It's been a good extra income for us having someone else resell our products at the market. We just decided we weren't going to be able to do the markets ourselves and they already had a product and that was a good way for them to market it. And also having that variety on their table helped them out to bring more people. Every farm is in a different area and they can grow certain types of products better on their land. And so, I think it helps the market to have a create a variety.”

2) *Outsourcing transportation to third-party service providers:*

▪ *Trust:*

Regarding outsourcing transportation to 3PL, the ***positive*** point is that they are liable for damaged/missing products; they should know how to handle products appropriately and have temperature-controlled vehicles/storage. However, the major concern was competition (i.e., stealing customers).

Below are some of the participants' quotes regarding the above-mentioned advantages of outsourcing transportation to 3PLs:

▪ *Shifting Liability:*

“Most of the third-party companies are going to be bonded, so if product does get contaminated, I get sued because, you know it was delivered and it was out of spec. They served it to somebody and somebody got sick, the lawsuits come backs on me. Then that logistics company is bonded, and they would be able to carry that. The burden of any out of spec product that while it was in their custody.”

▪ *Additional Services:*

“They do that with the Uber eats like the other thing I do is I text the people and their deliveries at their door. Like I said it's perishable stuff, so you don't want it sitting outside but they do that, too, with your food that they deliver. They like take a picture and tell you that it's there when they get there, so there's already systems in place.”

3) *Collaboration with other farmers:*

Trust:

Regarding collaborating with other farmers, the ***positive*** point is that farmers trust each other since farmers know how to handle products appropriately. However, the major concerns were competition (i.e., stealing customers), as well as reliability (to a lesser extent).

In general, collaborating with other farmers was viewed as an exciting option and generated lots of discussions. Key reasons include: 1) farmers know how to handle products, 2) it could be an opportunity for farmers to aggregate products and extend their market reach, 3) it gives farmers opportunities to get to connect with more like-minded farmers. However, there were some concerns including; 1) competition as a major hurdle, and 2) complexity of coordination as another major hurdle.

In the case of collaborating with farmers, building new relationships with farmers, networking, collaboration, smaller but notable benefit, and connection were the most advantages mentioned.

Regarding *building new relationships with farmers*, some participants said:

“It did sort of get me thinking about well, are there other people who do this sort of thing that he does that might have a better way to do you know what he was suggesting, and I don't know anyone yet, but it's definitely something I'm open to. And I you know if that is another farmer, that's fine by me.”

“You know I am a huge collaborator. I'm a big fan of networking. I have really worked to make connections with a lot of the local farms and I really like doing that.”

Although farmers could benefit from collaborating and outsourcing their transportation, there are some primary disadvantages. The top two disadvantages of collaboration and outsourcing transportation mentioned by the focus group participants were:

Regarding the *Trust*, competition is perceived as an issue mainly with other farmers but also mentioned for the 3PLs option.

In addition, product quality in transit and handling mainly with a random individual is perceived as an issue.

Personal safety was another issue as pickup by a random person at the farm location could be dangerous.

Finally, reliability with other farmers and with a random individual is perceived as challenging.

In the case of collaborating with other farmers, 1) the complexity of coordination, 2) how to estimate and allocate costs, 3) how to coordinate aggregation, shipping, and harvesting schedules, 4) Farm remoteness, and 5) loss of connection to customers was perceived as challenging. Moreover, collaborating with other farmers adds to a farmer's burden as farmers just want to farm, so they are concerned about who will take on the task of transportation, especially when multiple deliveries are required.

9. Discussion of Results

Discussion on Pain Points:

Surprisingly, the biggest pain point in reaching urban buyers was not transportation cost; in fact, the cost was very rarely mentioned, and when it was mentioned, it was primarily in the context of not knowing how to estimate transportation costs. In this regard, fuel costs can be estimated, but it is difficult to separate them from trips that also involve non-business travel.

The main issue that was noted was the difficulty in valuing the farmers' time. One farmer expressly stated that any money was good money, indicating that she had not valued her time appropriately but was also being driven by issues of cash flow (i.e., the value of her time does not directly/immediately translate into cash).

It was also surprising that vehicles (their cost, maintenance, suitability) was not mentioned too frequently except in the context of temperature control, where it is brought up frequently.

In summary, time and distance were found to be the main overarching pain points. Time is often a function of distance (i.e., long transit times), but not always: sometimes it is time spent on making multiple delivery stops or time arranging shipments/deliveries.

Time and distance also drive some other pain points including: 1) customer minimum order size, 2) customer preferred delivery schedule, and 3) temperature control in transit.

Temperature control in transit is a major pain point. It was found to be a function of three factors: 1) distance and time in transit. The issue could be helped by adding mid-point storage locations; however, there is load/unload time and handling to consider, 2) a major difficulty due to vehicles without temperature control, and 3) a major impediment to collaboration and outsourcing.

The lack of outsourcing and collaboration opportunities for transportation was another pain point with has been mentioned three times as a limiter to business growth including: 1) limiting distribution radius, and 2) limiting the scale of production.

Mismatch of supply and demand was also mentioned as a pain point, especially not having the scale to sell wholesale and not being able to connect with potential demand. Wholesale is mentioned as being unavailable or unavailable at their scale (e.g., Common Market for small farms).

Discussion on Farmers' Ideas:

Aggregation and collaboration idea has been mentioned in all six focus groups. Nearly all collaboration ideas addressed multi-farmer collaboration. One participant described a potential aggregation of customer orders at the customer end. Some described a collaboration run by farmers only, and others described an externally facilitated collaboration (e.g., via a food hub).

In this regard, dominant ideas were: 1) inventory/storage aggregation, 2) transportation aggregation, or both. Roughly nine participants mentioned the inventory/storage aggregation idea.

The idea of inventory/storage aggregation was mentioned by farmers because it can overcome the issue of lacking mid-point aggregation points which was one of the transportation challenges mentioned by focus groups participants. However, it is challenging for small and mid-size producers to decide on the location of the aggregation point since proximity to suppliers and/or customers and providing temperature control equipment is complicated and challenging.

The idea of transportation aggregation was also mentioned by farmers since this horizontal collaboration benefits them through several factors like efficient vehicle utilization, on-time and frequent deliveries, networking and building new relationships with farmers, and saving costs and time by reducing unnecessary trips. However, competition and complexity of coordination, and cost estimation and allocation are some concerns.

Discussion on Collaboration and Outsourcing:

In general, farmers were in favor of collaborating transportation and generated lots of discussions. This is due to the fact that farmers know how to handle products. In addition, farmers can split gas costs and only one farmer has to invest in a truck. Moreover, collaboration with other farmers enables farmers to aggregate products and extend their market reach. This gives farmers opportunities to get to connect with more like-minded farmers. However, there were some concerns including competition and complexity of coordination as another major hurdle.

Surprisingly, cost savings were hardly mentioned at all. It was only mentioned for the option of collaborating with other farmers.

Competition is a major concern regarding working with other farmers; however, there are workarounds such as collaborating with trusted friends and collaborating with farmers who are producing something different from you.

Regarding outsourcing transportation to anonymous individuals, the major concern was not knowing how to handle products appropriately in terms of the appropriate temperature required for each product. Moreover, farmers were concerned about service reliability and personal safety (e.g., unknown individuals show up on their farms). However, the positive point was that there are no concerns about competition.

Regarding outsourcing transportation to 3PL, the major concern was competition (i.e., stealing customers). However, the positive point is that they are liable for damaged/missing products and they know how to handle products appropriately and have temperature-controlled vehicles/storage.

10. Conclusion

Comprehensive research has been conducted to increase understanding of the transportation capabilities and needs of Texas farmers and ranchers and define and reach a consensus on a set of regional food transportation system functions that are necessary to address existing shortcomings.

The results and discussion of this research study indicate that trust and temperature control are the two most common farmers' concerns.

The issue of trust could be resolved by outsourcing transportation only to trusted individuals that could be offered by other farmers and/or to a well-organized and scale appropriate third parties

(i.e., 3PLs and food hubs) that are known and famous due to their convenient services based on the customers rating and reviews.

The issue of temperature control in the storage stage could be resolved by having some mid-point aggregation points defining the right distribution radius. The issue of temperature control in the transit stage could be resolved by outsourcing transportation services to trusted individuals and/or 3PLs who own refrigerated trucks.

Considering the fact that Texas is one of the biggest States in the United State, conducting focus groups in different regions of Texas to increase the understanding of the small and mid-size farmers' and ranchers' pain points in reaching urban markets, farmers' and ranchers' ideas on how to overcome pain points, farmers' and ranchers' views on collaboration and outsourcing for transportation, the potential solutions to overcome transportation challenges could be relatively generalized to almost all regions in the United States.

The discussion and results presented in this research study are only based on the data extracted from focus groups that were conducted for small and mid-size farmers and ranchers in Texas. This increases the likelihood of missing some significant farmers' and ranchers' transportation challenges that are different from those found out and be specific to some United States regions.

Considering the limitation of this research study regarding being limited only to transportation challenges of farmers and ranchers in Texas, the research could be extended by conducting more focus groups in all the United States regions to guarantee that no significant information is missing.

CHAPTER 3: Exploring and Evaluating the Existing Online Delivery Platforms

1. Introduction

Regional food systems are critical to the food system and community resilience. A large portion of the United States farms (90%) belongs to the small and mid-size farmers and ranchers which surprisingly only account for a very small percentage of the total production value. Currently, the production value reduced from 46% in 1991 to 24%. This is due to the fact that farm businesses shift from small to large farms over time (Pilgeram, 2011). As a result, many small and mid-size farmers and ranchers — who are the cornerstone and one of the main stakeholders of the regional food systems — struggle to make a living from farming operations. This increases the competition between small and large farmers and ranchers and therefore, in order to survive small-scale farmers must find ways of distributing their products to more consumers. However, most consumers' locations are distant from farmers, and most small and mid-sized farmers do not have the necessary transportation infrastructure to support efficient distribution to these urban demand centers (Jensen, 2010).

Small and mid-size farmers and ranchers often distribute their products regionally via direct-to-consumer channels (i.e., farmers' markets) (Bosona and Gebresenbet, 2011), which tend to be inefficient and limited in scale (Hardesty, 2008; Low et al., 2015). Transportation is a major challenge and limiter for many small-scale farmers and ranchers.

A systematic review of the literature on logistics best practices for regional food systems Mittal et al. (2018) found that a major barrier to long-term farmers' and ranchers' success is the high cost and time requirements of distribution.

Farmers and ranchers often transport their products using their own trucks or vans, which results in using many small vehicles transporting small volumes. As a result, the balance between the volume of products transported and the amount of fuel used for transportation is inefficient (Mundler and Rumpus, 2012).

Moreover, according to the focus groups study, the most complaints mentioned by the participants were: transportation costs, time, vehicle maintenance, temperature control, and LTL volumes. Considering the fact that farmers' and ranchers' items are mostly perishable produce and frozen meat, makes products distributions for small and midsize farmers and ranchers whose distribution channels are both wholesale and home deliveries even more challenging.

In this regard, one of the most widely recommended methods for reducing distribution costs and time is collaborative transportation. With collaborative transportation, farmers do not need to perform all distribution tasks on their own (Chiffolleau, 2009; Frain, 2002; Greenberg, 2007; Pirog, 2002). Sharing transportation can help farmers reduce the time spent making deliveries and avoid purchasing additional/larger vehicles. As such, a new potential solution for addressing these challenges is online delivery platforms. These platforms have been found more efficient since they leverage underutilized vehicle capacity from a large pool of independent carriers which could yield

inexpensive and flexible transportation services. Since small and mid-size farmers and ranchers have unique transportation requirements such as smaller distribution delivery windows, multiple stops/deliveries in one trip, round trips to bring the delivery totes to the farmers and ranchers at the end of the delivery day, and refrigerated vehicles to maintain product temperature while in transit, the question is whether the existing online delivery platforms are suitable for small and mid-size farmers and ranchers

2. Literature Review

As pointed out by [Rogoff \(2014\)](#), the long-term sustainability, viability, and resilience of small and mid-size farmers and ranchers, as the main stakeholders of the regional food systems, can be significantly improved by selectively employing some transportation, warehousing, and inventory management best practices that make conventional food supply chains efficient and effective. Some of the transportation-related best practices that can be used and also were used by the small and mid-size farmers and ranchers during the COVID-19 pandemic, included: 1) efficient vehicle utilization, 2) scale-appropriate vehicle selection, 3) transportation collaboration or outsourcing, and 4) horizontal collaboration between geographically proximate farmers and ranchers. These best practices are extracted from the comprehensive literature review on logistics for regional food systems conducted by [Mittal et al. \(2018\)](#).

While transportation collaboration or outsourcing —as one of the above-mentioned transportation best practices — can improve small and mid-size farmers' and ranchers' efficiency, in practice it is challenging. Transportation collaboration or outsourcing requires farmers and ranchers to balance the potential advantages of collaboration with the additional time and effort that is needed to initiate the collaboration and coordinate with others. Collaborative transportation typically only occurs between farmers who already have established relationships, and it is coordinated using informal communication channels (i.e., phone calls, text messages, and emails) and cost-sharing mechanisms ([Craven et al., 2016](#)). This limits the number, size, and efficiency of farmer collaborations. Moreover, most farmers struggle to calculate their transportation costs accurately, so they are unable to evaluate the potential time and money they could save by sharing transportation.

Transportation collaboration or outsourcing can be categorized into three different alternatives including:

- 1) Collaboration with other farmers/buyers
- 2) Outsourcing transportation to 3PLs, food hubs, transportation brokers
- 3) Outsourcing transportation to other individuals

Each alternative has some advantages and challenges.

Collaboration with other farmers/buyers

The advantages of the collaboration between other farmers and buyers includes; 1) being cost and time efficient, 2) farmers spend significantly less time on distribution and much time on farming operation management, and 3) other farmers and ranchers understand food transportation requirements. However, farmers and ranchers found collaboration challenging in terms of some

factors including; 1) trust/competition, 2) scheduling, 3) vehicle requirements, and 4) farmers just want to avoid being involved with transportation.

Outsourcing transportation to 3PLs, food hubs, transportation brokers

The advantages of the outsourcing transportation to the 3PLs, food hubs, transportation brokers are; 1) eliminating responsibility for transportation, 2) increasing market reach, 3) provider may take on liability (ownership) of products, and 4) provider may offer other useful services (e.g., marketing). However, there are some challenges such as; 1) farmer loss of control/reliance on provider, 2) cost/pricing calculations, 3) delivery scheduling (i.e., based on farmers' and ranchers' harvesting schedules), 4) transportation service providers may not understand small-scale farmers' needs, 5) broker relies on relationships with a limited pool of carriers, 6) and unable to schedule less than truckload (LTL) deliveries.

According to [Schmit \(2016\)](#), “*regional food hubs are businesses or organizations that actively manage the aggregation, distribution, and marketing of source-identified food products from local and regional producers – mainly small and mid-size farm – to strengthen their ability to satisfy individual, wholesale, retail, and institutional demands*”. As pointed out by [Sonnino and Marsden \(2006\)](#), the regional food hub's goal is completely aligned with the reshaped regional food distribution channels which are shifting from an industrial and centralized food distribution system toward a localized and decentralized one.

Implementing the producer-led distribution model can also remedy the producers' most common concerns which are:

- 1) ***Distribution/travel distance***: as pointed out by [Schmit \(2016\)](#), as small and mid-size producers tend to sell to market channels with are in their geographical proximity, their average one-way travel distance ranged from 30 to 500 miles.
- 2) ***Building trust and relationships***: Usually producers are concerned about the way their products are distributed by outsourcing their distribution. According to [Brislen \(2017\)](#), producers feel comfortable with outsourcing their product distribution to food hubs, since they found regular and clear communication with food hub staff as a valuable component of trust. One farmer quote regarding the trust presented by farmers by interviewing 20 farmers for their study is: “*You got to communicate with me, I cannot work without communication. I'm used to talking to [the food hub produce buyer], and [they're] used to talking to me. We communicate, now we understand one another... We communicate and that means you can trust me, and I will trust you*”

Clearly, the long-term relationship with producer-led food hub results in a higher degree of trust, specifically due to transitioning from competition towards cooperation strategy.

Reviewing and evaluating the performance of local food distribution systems over fifteen years, [Abellera et al. \(2014\)](#), in their community alliance with family farmers (CAFF) report concluded that a huge gap exists in the distribution and accessibility of local foods. They categorized the local food systems goal into three distinct dimensions:

- 1) Developing a novel distribution infrastructure that offers greater market channels to small and mid-size producers.
- 2) Increasing consumers' awareness regarding the nutritional and environmental advantages of purchasing and consuming food offered by local producers.
- 3) Improving society's health through encouraging them to consume fresh produce.

The authors pointed out that new, stand-alone food hubs are not viable for three reasons which are food hubs 1) increase the supply chain costs, 2) duplicate the existing distribution infrastructure and efforts, and 3) struggle financially if they do not subsidize.

They believed the solution for regional food systems to be able to pursue their goals and remedy the disadvantages of the conventional food hubs business model, lies in working with the current distribution infrastructure instead of creating a competitive parallel distribution system. Their research came to the agreement that a producer-led distribution model is the most successful local food aggregation hub, in which producers cooperate to aggregate their products and mutually benefit through sharing the distribution costs, time, and responsibilities.

In the regional food literature, the necessity of a regional food hub is questioned in terms of its efficiency and feasibility. This is due to the fact that the regional food hub was perceived as a physical aggregation and distribution center. However, with the advent of digital technology, the conventional concept of food hub must be reconsidered as the e-business became a cornerstone of revolutionized food hubs known as digital food hubs.

Per [Van der Vorst et al. \(2002\)](#), [Venn et al. \(2006\)](#), [Barham et al. \(2012\)](#), and [G. Berti and Mulligan \(2016\)](#), all the value chain actors (i.e., producers, processors, distributors, and consumers) regardless of being in the same locality or regions can be connected in two different ways:

- 1) **Digital food hubs**, in which business communications and transactions happen via virtual meetings.
- 2) **Digital platforms**, by which connections between buyers and sellers will be facilitated in a more cost and time-efficient manner by offering features like online orders, in-app invoicing and payment, and delivery coordination.

Per [Schmit \(2016\)](#), “*digital food hubs are new digital business models developed to support small and mid-size farms with a value focus, forming new ways to leverage the technology as a facilitator for a cooperative organizational pattern*”.

The digital food hubs model is built to enable regional food systems to remedy the negative impact of competitive strategy by offering:

- 1) **Value creation** by differentiating local food based on their quality, healthiness, and production technology and introducing a new distribution strategy, which is more sustainable, transparent, resilient, equitable, and accessible.

- 2) ***An efficient organizational strategy*** that encourages local food systems to shift from individual competition towards cooperation with the help of creating strategic networks among small and mid-size producers.

The advantages of the digital food hubs business model, which is built on shared value and cooperation for aggregative scaling, unfold in three directions:

- 1) ***Safety and quality***, which takes into consideration the products' freshness, nutritional values, and the production method (inputs and farming practices).
- 2) ***Locality***, which refers to the distance between production and selling point and the identity of products such as organic or not, the location of production, and farm brand.
- 3) ***Cooperation***, which offers a creative way of scaling via product aggregation and strategic networking. The goal is to achieve the required volume of high-quality products by aggregating products from multiple producers instead of focusing on strategies to enable individual producers to scale up.

Outsourcing transportation to other individuals

There are two advantages to outsourcing transportation to other individuals including 1) more affordable transportation service fees, and 2) farmers do not need to be worried about the competition. Since individuals are only responsible for product distribution and not business communication and/or bargaining. However, there are some challenges such as service liability and personal safety (e.g., unknown individuals show up on their farms).

Considering the fact that transportation collaboration or outsourcing could be a new potential solution to address small and mid-size farmers' and ranchers' transportation-related challenges, providing them with a tool (an information and communication technology platform) that can connect them with collaborative partners and help them to estimate and allocate transportation costs fairly could help to encourage more collaboration, thereby improving farmers' profitability (Marusak et al., 2021).

A digital online platform becomes the intermediary (rather than a person) and facilitates a direct connection between farmer and carrier. It is a potential mechanism for connecting farmers and ranchers who need transportation services with carriers who have extra unutilized vehicle capacity and are willing to offer transportation services for a fee. However, to encourage farmers to adopt such a platform, it must be designed appropriately, offering features that meet their needs and match their values.

A digital online platform could potentially address some of the transportation-related challenges of small and mid-size farmers and ranchers including:

- 1) Farmers and ranchers spend much less time on products distribution and more time on farming operation management

- 2) Provide affordable transportation services based on farmers and ranchers' unique transportation restrictions and requirements like: harvesting schedules, short delivery time, multiple delivery/stops in one trip, calculating transportation cost accurately, real-time tracking of their package, transaction management (i.e., payment through the platform, invoicing, chat with the carriers through the platform).
- 3) Increasing their likelihood of reaching out to more urban customers/buyers

3. Research Question

RQ3: Are existing delivery platforms suitable for small and mid-size farmers and ranchers?

This question was being investigated by exploring the existing delivery platforms from two main sources. The first source was recent peer-reviewed papers, and the second source was the list of delivery platforms introduced by valid image clouds found by google search. The suitability of the existing delivery platforms was evaluated based on the following factors:

- *Distribution channels* which was Last mile vs. Long-haul deliveries
- *Travel distance* which was Less than 30 miles vs. More than 30 miles and less than 120 miles
- *Distribution areas*: Within city/county vs. Outside city/county
- *Shipment size* which was Package/Parcel load vs. Pallet loads
- *Number of deliveries stops* which was Multiple stops vs. One-stop
- *Equipment* which was Refrigeration required while in transit vs. None

4. Research Framework

This research focus is to explore and evaluate scale-appropriate delivery platforms to facilitate solving small and mid-size farmers' and ranchers' transportation-related challenges. As such, the first two cooperative farmers who are part of this research study have been interviewed to understand their transportation-related challenges for their distribution market channels. Although both farmers' major distribution channels were last-mile and long-haul deliveries, each farmer has transportation challenges for one of their distribution channels. The selected cooperative farmers' operating systems and transportation-related challenges were discussed in the "Case Study" section. Second, the existing transportation service provider platforms have been explored. To explore as many delivery platforms as possible that are currently operating and offering transportation services to businesses, two different sources have been used. First, the existing delivery platforms introduced by the recent peer-reviewed papers have been found. Second, lists of the operating delivery platforms provided by some image clouds created by a valid organization (whose profession is evaluating and helping platforms startups) have been explored. The method used to explore the existing delivery platforms is explained in the "Database" section. Third, the explored existing delivery platforms were shortlisted in several rounds based on different criteria. The method used for shortlisting the existing delivery platforms was explained in the "Shortlisting the existing delivery platforms" section. Next, the small and mid-size farmers' and ranchers' transportation requirements and preferences were discussed in the "Transportation operational requirements and preferences" section. Then, several quotes have been requested from the

shortlisted delivery platforms in several rounds and for two different case studies distribution channels using their unique and specific operational requirements. The method used for requesting quotes from the platforms was discussed in the “Delivery platforms quotes” section. In the next step, some platforms that were the most suitable for each case study were offered to cooperative farmers to request the quotes from those platforms based on their evaluation metrics on a trial basis and provide their feedback about if they find those platforms suitable and what features and/or services they like and dislike. This could help to justify and/or modify the evaluation metrics used in this study as well as help to consider their priceless first-hand knowledge and practical experience and point of view in developing a unique and scale-appropriate transportation platform for the small and mid-size farmers and ranchers which would be the future work of this study.

5. Methodology: Case Study Approach

This case study assesses the ability of the existing online delivery platforms to meet the requirements of two small-scale urban Texas farms. One of the farms, Profound Microfarms, is in Lucas, Texas, northeast of the city of Dallas. The farm produces microgreens and serves as a food hub (i.e., regional aggregator and distributor) for 60 other small-scale farmers in the North Texas region. They distribute products to 35 Dallas-area restaurants and offer home delivery service to 65 local customers using their two refrigerated vans. The two vans, driven by Profound Foods employees, have sufficient capacity to make the weekly restaurant deliveries. However, the demand for home delivery services has grown rapidly, and their delivery capacity is reaching its limit. Instead of investing in additional logistics infrastructure, the food hub has experimented with outsourcing home deliveries using crowd-based online delivery platforms. While they were able to find a service that charged an affordable fee (i.e., less than double their current delivery cost), the delivery drivers were unprofessional and lacked experience in handling perishable food. The service was also unable to return the farm’s reusable insulated tote bags and struggled to deliver products within specified time windows.

Terra Preta Farm is in Weslaco, Texas, a city in the Rio Grande Valley. The farm produces a wide variety of fresh vegetables for local consumers, as well as sells wholesale to customers in Houston, Austin, and San Antonio, which are more than 200 miles away. One of these customers, a grocery chain, backhauls its orders from the Rio Grande Valley to its San Antonio and Austin distribution centers. The farm has also been able to work with a local shipping company to send products to a food hub in Houston. However, shipments to customers in Austin are more challenging: orders are typically small (1-2 pallets), so the farm uses an LTL broker to arrange transportation. The broker often gives the farm very short notice on pickup times, forcing the farm to scramble at the last minute to harvest and pack products for the customer’s order before the truck arrives. The farm has sufficient production capacity to expand to new markets in Dallas and San Antonio, but they have been unable to find a carrier willing to deliver single pallet loads.

The farms are focused on different market channels – Profound on home delivery, Terra Preta on wholesale – but both have struggled to find cost-effective transportation services that offer highly flexible scheduling and are responsive to shippers with small volumes. Faced with these challenges, they both expressed willingness to experiment using crowdsourced delivery platforms. The idea was that the online platforms might offer more affordable and flexible

transportation services by connecting the farmers to a large crowd of independent carriers with underutilized vehicle capacity. Furthermore, such platforms can provide a measure of driver accountability through online ratings, and the capabilities of individual drivers offering services (e.g., temperature control) can be clearly specified.

5.1. Preliminary Search

The purpose of this research is to determine the degree to which online delivery platforms can provide suitable and scale-appropriate transportation solutions for small and mid-size farmers and ranchers, with a focus on platforms that leverage independent carriers' underutilized vehicle capacity to provide value. To accomplish this, an exhaustive search was performed for existing online transportation applications that connect senders and carriers, and the resulting platforms were evaluated for suitability based on the shipping requirements of the two case study farmers. The search for platforms included peer-reviewed journal articles from scholarly databases, as well as relevant logistics trade publications found online.

The paper by [Carbone et al. \(2017\)](#) is the first peer-reviewed journal article to perform a comprehensive exploration of existing crowd-logistics applications, providing a review of 57 crowd-logistics-based mobile applications and web-based platforms. Forward citation of this article revealed three more recent articles reviewing crowd-logistics-based applications. [Rześny-Cieplińska and Szmelter-Jarosz, \(2019\)](#), developed a design tool for crowd-logistics platforms developers and applied this tool to 69 crowd-logistics applications. [Le et al. \(2019\)](#) reviewed 45 crowd-shipping-based platforms from the perspectives of supply, demand, and operations management. [Ciobotaru and Chankov \(2021\)](#) proposed a framework for classifying different crowd-shipping platform features and applied the framework to 105 platforms to determine best practices for crowd-shipping organizations.

In addition to the peer-reviewed literature, platforms were found via an online search of relevant logistics and transportation trade publications. Multiple keywords were used to perform the search, including "crowd logistics," "transportation applications," "delivery platforms ". This search yielded three sources of delivery platforms. Culterra Capital, an advisory firm focused on tech-driven innovation in food systems, published a list of organizations that provide supply chain technology solutions for the food industry. Of the 457 total organizations on their list, 63 were identified as providing transportation-related services. CB Insight, an organization that analyzes online platforms, identified 130 companies offering logistics-supporting technologies, including 31 delivery platforms. Logistics IQ, a research and advisory organization that focuses on the supply chain and logistics sector, published their list of "Top 500" logistics companies, which included 28 transportation-focused platforms.

A summary of the number of online delivery platforms identified from each source is given in Table 1, with 275 derived from scholarly articles and 122 from online publications. An additional three platforms were identified through conversations with the case study farmers, for a total of 400 platforms.

Table 1. Sources of online delivery platforms

Source	Number of Platforms
Carbone et al. (2017)	57
Rześny-Cieplińska & Szmelter-Jarosz (2019)	69
Le et al. (2019)	45
Ciobotaru & Chankov (2021)	105
Culterra Capital: Food Supply Chain Tech Landscape 2021	63
CB Insight: Supply Chain & Logistics Tech Market Map	31
Logistics IQ: Next Gen Supply Chain Market Map 2020 Top 500	28
Case study farmers	3

5.2. Shortlisting Process

The master list of 400 delivery platform was evaluated via an iterative process to find platforms that would meet the requirements of the case study farmers. In the first round of review, 127 platforms were removed from the list because they were repeated instances across multiple sources. Sixty platforms that were no longer operating were then identified and removed from the list. Ninety-five platforms that were not intended for transporting commercial freight were then excluded as indicated below:

- 1) Ridesharing platforms, i.e., for passenger transport only (n=3)
- 2) Restaurant and grocery delivery (n=24)
- 3) Platforms connecting people who are looking for items with travelers who can acquire those items (n=13)
- 4) Platforms offering moving services (n=6)
- 5) Platforms offering a specialized service unrelated to transportation (n=48)

The remaining 118 platforms were evaluated to determine whether their services were intended to leverage the underutilized vehicle capacity of independent carriers. Such platforms seemed to have the greatest potential of being sufficiently affordable and flexible to meet the needs of the case study farmers. Thirty-two platforms were determined to be Transportation Management Software (TMS) solutions, which are platforms that offer a suite of services that help senders aggregate and manage shipments across multiple carriers. Although they allow senders search for and connect with carriers, TMS platforms do not serve as intermediaries for brokering shipments; therefore, they were excluded from further evaluation. The 86 remaining platforms were then classified based on whether independent carriers could participate. Four platforms were identified as operating their own fleets and disallowing independent carriers outside their organization from participating (e.g., UPS and FedEx); these platforms were removed from the list. In some cases, the platform organization operates its own fleet but also allows independent carriers to offer their services via the platform. These platforms, as well as platforms working strictly with independent carriers, comprised the remaining 82 platforms. The iterative approach taken to shortlist the platforms to those most relevant to this study is summarized in Figure 1.

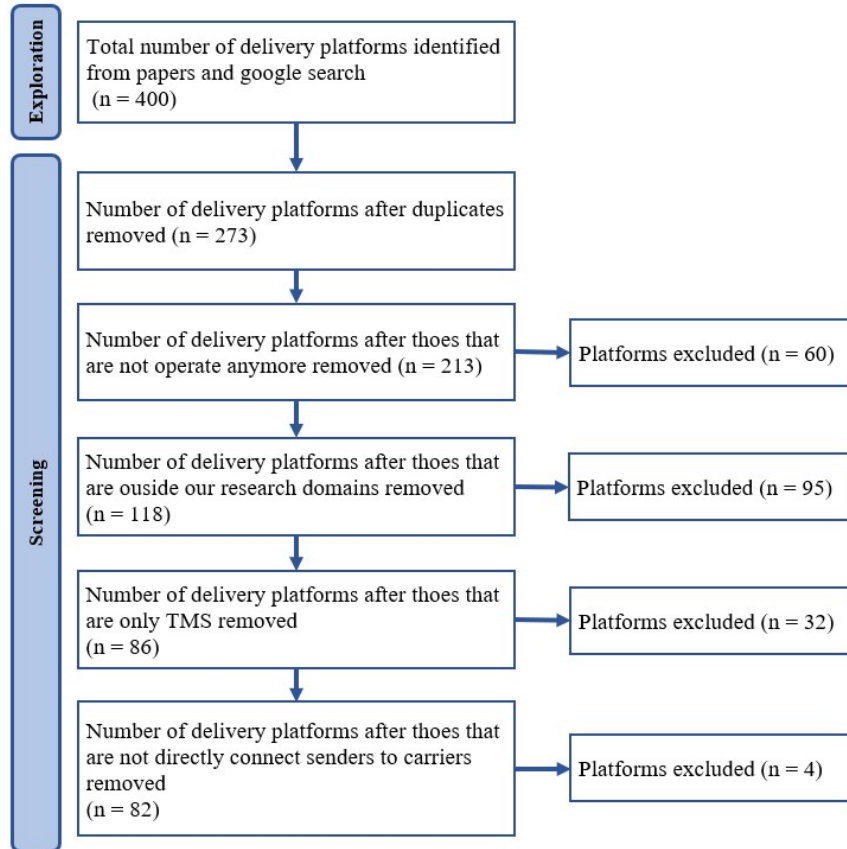


Figure 1. Flow chart depicting the shortlisting of platforms

5.3. Request for Quotes Process and Results

To assess the suitability of the 82 shortlisted delivery platforms, quotes were requested from each platform based on the shipment requirements for the two case study farmers. The purpose of requesting quotes was to determine which platforms would be feasible for each of the case study farmers to use for the specific shipment type (i.e., wholesale and home deliveries). Platform feasibility was evaluated on whether it could satisfy the requirements for each shipment outlined in the previous section. After completing the process for requesting the quotes, the case study farmers were tasked with conducting a review of the platforms that were the most likely candidates to suit their needs.

The shortlisting process described in section 5.2 was based on information available on platform websites. However, assessing the suitability of the 82 shortlisted platforms for the two case study farms would require case-based testing. As a first step, quotes were requested from all 82 shortlisted platforms for both home deliveries and wholesale shipments, based on typical requirements for Profound (home deliveries) and Terra Preta (wholesale), which are summarized in Table 2 below. Platform feasibility was then evaluated based on the degree to which the resulting quote provided by the platform could satisfy the requirements, as well as the quoted price.

Table 2. Shipment requirements for two case study farmers

	Distribution Channel	
	Home deliveries	Wholesale deliveries
Distance	30-mile radius from farm to customers	120 miles from farm to DC
Shipment Dimensions	14x8x9 inches	48x40x72 inches
Shipment Weight	15-20 lbs. each (total quantity: 5)	500 lbs. (1 pallet)
Freight class	60 (for one box)	150
Temperature control?	no	yes
# of stops required	5 stops per route/booking	1 stop per route/booking

Online quote request forms were completed for each platform based on the shipment requirements, specifying a lead time of three days. The same delivery day (a weekday) was requested for all platforms. For home delivery quote requests, if a platform offered multiple delivery stops on a single route, then a quote for five deliveries was requested, with each drop-off location chosen as a separate address within a 30-mile radius. If a given platform did not offer multiple delivery stops, then a quote was requested for a single package delivered to a single home address. For wholesale shipments, if a platform did not explicitly offer temperature control, the quote was requested anyway; however, failure to meet this requirement was noted.

Thirty-six platforms were operational only outside the U.S., and twenty-four of the U.S.-based platforms did not offer service in Texas. However, these platforms were included in the quotes evaluation process, since their responses could still potentially provide useful information about the degree to which existing online delivery platforms can serve small-scale farmers. For these platforms, arbitrary addresses within their area of operation were generated and assigned as origin and destination points based on the distances stated in the shipping requirements (i.e., 30 miles for home deliveries and 120 miles for wholesale shipments).

Each platform's response to these initial quote requests was then assigned to one of the categories described in Table 3. Figure 2 shows a summary of the results for all 82 platforms. Most platforms, including all 36 operating outside the U.S., did not respond. Fourteen platforms provided quotes for home deliveries; however, only four of these offered multiple delivery stops. Of the nine quotes received for wholesale shipments, none explicitly offered refrigerated vehicles, although three platforms allowed senders to note/request refrigeration while in transit (with no guarantee that the request would be granted).

Table 3: Categories of requested quotes

Category	Definition
No response	A response from the platform was never received
Requires call	The platform responded but requested a discovery call before providing a quote
Additional information required	The platform requested additional information from the sender about the shipment
Received quote: home delivery	A quote was received for home delivery only
Received quote: wholesale	A quote was received for wholesale shipment only
Received quotes: home delivery & wholesale	Quotes were received for both home delivery and wholesale shipments
Not suitable	A platform only offered full-truckload shipments or did not handle perishable products

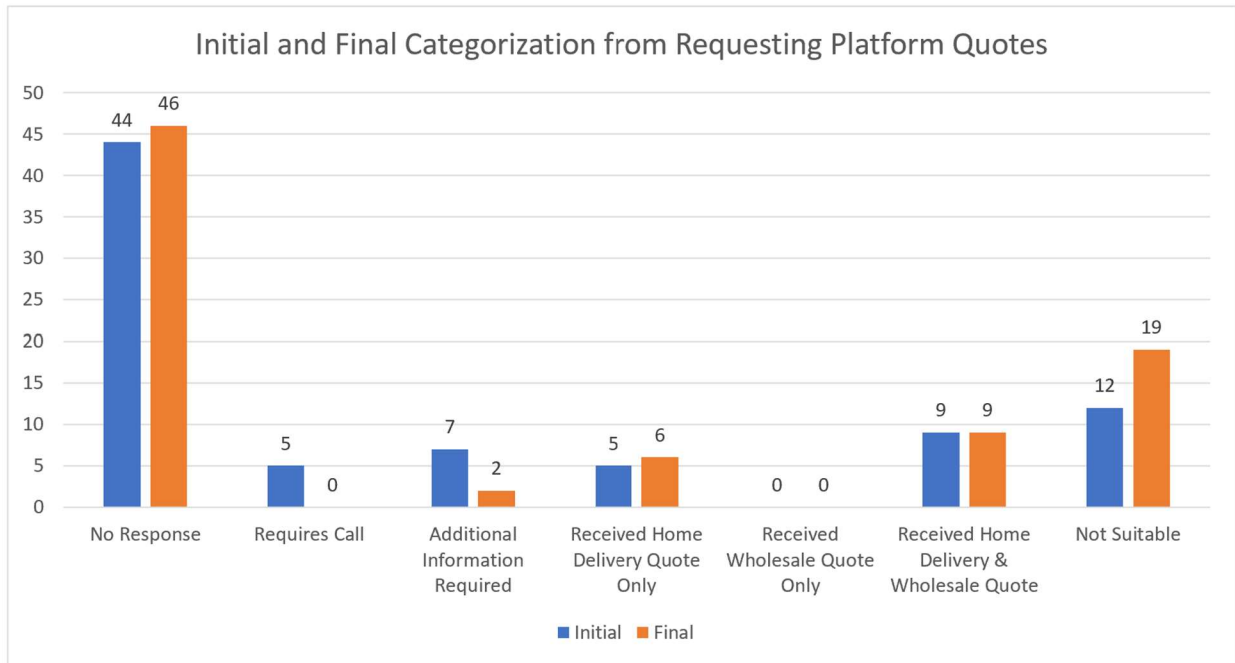


Figure 2. Summary of initial and final categorization of all 82 platforms after all iterations of requesting quotes

Next, follow-up emails were sent to the 36 platforms that were not operating in the U.S., with a repeated request for quotes. None responded, and no further attempts were made to contact them. Follow-up emails were also sent to the eight U.S.-based platforms in the “no response” category. Four of them did not respond, one (i.e., Kanga Delivery) requested additional information such as setting up a business account and authorized payment information, and the responses received from the remaining three platforms indicated that they were not suitable for the farmers’ shipments because they offered only full-truckload services or would not accept fresh produce.

The seven platforms that required additional information were then contacted via email. These platforms were seeking to detail shipment specifications, scheduling for a specific date, account registration, or payment enrollment. Only one of these platforms provided a quote; three did not respond, one required payment authorization before quoting (subsequently categorized as “not suitable”), and the remaining two required further information.

Follow-up emails were sent to the two platforms that required further information, but even after following up, they required more information. One was Dropoff, and they required us to actually book a delivery for a specific date before providing a quote. They wanted to verify they actually had available vehicles on a particular day before estimating the price. The other was TRADEMARK which only operated around the Twin cities.

The five platforms that required a call were first contacted via email to schedule a call and establish a point of contact. One of these platforms never responded. Phone conversations with personnel from the other four platforms revealed that two platforms provided only full-truckload service, one platform was operating primarily in Canada, and one platform could not guarantee temperature-controlled conditions at loading and unloading sites to ensure that high quality of perishable items was maintained.

This step completed the quotes request process. Table 4 gives the names of the platforms that provided quotes and the corresponding prices for delivering to a single home address, five delivery stops (for the four platforms that provided multi-stop quotes), and wholesale shipments, respectively.

Next, to compare pricing for weekday and weekend deliveries, two new quotes were requested from each of the 15 platforms that had previously provided quotes. Quotes were requested on Monday to get a price estimate for delivery on the following Thursday and Saturday. For home deliveries, a quote was received from 12 platforms for the Thursday delivery and eight for the Saturday delivery. Similarly, for the wholesale shipment, a quote was received from eight platforms for the Thursday delivery, and six for the Saturday delivery. Table 7 displays the quotes received for weekday and weekend shipments in the fourth iteration.

Table 4: Platforms that provided quotes

Platform Name	Home Deliveries Quote (1 stop)	Home Deliveries Quote (5 stops)	Wholesale Quote
PigeonShip	\$19.34	\$46.37	\$100.61
Roadie	\$26.86	\$95.00	\$72.37
TaskRabbit	\$30.00		\$63.00
Lalamove	\$57.99		
lugg	\$64.00		
uShip	\$72.49		\$647.00
GoShare	\$73.14	\$139.70	\$126.91
Dolly	\$82.00	\$111.00	
Burro	\$104.00		
Dude I Need a Truck	\$109.00		
C.H. Robinson	\$128.87		\$13.95
Schlep	\$157.50		\$547.75
TQL	\$586.02		\$682.85
Kuebix	\$657.24		\$1,903.44

Table 4: Quotes received for weekday and weekend shipments for home and wholesale deliveries

Platform Name	Weekday		Weekend	
	Home Deliveries Quote	Wholesale Quote	Home Deliveries Quote	Wholesale Quote
PigeonShip	\$23.97		\$23.97	
Roadie	\$15.00	\$83.00	\$15.00	\$83.00
TaskRabbit	\$26.00	\$70.00	\$26.00	\$125.00
lugg	\$74.00	\$372.00	\$74.00	\$372.00
uShip	\$219.00	\$127.00		
GoShare	\$50.60	\$384.04	\$47.90	\$371.80
Dolly	\$78.00		\$82.00	
Dude I Need a Truck	\$210.00		\$210.00	
C.H. Robinson	\$18.00	\$137.88		
Schlep	\$183.40	\$602.84	\$183.40	\$602.84
TQL	\$645.57	\$695.38		
Kuebix	\$275.00			\$750.00

After completing the process for requesting the quotes, the case study farmers were tasked with conducting a review of the platforms that were the most likely candidates to suit their needs.

5.3.1. Case Study Farmers' Feedback:

The two case study farmers were given the three most suitable platforms based on the platform evaluation process implemented in this research study and asked them to request quotes from those platforms and provide us with their feedback.

The three platforms that were suggested for Terra Preta (wholesale) case study were: GoShare, CH Robinson, and Kuebix.

Three platforms that were suggested to the Profound (home deliveries) case study were: Roadie, PigeonShip, and GoShare.

Only Terra Preta (wholesale) case study gave feedback as presented below.

Based on the feedback from the case study farmers, the following are some positive and negative aspects of using the suggested online platforms.

1) *Entering shipping requirements:*

- ***Positive Points:***

One of the platforms allowed farmers to enter the temperature control range for their products, another platform allowed them to select the type of delivery vehicle, and one platform offered the option of load/unload assistance.

- ***Negative points:***

One of the platforms did not offer the temperature control request option, two platforms did not offer the delivery date/time request option, and one required an account to be set up to get the quote.

2) *Usability:*

- ***Positive Points:***

One platform offered the real-time tacking option.

Terra Preta (wholesale) case study said:

“The steps bar on top lets you know how far along the quote process you are. I liked the visuals of the vehicles. Dropdown box of possible addresses was a nice feature.”

One platform offered the “**Quick and Guided views**” option, which is a preset option for location type with checkboxes with descriptions for each that made it easy to fill, one platform gave the farmers ability to specify temperature ranges and dimensions of the pallet, one platform gave enables farmers to get a quote with zip codes only so, they did not have to input complete address, and one provided a text box to write in special instructions which also offered an option to include order details for shipment such as *pickup number* and *delivery number*.

- **Negative points:**

One platform needed better usability in terms of providing a more guided view with prompts for special services, as the platform provided no visuals or prompts for the next steps.

3) **Services offered:**

- **Positive Points:**

One Platform allowed farmers to select the pickup time, the other provided service to limited-access locations (like her farm), tracking, and multiple quotes from multiple carriers at once.

- **Negative points:**

One platform did not offer LTL shipping for temperature-sensitive items, one allowed driver to change price on pickup day, but charged a cancellation fee, and required payment before delivery (in the event that the items shipped did not match the description provided by the sender).

4) **Responses:**

- **Positive Points:**

One platform provided a fast quote which is helpful especially when farmers need a last-minute delivery.

- **Negative points:**

One platform provided no quote (no temperature control for LTL).

5) **Price:**

- **Negative points:**

One quote was nearly ten times the typical amount (\$841 vs. \$90), and one was 50% more than the typical price (\$138 vs. \$90).

6) **Overall:**

Both farmers will use the transportation platform if they guarantee the pick-up and delivery flexibility, responsiveness of the delivery person, and also provide features like temperature control and multiple delivery options, offering more affordable service prices.

Terra Preta (wholesale) case study said:

“I think small-scale farmers have different needs that a general transportation app may not address. The benefit would be the ability to ship smaller loads, collaborate with other farmers to save costs, faster communication.”

The responsiveness of each platform was also tracked in this round of quote requests. Terra Preta Farm, the case study farm sending the wholesale shipment, had experienced challenges with booking shipments with enough time to complete harvesting and packing activities. Therefore, a platform’s response time is important in evaluating its suitability for small-scale farmers. As Figure 4 shows, the majority offered an instant quote via an online form.

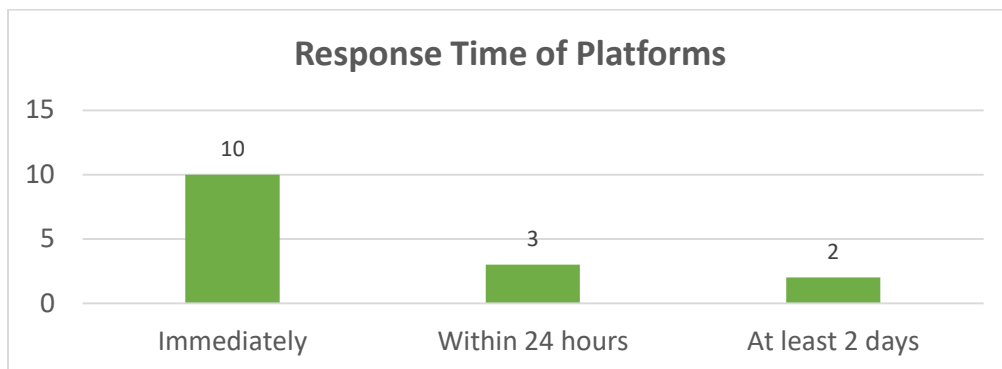


Figure 4: Platform Response Time

5.4. Discussion of Results and Implications

After evaluating the suitability of the short-listed existing transportation platform via the requesting quotes for two case studies' transportation requirements, the following is the discussion of the limitations of existing online delivery platforms and two case study farmers' feedback on those platforms offered to them for further evaluations.

5.4.1. Potential and Limitations of Online Platforms

- ***Low Longevity:***

According to this research study, after removing the duplicates, 60 platforms out of 273 were no longer in operation which was due to either financial issues or the number of users that found the platforms suitable for their businesses. This conclusion is also confirmed by other literature. The fact is despite the existence of many crowdshipping companies, none has become really successful, and many have gone out of business ([Ciobotaru & Chankov 2021](#)).

- ***Domain Restriction:***

The majority of the existing Platforms are restricted to a certain domain (e.g., outside of the United States or outside of Texas). For instance, 36 out of 82 shortlisted platforms were operating outside of the United States. Although these platforms were included in the quotes evaluation process, since their responses could still potentially provide useful information about the degree to which existing online delivery platforms can serve small-scale farmers, requesting quotes from these platforms was not easy since arbitrary addresses within their area of operation were generated and assigned as the origin and destination points based on the distances stated in the shipping requirements (i.e., 30 miles for home deliveries and 120 miles for wholesale shipments). Moreover, 24 platforms that were operating in the United States, were not operating in Texas, which made the process of requesting quotes only feasible by selecting areas that met the distance required for each case study.

- ***Requesting Quotes was Challenging:***

48 platforms either did not respond at all or kept asking for additional information such as setting up a business account and authorized payment information, which was challenging for the research team to provide that information. Moreover, being able to contact the right person in charge of providing quotes (i.e., human broker/dispatcher) was difficult and time-consuming. In this regard, it took a long time to receive quotes for each targeted platform.

- ***Lack of Suitability of Platforms for Farmers' Logistics:***

The delivery platforms evaluation indicated that none of the existing platforms were created specifically for catering to farmers' logistics. For instance, 19 of 82 platforms were deemed unsuitable due to one of the below reasons:

- a) The platforms were only designed for full truckload services
- b) The platforms did not ship fresh produce that required a temperature control feature
- c) The platforms could not guarantee cold chain and/or accept perishable items
- d) The platforms did not offer multiple delivery stops

- ***Delivery Schedule and price was Challenging:***

Although delivery schedule and pricing are perceived as some positive features that could be handled by online platforms, according to two case studies farmers' feedback flexibility with pick-up and delivery, the responsiveness of delivery person, and price were the three most common complaints and concerns.

According to Terra Preta (wholesale) case study, pricing is too high; temperature control is not necessarily available; while pickup time can be specified, delivery date/time can't be directly specified.

According to Profound (home deliveries), pricing is reasonable, but drivers do not know how to handle the product and do not have a suitably professional appearance to meet the expectations of the customer.

5.5. Conclusion

Considering the uniqueness of their products and the specific requirements for their product transportation, evaluating and requesting quotes from 82 platforms clearly indicates that unfortunately, the services offered by the existing platforms are not suitable for small and mid-size farmers, as was expected. Lack of responsiveness is the biggest problem (likely due to insufficient carriers, or no interest in this kind of temperature-controlled LTL shipment). Temperature control is another big challenge, and the flexibility of multiple deliveries according to the senders' needs is a gap. As such, there is a significant need for online platforms that offer types of services that are particularly required by small and mid-size farmers to guarantee the pick-up and delivery flexibility, the responsiveness of the delivery person, temperature control, and multiple delivery stops.

5.5.1. The Research Contributions to the Regional Food Systems

This research study identified the need for the type of platform for small-scale food producers and distributors and the research result indicates that among the existing delivery platforms, no platform offers all the services (and fees) of a full-service food hub like the services that are offered

by Hawaii Food Hub and Iowa Food Hub. Moreover, services offered by existing platforms would need to add on features to facilitate fresh food transport.

5.5.2. The Research Contributions to the Knowledge of Online Delivery platforms

A case study approach was selected to evaluate the degree to which existing online delivery platforms can serve small-scale farmers and apply the existing transportation services to actual businesses' needs. It allows us to evaluate the suitability of each platform's business model (Ciobataru and Chankov 2021) to a specific type of the commercial sender.

In addition, transportation quotes were requested from the actual existing transportation services providers' platforms. As a result, much more realistic information was extracted as compared to what can be discerned from the websites alone since many platform websites required scheduling a meeting to get the demo of the platform and requesting quotes. Moreover, the research study was able to assess the responsiveness/reliability of the platforms which were low to mostly not responsive (see Table 3 and Figure 2).

The result of this research study implies that delivery platforms really need to cater to fresh food for them to work, and none of the reviewed apps do this

5.5.3. The Research Limitations

Using the case study approach offers the benefit of a real-world application. However, it limits the generalizability of this research to the specific case study, namely small-scale businesses in the U.S. that require temperature control or multiple delivery stops.

Moreover, it could not obtain appropriate information from international platforms to make a thorough evaluation. Another limitation of this research study is that quotes were received from the existing platform, but farmers did not actually use the services, which could give us more useful and practical information on a deeper level regarding the functionality and features of platforms.

5.5.4. Future Research

Investigating to see if any of the larger and more established apps (e.g., Favor) be willing to step in and fill gaps (e.g., temperature control) to help farmers.

As the result of this research study indicates, there is no suitable transportation platform in the market which rules out the possibility of selecting the most appropriate platform and modifying the features based on the unique requirement of small and mid-size farmers for their fresh food transportation. As such, future research could be devoted to the investigation of the features that are offered by the existing platforms to develop and pilot a scale-appropriate transportation platform and get feedback from collaborative farmers in this study.

CHAPTER 4: Discussion, Conclusion, and Future Research

The impetus behind this research study was investigating the transportation challenges faced by Texas small and mid-size farmers and ranchers, and to use this knowledge to inform the future design and development of a collaborative delivery tool that will help these farmers and ranchers begin to build efficient regional food transportation networks.

Considering the fact that there is a significant growth in customers' interest in locally produced food to take advantage of purchasing food that is fresher, safer, and/or more nutritious food, reduced reliance on fossil fuel consumption, and the ability to support the local economy, RFSs offer the potential to greatly improve agricultural sustainability.

However, in the face of increasing competition, regional farmers must find ways of expanding their market reach to a larger number of buyers to ensure the survival of their farms. Larger markets are typically located in urban centers that are geographically distant from farmers, and most small and mid-sized farmers do not have the necessary transportation infrastructure in place to support efficient distribution.

As a result, this research study followed two paths to understand the small and mid-size farmers' and ranchers' transportation-related challenges and provide a feasible solution to overcome the existing shortcomings.

First, to provide a better understanding of Texas farmers' and ranchers' transportation capabilities, needs, and challenges, six focus groups were with producers located throughout Texas, including North, Central, West, and South Texas. The purpose of the focus group study was mainly to be able to answer the following research questions:

- 1) *What are small and mid-size farmers' and ranchers' main transportation-related challenges?*
- 2) *What are viable solutions to address these challenges?*

Second, to facilitate solving small and mid-size farmers' and ranchers' transportation-related challenges, comprehensive research was conducted to evaluate the suitability of the existing delivery platforms using the case study approach. The evaluation process was based on transportation-related factors such as distribution channels, travel distance, distribution areas, shipment size, number of delivery stops, and required equipment. The main purpose of platform evaluation was being able to answer the following research question:

RQ3: Are existing delivery platforms suitable for small and mid-size farmers and ranchers?

The results of the focus group study indicated that the biggest pain point for small and mid-size was not transportation costs, which was against the information gathered from the conducted informal interviews with farmers and ranchers prior to this study. In fact, the farmers' challenge with regard to the cost was in the context of not knowing how to estimate transportation costs. The main overarching pain points were time and distance which both are a function of distance.

Temperature control in transit was found to be another pain point, which was found to be a function of distance and time in transit, and the lack of vehicles with temperature control.

Finally, the lack of outsourcing and collaboration opportunities for transportation was another pain point which found to be a limiter to farmers' business growth.

Mismatch of supply and demand was also mentioned as a pain point, especially not having the scale to sell wholesale and not being able to connect with potential demand.

Regarding the question of “*What are viable solutions to address these challenges?*”, the results of this research study showed that aggregation and collaboration was the dominant idea.

Regarding the aggregation, the majority of the focus groups participants agreed on the idea of having a potential aggregation of orders at the customer end and aggregation facility led by farmers or via a scale-appropriate food hub.

Regarding the collaboration, the majority of participants were in favor of transportation collaborations since the idea of horizontal collaboration could benefit them from several aspects including efficient vehicle utilization, on-time, and frequent deliveries, networking and building new relationships with farmers, and saving costs and time by reducing unnecessary trips. However, competition and complexity of coordination, and cost estimation and allocation are some concerns.

The results of the second part of this research study (i.e., exploring and evaluating the existing online delivery platforms) indicated that almost none of the existing platforms were suitable. This is due to the fact that the uniqueness of farmers' products and the specific requirements for their products make the services offered by the existing platforms not suitable, which was expected.

Even from the three most suitable platforms that were suggested to two case studies, none of them were found to be suitable. The preseasons mentioned in the feedback provided by Terra Preta (wholesale) case study based on different factors were:

- 1) ***Entering shipping requirements:*** the platform did not offer the temperature control request option, did not offer the delivery date/time request option, and required an account to be set up to get the quote.
- 2) ***Usability:*** platforms needed better usability in terms of providing a more guided view with prompts for special services, as the platform provided no visuals or prompts for the next steps.
- 3) ***Services offers:*** platform did not offer LTL shipping for temperature-sensitive items, and one allowed the driver to change the price on pickup day, but charged a cancellation fee, and required payment before delivery (if the items shipped did not match the description provided by the sender).
- 4) ***Responses:*** platform provided no quote (no temperature control for LTL)

- 5) **Price:** the quotes were more than the typical amount (one offered ten times the typical amount and the other 50% more than the typical amount)

In general, the case study feedback indicated that farmers will use the transportation platform if they guarantee the pick-up and delivery flexibility, responsiveness of the delivery person, and also provide features like temperature control and multiple delivery options, offering more affordable service prices.

Potential Solution:

According to the focus group participants' discussion regarding their transportation pain points, ideas to overcome the pain points, and the idea of collaborating and outsourcing transportation, Micro-hubs for temporary storage and aggregation, located outside urban areas could be a potential solution.

Some potential benefits of Micro-hubs could be first, the capability of addressing the “*time*” issue. It reduces the transportation distance and the number of unnecessary trips. As a result, farmers would spend less time driving from farm to micro-hub. Moreover, it enables farmers to address the temperature control issue in transit by reducing the distribution distance. Second, it could address the issue of customer minimum order size and customer-preferred delivery schedule by reducing the distance between micro-hub and making the end customer pick-up option possible. In addition, more frequent deliveries would be possible, which increase the flexibility of deliveries. Third, it addresses the storage issue. This is because farmers will need less on-farm storage, less coordination between harvest and delivery time is needed, and offers much greater flexibility with farmers’ dropoff schedules. Finally, it follows the producer-provider idea of having a food hub for small-scale farmers or an aggregation scheme run by a collaboration of farmers.

However, there are some potential challenges to the idea of having a micro-hub facility. First, farmers would still need to transport products to the micro-hub. Second, it does not answer the question of how outbound from micro-hub to customer would work, which could be a combination of different options including customer pickup from micro-hub, micro-food hub does the delivery, and/or using 3PLs transportation services. Third, farmers need to spend more time on coordination and handling as additional handling tasks are necessary. Although a part-time aggregator could be hired to perform the handling, the questions of who and at what cost will need to be answered. Forth, with the additional loading and unloading, the issue of the temperature control should be considered. Fifth, farmers need to decide where these micro-hubs should be located. However, the existing facilities with underutilized cold storage could be an option. Sixth, farmers need to decide how to allocate costs, which is challenging considering the fact that they are already having a hard time estimating transportation costs. Seventh, farmers need to decide about micro-hub leadership. They need to decide who should be in charge of the micro-hub. Should it be Farmers-led or led by a third party? Here the issue of “*Trust*” comes back to the decision-making equation. Eighth, labeling would be necessary to make the brand of the farm recognizable to the end customers. since they are interested to know where their food comes from and how their food was

produced. Finally, the information sharing, and tracking could be challenging and again the issue of “Trust” comes back to the decision-making equation.

Future Research:

Focus group study:

Since the discussion and results presented for the focus group study are only based on the data extracted from focus groups that were conducted for small and mid-size farmers and ranchers in Texas, it is more likely that the research lacks some significant farmers’ and ranchers’ transportation challenges that are different from those found out and be specific to some United States regions. Therefore, the research could be extended by conducting more focus groups in all the United States regions to guarantee that no significant information is missing.

Online delivery platforms:

Since it found out that there is no suitable transportation platform in the market, it rules out the possibility of selecting the most appropriate platform and modifying the features based on the unique requirement of small and mid-size farmers for their fresh food transportation. As such, future research could be devoted to the investigation of the features that are offered by the existing platforms to develop and pilot a scale-appropriate transportation platform and get feedback from collaborative farmers in this study.

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