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Original Research Article

Food system resilience during COVID-19: The role of local producers in rural Canada

Kelli Weinkauf[a] and Tracy Everitt[b*]

[a] St Francis Xavier University
[b] St Francis Xavier University; ORCID: 0000-0002-9483-4828

Abstract

Over the last seventy years, Canadian agriculture has shifted from many small farms that supplied local residents, to fewer large farms designed to maximize production, reduce cost, and target international markets. At present, small local food chains exist as a tiny fraction of the Canadian food system. However, during the COVID-19 pandemic, Canadians valued local producers. The purpose of this study was to gain insight into the role local producers played in maintaining food system resilience during the early part of COVID-19, in the spring of 2020. We were particularly interested in identifying adaptation strategies that enabled or constrained local food system resilience (i.e., the perseverance of farms and farm production). We also examined the accessibility and sufficiency of current agricultural supports. Eight semi-structured interviews were conducted with producers from the Antigonish Farmers' Market (AFM), in Nova Scotia, Canada. Results demonstrated producer resilience in response to challenges such as system bottlenecks, increased costs, increased demand, changes in sales, and the need for online literacy, and were summarized as enablers and constrainers to food system resilience. Half of the study participants accessed agricultural support related to COVID-19 in the form of government financing while other participants expressed discontent with the suitability and accessibility of current support programs available. Opportunities to increase local food system resilience in Antigonish, Nova Scotia included promoting AFM collaboration, increasing local support, and tailoring agricultural support for small, diversified, local farmers.

*Corresponding author: teveritt@stfx.ca

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Résumé

Au cours des 70 dernières années, l'agriculture canadienne est passée d'un grand nombre de petites exploitations qui approvisionnaient les résidents des environs à un nombre réduit de grandes exploitations conçues pour maximiser la production, réduire les coûts et cibler les marchés internationaux. Aujourd'hui, les petits réseaux locaux d'alimentation ne représentent qu'une infime partie du système alimentaire canadien. Cependant, pendant la pandémie de COVID-19, la population canadienne s'est tournée vers les producteurs locaux. L'objectif de cette étude était de mieux comprendre le rôle des producteurs locaux dans le maintien de la résilience du système alimentaire au début de la pandémie, au printemps 2020. Nous avons spécialement porté notre attention sur l'identification des stratégies d'adaptation qui ont permis ou limité la résilience du système alimentaire local (c'est-à-dire la persévérance des fermes et de la production agricole). Nous avons aussi examiné l'accessibilité aux soutiens agricoles actuels et leur suffisance. Huit entretiens semi-structurés ont été menés avec des producteurs du marché fermier d'Antigonish, en Nouvelle-Écosse, au Canada. Les résultats ont démontré la résilience des producteurs face à des défis tels que les goulets d'étranglement du système, l'augmentation des coûts, l'augmentation de la demande, les changements dans les ventes et le besoin de connaissances sur le fonctionnement du Web, résultats qui ont été saisis en tant qu'éléments facilitateurs ou contraignants pour la résilience du système alimentaire. La moitié des participants à l'étude ont eu accès à un soutien agricole lié à la COVID-19 sous la forme d'un financement gouvernemental, tandis que d'autres participants ont exprimé leur mécontentement quant à la pertinence et à l'accessibilité des programmes de soutien actuels. Les possibilités qui en sont ressorties pour accroître la résilience du système alimentaire local à Antigonish comprennent la promotion de la collaboration avec le marché fermier, l'augmentation du soutien local et l'adaptation du soutien agricole aux petits agriculteurs locaux diversifiés.

Introduction

Beginning in March 2020, COVID-19 disrupted all parts of the food system, including production, distribution, transformation, access, and consumption (Food Secure Canada, 2020). Farmers were faced with international border closures, labour shortages, and changes in industry protocols such as physical distancing, limitations to indoor capacities, implementation of PPE, and increased sanitation requirements (Brand, 2020; Food and Agriculture Organization of the United Nations [FAO] & World Health Organization [WHO], 2020; Starratt, 2020). Food transformation, or the processing and packaging of food, was impacted by the closure or reduced capacity of processing facilities, transportation restrictions, and labour shortages (Emmanuel, 2020; Hobbs, 2020). These disruptions resulted in major bottlenecks in the food chain, which, in some cases, also resulted in significant food losses

(Emmanuel, 2020). Finally, limitations to production capacity and changes in consumer buying patterns impacted food consumption (Cotnam, 2020; Emmanuel, 2020). Panic buying, stockpiling, less frequent shopping trips, and the desire for high-commodity staple items, such as yeast and dried goods among consumers all influenced the demand for certain foods (Hobbs, 2020). These initial challenges overstressed the conventional food system and left many consumers questioning the dependability of Canada's major food supply (Donnelly, 2020; Hobbs, 2020).

At the same time, news reports and headlines conveyed an increase in demand for local food as well as an increase in local food production (Brown, 2020; Cotnam, 2020). Although local producers were faced with challenges similar to global producers, there was arguably faster adaptation observed at the local level (Hobbs, 2020). This suggested that in the most unprecedented of times, local food systems may have been more resilient than Canada's conventional one. The focus of this research was to assess COVID-19 related disruptions and adaptations among local producers and determine how this contributed to their resilience. Was there something to be learned from local producers? The secondary aim of this research was to determine how agricultural support may have contributed to the overall resilience of the local food system. More specifically, we were interested in understanding if new or established government support and programs were available, accessible, and sufficient among local producers.

Background

Local food systems

Short-chain, local food systems offer characteristics that may better support a resilient Canadian food system (Blay-Palmer, Haine-Bennett, et al., 2020; Food Secure Canada, 2020). Though there is no consensus on a definition, it is generally accepted that local food systems include food production, distribution, and consumption rooted in a particular place, whether a community, metropolitan area, or region (Hendrickson et al., 2018). Because of their smaller size and reach, if and when disruptions in the chain occur, the impact would be less widespread (Albrecht, 2020). Additionally, local food systems provide other advantages such as socioeconomic and environmental benefits (Feldmann & Hamm, 2015; Irshad, 2010). Supporting local strengthens the regional economy, increases local job opportunities, strengthens community partnership, preserves local landscapes if farmers are environmentally conscious, and may help reduce food production's carbon footprint (Beingessner & Fletcher, 2020; Irshad, 2010). As such, choosing to support local food systems helps to establish resilience and community autonomy, as opposed to dependence on conventional systems.

Canada, at least to some degree, is dependent on the conventional system via the global market for some commodities such as the export of Canadian grains and pulses or the import of goods such as coffee, tea, or citrus. For this reason, local versus conventional food systems cannot be absolute, and both will continue to exist within the larger Canadian food system. However,

studies suggest that there is a significant opportunity for local food system growth within Canada that would help lessen the impact of pandemic related or other system stressors (Blay-Palmer, Carey, et al., 2020; Blay-Palmer, Haine-Bennett, et al., 2020; Food Secure Canada, 2020). The overreliance on import/export markets, the concentration of food chain ownership, the centralization of food processing, and the use of high-input, high-emission farming, are major points of weakness within Canada's conventional food system (Food Secure Canada, 2020). Conversely, local food systems offer characteristics such as diversity, flexibility, social-economic gain, and environmental welfare that help to revitalize communities, increase access to safe, healthy food, support a sustainable environment, and reduce food waste (Albrect, 2020; Food Secure Canada, 2020).

Agricultural support

Prior to COVID-19 there were several programs already in place with the federal and provincial governments designed to assist farmers in times of uncertainty, as the nature of agriculture production is highly unpredictable. These programs fall under the Canadian Agricultural Partnership: Nova Scotia Cost-Shared Programs and Business Risk Management Programs (Government of Nova Scotia, 2020). Additionally, several Business Risk Management Programs exist and are designed to help farmers manage risks that threaten the viability of their farms, such as the Nova Scotia Crop and Livestock Insurance Commission (Government of Nova Scotia, 2020). Although these existing programs may be adequate risk management resources against typical variabilities Nova Scotian farmers face (i.e., weather damage), COVID-19 presented farmers with many new challenges that these programs may not have accounted for.

As such, following the arrival of COVID-19 in Canada in the spring of 2020, several new agriculture support programs were introduced to support farmers in the unique challenges they were facing. On May 5, 2020, the Government of Canada announced an initial fund of $252 million in response to the Canadian Federation of Agriculture's request for $2.6 billion in aid (Tunney & McGregor, 2020). Several months later, on October 23, 2020, the Nova Scotia Federation of Agriculture announced an agreement with the federal government to help cover some of the increased costs associated with COVID-19 in trying to protect the health and safety of workers and prevent the spread of the virus (Campbell, 2020). This agreement resulted in a fund of $1,229,375 available to Nova Scotian farmers under the COVID-19: Emergency On-Farm Support Fund (Campbell, 2020). Additionally, the COVID-19: Agriculture Response Program was also developed. This program has four streams of funding designed to help Nova Scotia's Agriculture Industry mitigate the effects of the pandemic and did not have to be repaid (Government of Nova Scotia, 2020).

Food system resilience

The concept of resilience was born in the field of ecology and is used to depict the persistence of an ecological system while experiencing external disturbances (Holling, 1973). A system is considered resilient when it has the capacity to withstand shocks and external pressures while maintaining its basic structure, process, and function (Schipanski et al., 2016). In the food system context, resilience may refer to the perseverance of farms and farm production, or to maintaining food security (Kuhmonen, 2020). A resilient food system would provide food to people while respecting the production and carrying capacity of the ecosystems that produced it (Kuhmonen, 2020). In addition to the persistence of structure and function,

resilience expands to include capacities such as self-organization, adaptation, and learning (Davidson et al., 2016; Schipanski et al., 2016; Tendall et al., 2015; Walker et al., 2004). The ability of a system to grow and adapt indicates that resilience is not a state to be achieved, but rather a continuously developing capacity (Tendall et al., 2015).

Social-ecological systems

A food system is best conceptualized as a social-ecological system, or the integration of humans and the environment, where people and nature are interdependent systems (Ericksen, 2008; Folke et al., 2010; Tendall et al., 2015). The social-ecological framework emphasizes the dynamics between the social structures that surround a farm system (i.e., market, politics) and the biophysical structures of a farm and its agro-ecosystem (Darnhoffer et al., 2016; Kuhomenen, 2020; Schipanski et al., 2016; Tendall et al., 2015). This framework is frequently used to analyze food system resilience (Darnhoffer et al., 2016; Kuhomenen, 2020; Schipanski et al., 2016; Tendall et al., 2015). In the wider literature, there have been several attempts to distinguish specific indicators of resilience (Anderies et al., 2006; Biggs et al., 2012; Cabell & Oelofse, 2012; Folke et al., 2003; Walker et al., 2006). However, while there is some agreement on broad strategies of resilience (i.e., diversity, redundancy, connectivity, self-regulation), system complexity prevents the development of universal recommendations to enhance resilience (Darnhoffer et al., 2016). As such, understanding food system resilience from this perspective is limited.

The social-ecological perspective has been challenged for its superficial analysis of the "social" domain (Kuhmonen, 2020). This criticism calls for the social domain to include the consideration of agency more explicitly, where one must consider how individuals perceive the viable choices within his/her operational environment (Darnhoffer et al., 2016; Kuhomenen, 2020). In other words, producers are enabled or constrained, but not determined, by their surrounding social and ecological structures (Darnhoffer et al., 2016; Kuhmonen, 2020). Farmers are active agents in the process of change, as they generate activity, create opportunities, adapt, and transform their farms (Darnhoffer et al., 2016). This approach highlights the important role a farmer plays in maintaining the operations of their farms and contributing to food system resilience. Additionally, this perspective highlights the role of the unique values and perceptions of farmers and how these individual differences determine what strategies are viable in the face of disruption.

Social-ecological systems are complex and multi-levelled; therefore, it is important to distinguish that resilience does not exist in isolation (Kuhmonen, 2020). An individual farmer/farm system is embedded within a greater local community, which is embedded within a larger social, political, institutional, economic, or environmental paradigm. What happens at one level of this system will influence the others, as all levels are interconnected (Kuhmonen, 2020). This distinction is important when considering resilience interventions.

Resilient systems are relevant to this study as they relate to our food system's response to COVID-19. Resilience is essential to preserve food provisioning and food security (Hodbod & Eakin, 2015; Kuhmonen, 2020). A highly resilient food system is one that would be able to adapt and transform in response to the shocks and stressors associated with COVID-19, while maintaining its basic structure, process, and function. Considering the challenges presented by COVID-19 and the current state of Canada's food system, the purpose of this study was to gain an understanding of how COVID-19 impacted local food system producers

at the Antigonish Farmers' Market (AFM) in Nova Scotia, Canada. We were particularly interested in identifying adaptation strategies that enabled or constrained producer resilience. We also examined the accessibility and sufficiency of agriculture support available to AFM producers during this time, with an interest in how they, among other structures, may contribute to local food system resilience.

Research setting

This research project took place in Antigonish, Nova Scotia, Canada, a rural community with a population of approximately 5000 community members (Statistics Canada, 2017). In this region, farming is diversified and occurs at a smaller scale when compared to Western Canada. For example, Saskatchewan farmers typically produce cereal grains or legumes and farm livestock (mainly beef) with an average farm size of 1766 acres (Statistics Canada, 2021a). Comparatively, Nova Scotian producers farm a variety of produce and/or raise several different herds, and the provincial average farm size is 263 acres (Statistics Canada, 2021a). The financial picture of Nova Scotia farms is also quite different than large farms out west, as the average net farm income in 2020 in Nova Scotia was -$58 328 compared to a +$3 million average net farm income in Saskatchewan (Statistics Canada, 2021b).

Antigonish producers can market their products at the AFM, directly to consumers, or through various local retail businesses. The AFM is open once a week on Saturday mornings and closes for only two weeks over Christmas (Antigonish Farmers' Market, 2021). Additionally, direct-to-consumer sales may include online platforms, roadside stands, or farmgate sales. There are also two large chain grocery stores in the town; however, these grocery stores are primarily supplied by the conventional food system.

Applied research methods

A cross-sectional, qualitative methodology was employed using semi-structured, online interviews that were audio/video recorded, transcribed verbatim, and thematically analyzed using an inductive grounded theory approach. Ethics approval was granted by the Human Nutrition Student Research Ethics Committee and the StFX Research Ethics Board on September 21, 2020 [Romeo file #: 24880].

Recruitment

Participants were recruited via maximum variation purposive sampling by selecting from a total of twenty-two food producers that sell products within four different categories (i.e., dairy, produce, meat, and pantry) at the AFM. The inclusion criteria required that participants: were over the age of eighteen, current members of the AFM, and identified as local Nova Scotian producers. Purposeful selection was used to select and invite approximately thirteen vendors, ensuring the inclusion of participants from different sectors of farming (i.e., produce, livestock, other) and diverse perspectives. These vendors were approached in person at the AFM and informed of the study. If interested in participating, they received a follow-up email containing the Invitation to Participate and the Consent Form. Once these forms were completed, an interview was scheduled based on participant convenience. A total of eight vendors completed these forms and took part in the project.

Data collection and analysis

A researcher (KW) developed a semi-structured interview guide, informed by expert opinion via the Nova Scotia Department of Agriculture and reviewed by the AFM community partner (MW). The guide consisted of thirteen open-ended questions, focussed on how local farmers managed their businesses during COVID-19, the challenges they faced, and how they adapted.

A total of eight interviews were completed with food producers from the AFM. Of the eight participants, three were primarily fruit or vegetable farmers, three were primarily meat, poultry, or egg farmers, and two were in the other category, as shown in Table 1. The other category captures farmers who do not fall into the fruits/vegetables or meat, eggs, or poultry sectors, such as dairy, honey, or maple syrup producers.

A single round of interviews was conducted online via Microsoft Teams or over the phone based on participant preference. These formats were selected to ensure that the study upheld COVID-19 protocols and maintained participant privacy and confidentiality. Interviews varied in length from approximately twenty to fifty minutes.

Data were thematically analyzed following six stages, as suggested by Braun & Clarke (2006): familiarizing oneself with the data, generation of initial codes, collation of codes into potential themes, review of themes, ongoing analysis to refine each theme's definition and name, and finally, completion of a written report.

Quality and rigor

To ensure the accuracy of transcription, hard copy transcripts were hand-delivered to each participant after interviews to check for correctness. One participant provided minor clarification upon the return of their transcript, while the other seven had no concerns. Strategies such as peer debriefing, member checking, and external auditing were utilized to increase the validity of the results. Additionally, intercoder agreement was reached between the researchers to establish qualitative reliability.

Results

COVID-19 impact on local AFM food systems

This research was primarily designed to investigate local food system resilience at the production stage of the system. However, as the research was conducted, it became clear that local food producers are intimately involved with all stages of the food system. This differs significantly from conventional producers where stages of the food system are siloed (Mosby et al., 2020). As such, the results presented here detail local AFM producers' experience with food system production, transformation, distribution, access, and consumption.

The production stage of the food system involves the growth and cultivation of food. During this phase, the most notable challenges resulting from COVID-19 were the concern about input and service access due to

border closures, increased production, and the use of additional help on the farm.

Transformation is the processing and packaging of raw food to products that are ready for sale, and the biggest concern at this stage of the food system was disrupted input or service access. Among the meat/poultry/egg producers, several participants expressed major concern regarding access to processing facilities. Producers seemed to be worried that they would not be able to get their product processed in time or at all due to the major bottleneck at these facilities. The cause of such bottlenecks was not made clear during interviews, though several news reports express a limited work capacity due to COVID-19 outbreaks (Canadian Press, 2020). One producer stated, "the worry was definitely processing facilities, be it for butchering or for preparing feeds or fertilizers or any of our silage wrap or any inputs that [we] would have on farm to make sure that everything was booked well enough in advance and that we were going to actually receive them…it is limited here, especially in this end of the province." [Participant 06] Another participant worried about their access to bottles required for product packaging. This input concern reflected shipment delays across international borders that were slowed or halted completely because of the pandemic.

Distribution involves the transportation of products to either intermediates (i.e., wholesalers, retailers) or directly to the consumer, and access refers to the channels through which consumers can acquire products. During these stages of the food system, COVID-19-related repercussions included market channel closures, increased transportation and marketing costs from pursuing new distribution channels, increased product prices, and increased marketing efforts.

Increased marketing and distribution costs resulted from producers exploring new business avenues. One example was the AFM online market, which opened in 2019 and replaced the physical market during the COVID-19 shutdowns in the spring. Though the online market served as a new distribution channel for many of our participants, two participants expressed challenge with the subsequent "online fee" that had to be paid by either the producer or the consumer. One producer expressed, "when we were going online to the farmers market and selling online, the farmers market charged the producer and also the consumer a total of 25 percent" [Participant 07] Users had to absorb increased marketing costs or increase their sales prices.

In addition to the online market, many participants began offering delivery services. These distribution costs were also a concern, again to be borne by either the producer or the consumer. Participants seemed torn between maintaining a fair price for their customers while making profitable margins. Another producer concurred, "we had to make sure that whatever price we put on would be satisfactory not only to our consumer but as producers as well." [Participant 05]

It is also important to note that increased reliance on online markets required a high technological literacy among producers. If producers did not have this skill, they had to be willing to learn, or they would lose out on potential sales.

Finally, consumption refers to the final piece of the food system: the sale of products. Changes in sales and a lack of local support were the most common themes mentioned by participants at this stage of the food system. Five of eight participants described their changes in sales as dynamic. These producers experienced an initial increase in sales during the immediate panic of COVID-19, then a drop in demand as the public was encouraged to stay home and limit public outings. Two of these participants estimated that their overall sales were slightly decreased from previous years, opposite to the experience of another participant

who projected an overall increase in sales compared to previous years. Decreased sales were attributed to the closure of market channels (i.e., restaurants), public fear, and the absence of tourism and/or travel, while increased sales were attributed to an increasing consumer desire for locally sourced products. The other two participants with dynamic changes described their experience as "off the charts" [Participant 04] at the beginning of the pandemic but levelling off to normal as time went on. Of the remaining participants, two producers shared no sales changes compared to previous years, and one participant was in their first year of business. In general, participants had varied experiences that were seemingly unpredictable and required adaptation.

Across all stages of the food system, participants who had independent operations and financial security expressed fewer challenges/concerns than participants who relied on external structures (i.e., processing facilities, market channels, etc.). For example, Participant 01 shared that they felt secure as a business operation because they were self-sufficient, stating, "as long as we don't lose power, we're good." This producer felt like their operation differed from the experience and risk of other producers, namely livestock, who utilize external operations such as slaughterhouses in various parts of the province or across domestic borders.

Producer response

In response to their significant challenges, AFM producers demonstrated a wide range of adaptation strategies that allowed their businesses to persevere. At the production stage of the system, local AFM producers modified their production capacity in response to changing demands. For example, two participants observed an increased demand and expressed plans to increase their production to meet this need moving forward. For one producer, this meant adding another greenhouse and purchasing more land, and for another, purchasing more breeding hogs and a new investment in meat rabbits.

At the distribution and consumption stages, local AFM producers adapted by increasing their marketing and media efforts and transitioning and/or expanding their marketing and distribution channels. For many participants, online marketing and sales platforms became an essential distribution stream during the COVID-19 disruptions. Typically, this involved business social media pages, websites, or the AFM online website. Seven of the eight participants spoke extensively about how their use of online platforms had increased due to the pandemic. One producer identified, "I did a lot of orders online on my own website, and then the farmers market online website." [Participant 02] In addition to the boom in online sales, five of the eight participants also mentioned the pursuit of contactless distribution channels, which in many cases referred to doorstep deliveries, curbside pickup, or farmgate sales. These new avenues were a major source of survival for many farmers' businesses. One producer explained, "allowing people to get deliveries and curbside pickup was huge." [Participant 02] A second producer agreed, "we ended up with a huge influx of farm gate sales during that time." [Participant 06]

Agriculture support

The availability and suitability of agricultural supports was another important consideration of producers' response to COVID-19. This included both ongoing programs and those specifically designed to address challenges resulting from the pandemic. Several participants expressed that they were generally uninformed of what programs were available to producers during COVID-19: two producers stated that they had never been made aware of any supports

available and two producers shared that they had to "dig" to find programs that were suitable to them. Conversely, the remaining participants expressed that knowledge of these programs was readily available through various sources such as the AFM Association, other producers, the Federation of Agriculture, and local agriculture representatives. Table 1 displays the participants' production sector, approximate size, whether farming provided a sole or partial income, and if participants accessed government support during COVID-19. Of note, when asked to self-identify the size of their farm, six of eight participants claimed to have a small, or small-medium, size operation. Land ownership among producers in the fruits/vegetable sector ranged from a quarter of an acre to two acres, while producers in the meat/poultry/eggs and other sectors self-proclaimed as small or small-medium based on their livestock count. Producers were not explicitly asked about their annual eligible gross commodity income.

Table 1: Participant characteristics and access of government support programs

Sector	Size	Income	Support	Source of Support
Fruits/vegetables	Small	Sole	Yes	EI
Fruits/vegetables	Small	Partial	No	-
Fruits/vegetables	Small	Partial	No	-
Meat/poultry/eggs	Small	Partial	No	-
Meat/poultry/eggs	Small-medium	Partial	Yes	loans, relief of loan
Meat/poultry/eggs	Small	Sole	Yes	CERB
Other	not specified	Partial	No	-
Other	not specified	Sole	Yes	loan

Half of the participants (n = 4) claimed to have accessed government support since the pandemic began. Those who did access support utilized financial assistance programs such as loans, relief of loans, Employment Insurance (EI), or the Canada Emergency Response Benefit (CERB). In our sample, EI was collected from seasonal work done prior to the farming season.

Participants who accessed support utilized their financial assistance in various ways. Some producers accepted the money as reparation for the loss of sales, while others used it to expand their business. For example, Participant 02 invested in a new cooler to distribute their product, "just for distribution of my product creating a cooler, a portable cooler trailer that I can use to haul product from the abattoir and also to the market and that would make my life a lot easier and make it more efficient for me to do things."

Among the three participants whose sole income came from farming, all accessed government support programs. Conversely, for participants in which farming supplies only a partial income, only one participant of five accessed governmental support.

There were various reasons the partial income producers did not access government support. For one producer, farming was viewed as more of a hobby. When asked if they had accessed any support during COVID-19, Participant 05 replied, "No, I was aware of it, there were other people getting it, but I said 'oh, we won't worry about that.' The vegetables that we're doing now is just a partial income.... Just more for the joy, we really enjoy working with soil and we enjoy

doing this type of work and it's a nice way to keep busy." [Participant 05]

In other cases, producers did look for support but were too intimidated to apply, ineligible, or turned down. One producer explained "I may have been intimidated by what I may have thought [the] process to be.... I just assumed I didn't have the time or whatever to do it." [Participant 04] Another producer did not find an appropriate program, "there's a massive list, [of supports].... But, you know, most of them are not specific to my type of farm because we're not large.... That's the biggest problem we have is like, all these programs are set up for wages and stuff, and we don't make wages. [The] more general programs that came out for businesses, not necessarily for farms but for businesses could [apply, but I didn't qualify] because our sales and revenue didn't decrease." [Participant 02] Yet another producer had no luck, "We've applied for a list [of supports], but we've been turned down." [Participant 07]

Finally, there was an additional subset of producers who did not feel the need to access to supports at all. Despite the challenges from COVID-19 their sales were not down, and financial relief was not necessary. Participants in this subset were exclusively partial-income farmers.

Opportunities to increase local food system resilience

Analysis of food system challenges and AFM producer response offered insight into opportunities to enhance local food system resilience. Three key themes became apparent: producer collaboration, increasing local community support, and tailoring agriculture support.

Producer collaboration

Many participants expressed interest in creating local partnerships within the AFM Association. Several ideas were explored, some involving collaboration at the food system's production, distribution, or consumption stage. During production, one farmer proposed the idea of an "aggregate garden supply" to create a network where producers could share tools and resources. At the distribution stage, the idea for a "market store" was explored—a store that would function like a grocery store, but local AFM vendors would supply the products. The hope is that this store would make the farmers' products more available to consumers by extending the days and hours of operation. One producer explained, "tying in with other farmers like it'd be beneficial...sales and marketing co-ops with other farmers to allow for customers to get your one-stop-shop." [Participant 01]

Another idea for collaboration was to develop programs that would allow local farmers to partner and expand their distribution channels to surrounding communities. One example shared was splitting the cost of transporting products to surrounding community markets (i.e., Truro, Halifax). This would allow local farmers to increase their customer base and sell more products, without the burden, cost, or environmental impact of transporting their products to surrounding regions on their own.

Enhancing local support

Establishing relationships with local consumers in response to their rising interest in local food was imperative for producer success throughout the pandemic. In fact, all eight study participants spoke extensively about the importance of their relationship with the local public at both the individual and community levels. For some, this meant establishing

relationships, and for others, continuing them. The foundation of a strong local consumer network seemed to be a predictor for resilience during the pandemic. One producer identified, "the biggest resilience was just having, you know, strong customer base, right…personal relationships with a lot of my big customers helped a lot." [Participant 02]

Local support could also be shown in forms other than the individual level. For example, several producers have established or are looking to partner with local restaurants, businesses, or institutions to sell their products through. These relationships benefit the local community and the producer; thus, the opportunity to increase the development of local partnerships is a win-win. One producer explained, "I used to sell to [local restaurant]…and they've asked me again whether that's a possibility…so we'll see if there's enough product there next year to spread our wings a bit." [Participant 06]

Finally, extending outside the immediate community, many participants expressed interest in establishing a more robust provincial food system. This means that a food system (i.e., production, transformation, distribution, access, and consumption) would be fully functional within Nova Scotia. Participants expressed a desire for these developments, as they believed it would increase their individual resilience as a farmer and contribute to the resilience of the larger food system. Developing a more robust provincial food system had high desirability among participants but was acknowledged to be a significant challenge to achieve on their own.

Agriculture support

Our data suggest that the government support programs available for local producers at the time of study may not have been sufficient. Although various agriculture support programs were available, not all producers could access them due to ineligibility or intimidating and lengthy application processes. Participants made several recommendations when asked to hypothesize what types of programs or supports may be beneficial.

Participant 02 expressed a desire for assistance with developing marketing channels. If producers do not (or cannot) utilize in-person or online farmers' markets, they must generate, develop, and implement distribution channels on their own. Participant 02 describes this task as "significant for a small farm."

Participant 07 wanted more support with pandemic-related costs, "If the government really wanted to help in COVID, they could've helped those costs that the farmers' markets were having to field to go online, which were passed on to the consumer and the producer. The government could've come in and given a 20 percent grant to the Farmers' Markets so that the producer and the consumer didn't have to pay those costs."

Other participants were interested in the development of supportive programming and further education. Courses were needed to teach participants how to move a business online or to market through social media. Some of these programs exist; however, one participant expressed concern about their ability to attend, as most of the classes were scheduled during the workday.

Discussion

Producers demonstrated agency in adapting their businesses to various uncertainties caused by the COVID-19 pandemic. They contributed to local food system resilience through many responses to pandemic challenges, including being active agents of change, creating opportunities, adapting, and learning. Although these reactions allowed producers to persist, opportunities still exist to further enhance local food system resilience as a whole. Producers are embedded within larger social, environmental, and economic systems. Other opportunities to enhance local food system resilience from larger spatial and temporal domains include increasing local support and fostering producer collaboration. Additionally, data suggest that the suitability and accessibility of agriculture support can be improved upon to better support small-scale, diversified Nova Scotian producers. The following discussion explores our study findings from a social-ecological lens, drawing conclusions about the resilience of the local AFM food system during the COVID-19 global pandemic.

Food system resilience from a social-ecological relational perspective

The social-ecological framework depicts people and their environment as interdependent systems. Through the lens of COVID-19, this framework can be used to understand how producers have been enabled or constrained by social, environmental, or economic factors outside of themselves (Kuhmonen, 2020). In 2016, Darnhoffer and colleagues evolved this framework from its original dyad to a relational perspective. Instead of viewing resilience as an interaction between social and ecological domains, or between structure and agency, resilience from a relational perspective develops from interactions across a variety of domains. By considering farmers as intimately entangled with various spatial and temporal domains, Darnhoffer and colleagues' progressive approach addresses many of the previously criticized features of the social-ecological perspective (2016).

A relational approach to the social-ecological framework offers insight to how farming modifies and is modified by a range of social, environmental, and economic processes over space and time (Darnhoffer et al., 2016). Resilience is not a steady state to be achieved, nor can it be achieved through a prescriptive format (Darnhoffer et al., 2016; Tendall et al., 2015), it evolves continuously over time (Darnhoffer et al., 2016; Tendall et al., 2015). Expanding on this perspective, we depicted local AFM food systems across three interrelated domains: intrapersonal (the farmer), interpersonal (the farm system), and systems-level factors (the agri-food system) (Kuhmonen, 2020) [see Figure 1]. Intrapersonal factors refer to a farmer's individual agency in the food system, operating within their knowledge, expertise, and skill. At the interpersonal level, food system actors rely on relationships (i.e., organizational or community) to produce and sell food in a social setting. Finally, at the systems level, political contexts, economic climates, institutional supports, and environmental constraints influence the food system more broadly.

Resilience

In response to the variety of challenges reported during COVID-19, producers maintained their business operations by modifying their production capacity, increasing distribution channels, and expanding their marketing strategies [Figure 1]. This demonstrates resilience capacities such as self-organization, diversity,

adaptation, and learning (Darnhoffer et al., 2016; Tendall et al., 2015). The persistence and perseverance of producers' businesses enabled the local food system to maintain structure and function, contributing to local food system resilience (Holling, 1973; Kuhmonen, 2020; Shipanski, 2016).

This research aimed to determine how local producers achieved resilience during COVID-19. However, considering the larger social-ecological perspective of food systems, further analysis sought to discover how producers contributed to overall food system resilience from greater spatial or temporal domains. This is conceptualized by enabling and constraining factors that helped the local food system maintain process, structure, and function. As defined above, these factors can be grouped into intrapersonal, interpersonal, or systems-level factors.

Enablers

Individual qualities that lead to personal agency such as adaptability, flexibility, preparedness, and the willingness to learn were enablers and contributed to positive adaptation strategies. These qualities allowed participants to respond creatively to the changes brought about by COVID-19. Additionally, financial security among participants (i.e., personal savings, being retired or debt free, or other means of compensation) was considered an enabler of resilience. This meant that participants were not dependent on their farming related income for survival and had additional means to support themselves.

Strong interpersonal local relationships also enabled participants to successfully adapt to maintain their business, thereby supporting local food system resilience. Professional relationships with government, agricultural departments, and producer networks supported participants through information sharing, increasing self-sufficiency, and developing partnerships or camaraderie. Customer and community relationships were also strongly valued. Loyal customer bases were the foundation of survival during this unprecedented season, whereas community relations reflected participants and their business' reputation more broadly.

Finally, broader system enablers of resilience included food system independence and enhanced food system autonomy. Participants who had independent operations (meaning that they could carry out each stage of the food system themselves) appeared more resilient than those relying on external processing facilities or distributors. Production independence allowed farmers to have complete control over their operations and therefore were less susceptible to disturbance or disruptions related to COVID-19.

Structural agricultural support programs also had the ability to enable local food system resilience. Among those who utilized agriculture support, these programs enabled producers via financial compensation, allowing them to pursue adaptation strategies or to recover from the loss of sales due to the pandemic.

Constrainers

Constraining factors of local food system resilience included limited interpersonal and system-level support and the general unpredictability of COVID-19 on the food system. Some participants felt under-supported by local consumers, the broader local community, and government institutions. Although some producers experienced a temporary increase in their customer base, they felt this was unlikely permanent. More broadly, one producer spoke about the lack of local support from larger community institutions such as a local university. Finally, some producers expressed a desire for more formal agricultural support from government or non-governmental programs. Support could come in the form of financial assistance

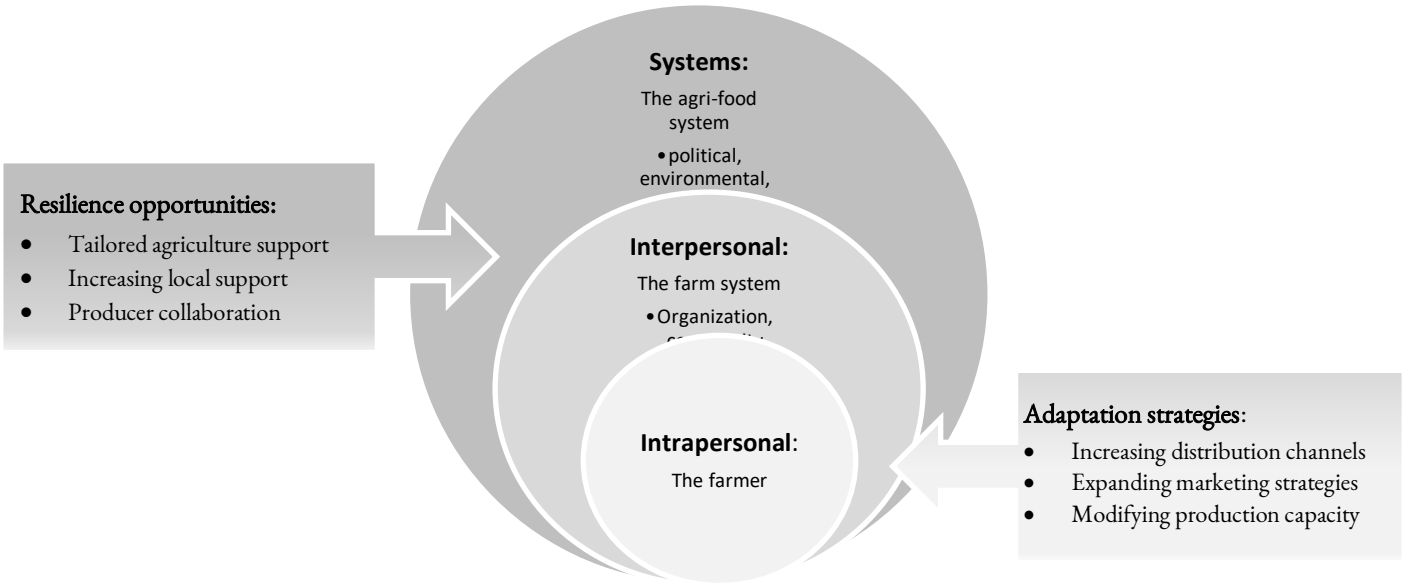
programs, business development programs, or skills programs (i.e., technology or social media courses). Not all producers were able to utilize the current agriculture support based on eligibility or accessibility. Generally, participants felt as though there weren't many programs designed for small, local farmers like themselves.

Finally, due to fluctuations in consumer demand and the general unpredictability of the virus, producers struggled to plan ahead for their season. Unpredictability affected other system inputs such as seeds, animal feed, and farming equipment. The main fears among producers were border closures, temporary market cessations, and temporary closures of processing facilities.

Resilience from a social-ecological relational perspective

The ability of local AFM producers to adjust to changing internal processes and external drivers resulting from COVID-19 demonstrates resilience as defined by Folke et al. (2010). In our study, most adaptation strategies occurred at the intrapersonal and interpersonal levels, and opportunities to increase local food system resilience at the AFM are rooted within the interpersonal and structural domains [Figure 1]. At the interpersonal level, producer collaboration and increasing local support are opportunities to increase the social network of AFM producers. These opportunities focus on enhancing producers' relationships in their organization or community. Additionally, optimizing agriculture support is rooted in systemic change, either political or institutional in nature. This opportunity is a systems-level factor and relies much more significantly on structural influences. Regardless of where opportunities lie within the social-ecological framework, a multilevel approach is necessary to bolster local food system resilience. For example, interpersonal relationships are enabled by intrapersonal qualities such as charisma or approachability as well as system structures such as political climate. In this example, the importance of interrelated thinking is evident.

Figure 1: Social-ecological relational framework of the local AFM food system



The social-ecological framework distinguishes different levels of the food system as intimately interconnected. Understanding the interrelatedness of the social-ecological domains is important when considering resilience interventions. As demonstrated by our findings, we have learned that local producers are innately involved with all stages of the food system and that opportunities for adaptation exist across all domains. Focussing on only one part of the system fails to account for the interconnectedness of the system. As such, when considering food system resilience interventions, all levels of the system and how these levels interact with one another must be considered.

Agriculture support

The secondary aim of this research project was to assess the accessibility, suitability, and sufficiency of agriculture support available during COVID-19. Our data demonstrated that although various government support programs were made available during the pandemic, they were not entirely suitable for our participant population (which included both sole and partial income small-scale farmers). Among those who wished to access government support but could not, there is a clear opportunity for improved access and suitability.

Tailoring agriculture support programs to small, diversified Nova Scotian farmers has been identified as an opportunity for enhancing local food system resilience. As such, this research project calls for closer consideration of developing agricultural support programs that suit our population of interest. Increased collaboration between local producers and policy makers could ensure that programs are more suitable to those they are designed to serve. Furthermore, the application process for these programs currently functions as a barrier to use, and as such, simplifying this process would increase accessibility.

Strengths and limitations

Strengths of this research include the quality and rigour prioritized throughout the study and good representation among our sample. From a total of twenty-two AFM producer vendors across three sectors, our sample included eight participants from all three divisions of production.

This study took place in the fall of 2020. The COVID-19 pandemic has been a dynamic situation, and as such, findings in this study are specific to the time of our research and may not apply to other time points in the pandemic. Additionally, this study was conducted in a rural Nova Scotian community, and the findings may not apply in other contexts.

Conclusion

The Canadian food system faced significant challenges during the COVID-19 global pandemic. This included barriers along each stage of the food system, such as reduced border access for production inputs or transformation services, bottlenecks in the system, the closure of marketing and distribution channels, and unpredictable consumer sales. Despite these challenges, AFM producers responded by modifying their production capacity, increasing distribution outlets,

and enhancing marketing strategies. Furthermore, we defined opportunities for strengthening local food system resilience such as increasing producer collaboration via the development of a market store or aggregate farm supply, increasing local support, establishing local partnerships, advocating for a more provincially robust food system, and tailoring agriculture supports to be more accessible and suitable to small, diversified Nova Scotian farmers.

Considering food system resilience from a social-ecological relational lens, the local AFM food system can be viewed across three interrelated domains: intrapersonal, interpersonal, and systems-level. In our study, most adaptation strategies occurred at the intrapersonal and interpersonal levels, whereas opportunities for increasing resilience were rooted within the interpersonal and structural domains.

At large, COVID-19 has exposed the fragilities of the conventional Canadian food system. Our project demonstrated that local food system producers in and around Antigonish, Nova Scotia showed high resilience throughout the pandemic. As such, this research provides an opportunity to recognize the resilience of local AFM producers and analyze their experiences, with the hope that our findings can inform opportunities to enhance food system resilience on a larger scale. Further research could be done on global/conventional food systems that also achieved resilience, comparing the enabling and constraining factors of each.

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Kelli Weinkauf received her BSc in Human Nutrition from St. Francis Xavier University in 2021, during which she completed an honours thesis with Dr. Everitt. This research was close to Kelli's heart, as she grew up in a farming community in rural Saskatchewan and understood the impact of farmers in their local community. She has since gone on to pursue a career in dietetics and currently works as a Registered Dietitian in Southern Alberta.

Tracy Everitt is a Registered Dietitian and an Assistant Professor in the Department of Human Nutrition at St. Francis Xavier University. Her professional and scholarly work supports sustainable, resilient, and healthy systems and people. Her work expands the role of sustainability in dietetic education, practice and research and supports the development of a national school food program through research on food and sustainable food systems in schools.

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