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Reflecting on COVID-19 for integrated perspectives on local and regional food systems vulnerabilities

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ABSTRACT

The COVID-19 pandemic has highlighted multiple vulnerabilities and issues around local and regional food systems, presenting valuable opportunities to reflect on these issues and lessons on how to increase local/regional resilience. Using the Fraser Valley Regional District (FVRD) in Canada as a case study, this research employs integrated planning perspectives, incorporating comprehensive-systems, regional, place-based, and temporal considerations, to (1) reflect upon the challenges and vulnerabilities that COVID-19 has revealed about local and regional food systems, and (2) examine what these reflections and insights illustrate with respect to the needs for and gaps in local/regional resilience against future exogenous shocks. The study used a community-based participatory approach to engage local and regional government, stakeholders, and community members living and working in the FVRD. Methods consisted of a series of online workshops, where participants identified impacts related to the food production, processing, distribution, access, and/or governance response components of the local and regional food systems and whether these impacts were short-term (under 3 months), medium-term (3 to 12 months), or long-term (over 1 year) in nature. Findings from the study revealed that food systems and their vulnerabilities are complex, including changes in food access and preparation behaviours, lack of flexibility in institutional policies for making use of local food supply, cascading effects due to stresses on social and public sector services, and inequities with respect to both food security impacts and strategies/services for addressing these impacts. Outcomes from this research demonstrate how including comprehensive-systems, regional, place-based, and temporal considerations in studies on food systems vulnerabilities can generate useful insights for local and regional resiliency planning.

1. Introduction

The COVID-19 pandemic has highlighted the vulnerability of global food systems, revealing multiple issues related to long supply chains, the nature of food systems labour, and economic insecurity (Clapp & Moseley, 2020). Communities across the world have experienced a range of pandemic-related short- and longer-term food systems issues, including mismatches between supply and demand due to panic-buying, loss of incomes, labour shortages, and challenges maintaining a safe working environment for food production and processing (Hobbs, 2020). Food systems vulnerabilities were simply highlighted (and not created) by COVID-19, and the pandemic has provided a glimpse into the disruptions that societies will experience with other major socio-economic disturbances, such as climate change (Newell & Dale, 2021).

Uren (2020, para. 14) aptly describes the pandemic as “a dress rehearsal for the kinds of disruption we are set to see in the next decade [with respect to climate change]”. Communities and regions must learn from this ‘dress rehearsal’ to increase local resilience. As noted by Carey et al. (2021), the pandemic has provided valuable lessons and opportunities for cities to understand vulnerabilities and increase resilience in food systems accordingly, and expressed by Newell & Dale (2021), such work should employ integrated perspectives that recognize the vulnerabilities highlighted by COVID-19 are not exclusive to pandemic impacts. The first critical step in harnessing these opportunities and engaging in such work is to examine the lessons from COVID-19. Using a Canadian case study, this research engages in such an effort by (1) reflecting on what COVID-19 has taught us about vulnerabilities in local and regional food systems and (2) elucidating how such reflections provide insights for

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integrated planning that can increase local and regional resilience.

Efforts toward examining and understanding food systems vulnerabilities through an integrated perspective require first understanding what comprehensively comprises a 'food system'. Food systems are complex, consisting of interactions between human and biophysical environments, interlinked processes from production to consumption, social and environmental outcomes (e.g., food security, health of ecosystems services, etc.), and other factors (Ericksen, 2008). Frameworks have been developed to better define these systems and their components, for example, the Initiative for a Competitive Inner City (ICIC) food systems framework which illustrates what comprises 'city food systems' by identifying four different components: processing, distribution, access, and government policies and practices (Zeuli & Whalen, 2017). Although useful, their framework is somewhat incomplete, as food systems are made up of all components and processes associated with food supply, from production to consumption (Pothukuchi & Kaufman, 2000). The ICIC framework excludes production, arguing that this outside of the domain of most cities (Zeuli & Whalen, 2017), and indeed, production is often thought of by city planners as being part of the rural domain (Greenstein et al., 2015; Pothukuchi & Kaufman, 2000). Accordingly, when examining food system vulnerabilities to support efforts toward resilience, it can be useful to expand the geographical scope to include interconnectivity between rural, peri-urban, and urban environments, using what some refer to as the 'city-region food system' approach (Blay-Palmer et al., 2018). This research takes such an approach and centres on the regional scale and inter-relatedness between cities within the region.

In the context of resilience, vulnerability can be defined as "the manifestation of the inherent states of the system that can be subjected to a natural hazard or be exploited to adversely affect that system" (Aven, 2011, pp. 517). In accordance with this definition, understanding food systems vulnerability requires examining the state and interactions among different system components (e.g., as characterized through frameworks such as described above) and what aspects of these systems allow hazards to exert adverse impacts on food supply. In some cases, hazards can contribute to and augment vulnerabilities. For example, the Intergovernmental Panel on Climate Change (IPCC, 2021) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem (IPBES, 2019) highlight the vulnerabilities and challenges agri-food systems will experience as (respectively) climate change and biodiversity loss issues progress and worsen. In the face of increasing global pressures such as climate change, the opportunity to examine and take heed of the lessons learned from the pandemic appear as particularly important (Carey, Murphy, & Alexandra, 2021). Prior to the pandemic, scholars such as Fraser and Campbell (2019) have argued for new approaches to food production, distribution, and consumption to create resilient food systems that can sustainably feed a growing population; this need is perhaps more apparent now than it ever has been. Albeit a different crisis, pandemic preparedness and climate adaptation share similarities and common needs, such as strategic optimization of local production and global supply chains (Newell & Dale, 2021).

It is important to note that although commonalities exist among food systems features and issues from place-to-place, these systems are shaped by social, cultural, economic, governance, and environmental characteristics; thus, there is no 'one size fits all' for food systems planning (Knezevic et al., 2017). Therefore, work that involves reflecting on food systems vulnerabilities highlighted by COVID-19 to inform resiliency planning efforts should also take place-based approaches. Such place-based work is best done through participatory approaches to integrated planning that are inclusive of diverse stakeholders to effectively ground plans and policies in local sociocultural and biophysical realities (Ling et al., 2009), and scholars have argued for using this form of planning in efforts to strengthen local food systems (e.g., Kaiser, 2017). Accordingly, research that is designed to support such planning and resilience efforts should also be participatory to ensure local values, knowledge, and interests are effectively incorporated into the studies

that aim to produce useful, practical outcomes for informing planning efforts (Newell et al., 2020). Therefore, when performing studies and efforts on reflecting on what COVID-19 has illustrated in terms of food systems vulnerabilities and needs for strengthening resilience, such work should be done through community-based, participatory exercises to ensure outcomes appropriately capture place-based contexts, issues, and realities.

In addition to being place-based, scholars in food systems planning (Carey, Murphy, & Alexandra, 2021) and, broadly speaking, integrated sustainability planning (Ling et al., 2009) argue that planning should involve temporal dimensions and long-term perspectives. Similarly, Savary et al. (2020) express how vulnerabilities food systems can be analysed both temporally and across food security components. Adding a temporal component to research centred on food systems vulnerabilities and resilience is important because impacts to food systems from exogenous shocks are dynamic and change over time (Hobbs, 2020), and thusly require differing immediate and longer-term responses. Furthermore, temporal explorations of impacts are useful for long-term planning, as they elucidate areas where policies and strategies can be directed, and capacities can be built, to support long-term sustainability goals.

This study harnesses the opportunity to reflect on COVID-19 to gain insights into how to increase local and regional food systems resilience (Carey, Murphy, & Alexandra, 2021), and to this end, the research is driven by the question: what has the COVID-19 pandemic taught us about food systems vulnerabilities and needs for improving local and regional resilience? As presented in the discussion above, exploring such a question requires using an integrated planning perspective, which in turn involves (1) comprehensively examining different components of food systems on a regional scale (Blay-Palmer et al., 2018; Pothukuchi & Kaufman, 2000), (2) employing place-based and participatory methods (Kaiser, 2017; Knezevic et al., 2017), and (3) including temporal dimensions for insights on long-term planning (Carey, Murphy, & Alexandra, 2021; Savary et al., 2020). The research methodology is designed in such a way to capture each of these elements, thereby nuancing the research question to become: how does a comprehensive-systems, regional, place-based, and temporal research approach help us reflect on what the COVID-19 pandemic taught us about food systems vulnerabilities and needs for resilience? To explore this question, the study employs a community-based approach, using the Canadian region of the Fraser Valley Regional District (FVRD) as a case study to reflect on what COVID-19 has illustrated regarding local and regional food systems vulnerabilities for the purposes of generating insights that can inform long-term integrated planning. The FVRD makes for a useful case study for multiple reasons, including that the region has an active agricultural industry, is a key site for provincial and international food distribution and processing, contains a diversity of communities with respect to size, geography, and multiple food-related issues and vulnerabilities.

2. Methods

2.1. Case study

The FVRD is located in the southwest of the Canadian province of British Columbia, directly adjacent to the province's major population centre of Metro Vancouver (Fig. 1). The region supports a population of over 330,000 (BC Stats, 2021). It is composed of six municipalities, eight electoral areas, and 30 First Nations bands (FVRD, 2021, n.d.). The FVRD contains rich soils, favourable climatic conditions, available water sources, and close proximity to lucrative food markets such as in Vancouver and the United States (FVRD, 2017); thus, agriculture forms an important component of the economy and identity of communities in the region (Newman et al., 2017).

The FVRD makes for a compelling case study on food systems vulnerabilities due to the importance of agriculture to the region and as a key site for food distribution and processing. The region generated 39%

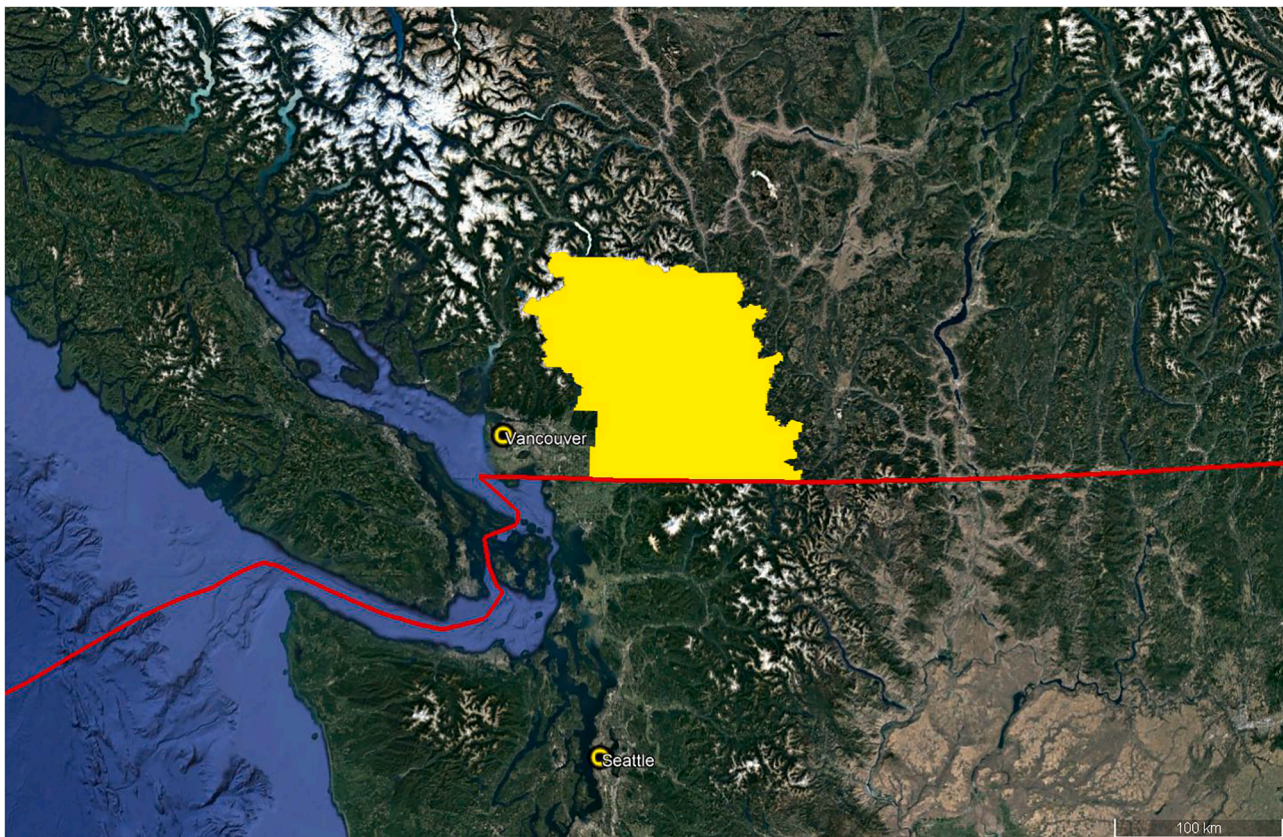


Fig. 1. Map of the Fraser Valley Regional District (yellow) and the Canada-USA border (red). Data sources: BC Data Catalogue, Google Earth, SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat / Copernicus, LDEO-Columbia, NSF.

of the total provincial gross farm receipts (GFR) and producers in the region were responsible for 44% of the total provincial increase to GFR over the 2010 to 2015 period (FVRD, 2017). Additionally, the FVRD estimates that the economic impact of agriculture drives \$3.1 billion in annual economic activity and support as an additional 18,000 full time jobs (FVRD, 2017). Accordingly, food processing and value-added activities are situated within the region with major food and beverage businesses and small-scale processing playing an integrated role with the broader region and provincial agri-industrial and agri-food systems.

Historically, a benefit of agriculture in the region has been its relative stability compared to other sectors (e.g., construction and manufacturing) (FVRD, 2017). However, there is also strong recognition and concern around increasing threats to the agricultural resources and industry in the FVRD, as detailed in the region's agricultural climate adaptation plan (BC Agriculture & Food Climate Action Initiative, 2015) and the Regional Snapshot Series: Agricultural Economic in the FVRD (FVRD, 2017). Accordingly, a community-based research effort on food systems vulnerabilities in the FVRD is beneficial in that it aligns and supports efforts toward addressing existing concerns in the region about the threats to an economically- and culturally-significant industry.

In addition to the role of agriculture in the FVRD, the region provides a useful case study for this research due to its diversity of communities with respect to size, geography, urbanity, etc. The largest city in the FVRD is Abbotsford, with a population over 160,000 people, while the region also contains smaller municipalities of a couple to a few thousand people, such as Harrison Hot Springs, Kent, and Hope (BC Stats, 2021). In addition, the FVRD encompasses an area of over 13,000 km² (FVRD, 2021), and contains communities ranging from those that are urban and well-connected to metropolitan centres to those that are rural and remote. Therefore, food systems issues and concerns in the FVRD are varied, and examining these issues can elucidate the differing nature of systems vulnerabilities that relate to (for example) food access and

distribution in both urban and rural areas.

The FVRD serves as an interesting case study due to it being located along the Canadian-American border and situated in a bioregion that is transected by this border. The bioregion concept has been employed as a lens for understanding ecologically-based, closed-loop approaches for food systems (although not without critique, e.g., Blay-Palmer et al., 2018). Accordingly, when examining food systems through a regional perspective, the FVRD's location presents important transboundary considerations on regional food systems challenges and needs.

2.2. Workshops

Two stakeholder workshops were held respectively in July and September of 2021. The workshops were conducted online via Zoom, and each ran for approximately two hours. A total of 66 individuals were invited via email to attend the workshops. Research participants were identified via Internet searches of food system organisations and actors and through research team partnerships with various stakeholders (e.g., municipal and regional government) and network groups (e.g., Abbotsford FRESH Network and the Mission Food Coalition). Participants were included based on their connection to food system areas (e.g., production, processing, distribution, access, and governance) and recruitment efforts were made to include representatives from each food system area. In this way, the research employs a methodological approach used in other studies, involving small focus groups of participants with specialized knowledge (Onwuegbuzie et al., 2009), that is, the participants were recruited due to their knowledge and involvement with food systems and food-related issues in the FVRD. Such methods have been employed in a variety of other studies that engage government and stakeholders in explorations of local and regional planning issues (e.g., Chase et al., 2010; Newell et al., 2020; Salter et al., 2009; Tress & Tress, 2003).

While representatives from all areas of the food system were invited, limited participation occurred in certain areas, such as farming, processing, and distribution. Recruitment of these stakeholders was more challenging because in the midst of the COVID-19 pandemic, producers, processors and distributors time was extremely limited. In total, 20 people participated in the first workshop, and five in the second. Participant included representatives from regional and local government (elected officials and staff), the regional health authority, local and regional food network organisations, community development not-for-profit organisations, social services, and community food programs (e.g., food banks). A second workshop was conducted as a group of stakeholders in the District of Mission were unable to attend the first workshop.

The workshop began with the facilitators introducing the agenda and the background and goals of the research project. Participants were then invited to ask questions about the project and the letter of consent, which they were provided prior to the session and signed/returned electronically to indicate their consent to participate in the study. The research project and letter of consent were reviewed and approved by the Human Research Ethics Board at the University of the Fraser Valley in May 2021 (file number: 100755). After addressing questions about the project and letter of consent, workshop participants were organised into virtual breakout rooms to identify the pandemic-related impacts on food systems that they observed through their professional and personal experiences. The ICIC framework was employed in this study; however, it was modified to include a food production component due to comprehensive system and regional approach taken in this study. In addition, ICIC's 'government policies and practices' component was changed to 'government responses' to adapt the framework to the impacts/vulnerabilities context of the study. Each breakout room focused on a particular component of the food systems as defined by the modified ICIC framework (i.e., production, processing, distribution, access, and government response). As this study includes temporal dimensions, impacts and emergent issues were examined on three different time-scales: short-term (within a quarter year), medium-term (three months to a year), and long-term (over a year); these timeframes 'fit' multiple temporal characteristics associated with food system dynamics as per previous research (e.g., Savory et al., 2020). Two 20-minute rounds of the breakout room activity occurred so that each participant could contribute thoughts to two different food system components.

As noted in the Introduction section, the study takes an integrated planning perspective, involving comprehensive-systems, regional, place-based, and temporal considerations in research design and approach. Accordingly, the methods described here were designed specifically to incorporate these different considerations into the investigation and research activities. Table 1 illustrates how these considerations and aspects of integrated food systems planning were incorporated into the research design and methods.

The breakout room activities were supported by the CoLabS platform (www.changingtheconversation.ca/colabs). CoLabS is a flexible, online

platform designed to be used to collaborate around sustainable development issues and challenges, and it can be customised to include different tools and sections, depending on the needs of a particular group or collaborative (Jost et al., 2021). For this project, CoLabS was customised to include virtual 'working tables' for each of the food systems components, and the working tables consisted of embedded Padlet widgets, which allowed participants to provide thoughts/observations on food system impacts under short-, medium-, and long-term headings (Fig. 2). The participants were asked to discuss impacts as a group and input notes from their discussion in the appropriate places on the digital working tables. The researchers moved among the different breakout rooms to help facilitate the activities and answer participant questions.

The workshop concluded with a plenary discussion of approximately 25-30 min in length. The purpose of the plenary discussion was for participants to expand on the outcomes of the breakout room activities, and a section was created in CoLabS that presented all five digital working tables on a single page to facilitate this discussion. The discussion was guided by a series of questions, the first being: what has the COVID-19 pandemic revealed about the vulnerabilities in the Fraser Valley Region? Participants were also asked about who (or what) were minimally and most impacted by the pandemic. Finally, as part of the community-based participatory approach employed in this research, participants were asked about information gaps and research questions/needs that they feel were important to consider as the researchers move forward with the project.

2.3. Data and analysis

Two types of data were collected through the workshops: (1) working table notes and (2) plenary discussion transcripts. The working tables were first examined to ensure participant notes/comments were placed in the correct areas because (due to a lack of familiarity with the software application) some notes were intended for certain areas but were placed in others. For example, a participant may write a comment about a long-term impact but mistakenly place it in the short-term section. After cleaning the working table data in this manner, the data were prepared in a table that was sent to the group in a synthesis report for their review to ensure none of their thoughts/comments were miscommunicated or misrepresented. The synthesis report was made public following a one-month review period (Dring & Newell, 2021).

Discussion transcripts were obtained by transcribing audio recordings of the Zoom discussions using the Trint application. The transcripts were reviewed by the researchers for accuracy and to correct errors. The final versions of the transcripts were anonymized, using participant identification numbers instead of names.

Data were analysed using a thematic analysis approach (Clarke & Braun, 2014). Data analysis first involved applying inductive coding techniques to the working table notes by identifying common themes as data were reviewed (Thomas, 2006), and altogether, 13 unique codes emerged and were applied to the data through this process. Coded data were then organised by food system components (i.e., production, processing, distribution, access, and government response) and temporal categories (i.e., short-, medium-, and long-term). With respect to the latter, data for short- and medium-term impacts were aggregated, as it was observed during the workshops that uncertainties existed around whether a food systems impact would be considered short- or medium-term for a number of the impacts. Accordingly, the results of the analysis consist of coded data organised by short-/medium-term impacts (under a year) and long-term impacts (over a year), as well as by food systems components.

The plenary discussion expanded and elaborated on the thoughts provided through the breakout exercises; thus, to capture this relevance, the plenary transcripts were analyzed through a deductive coding approach (Thomas, 2006), with the coding framework consisting of the themes defined by the coding framework. The framework was used to examine the transcript data and expand on the thematic analysis. Doing

Table 1

Aspects of integrated food systems planning and the research design and methods.

Aspect	Research method and design
Comprehensive	Examines food system from production to consumption, and includes considerations around government response; Employs a regional perspective to capture and examine agriculture and food production; Engages participants working in a variety of organizations and sectors
Regional	Engages government and stakeholders who work and/or are involved with food systems a local and regional scales; Includes participants from different communities across the case study region
Place-based	Uses a community-based participatory approach; Centres the study and research activities on a particular region and place
Temporal	Examines food systems impacts through multiple timeframes

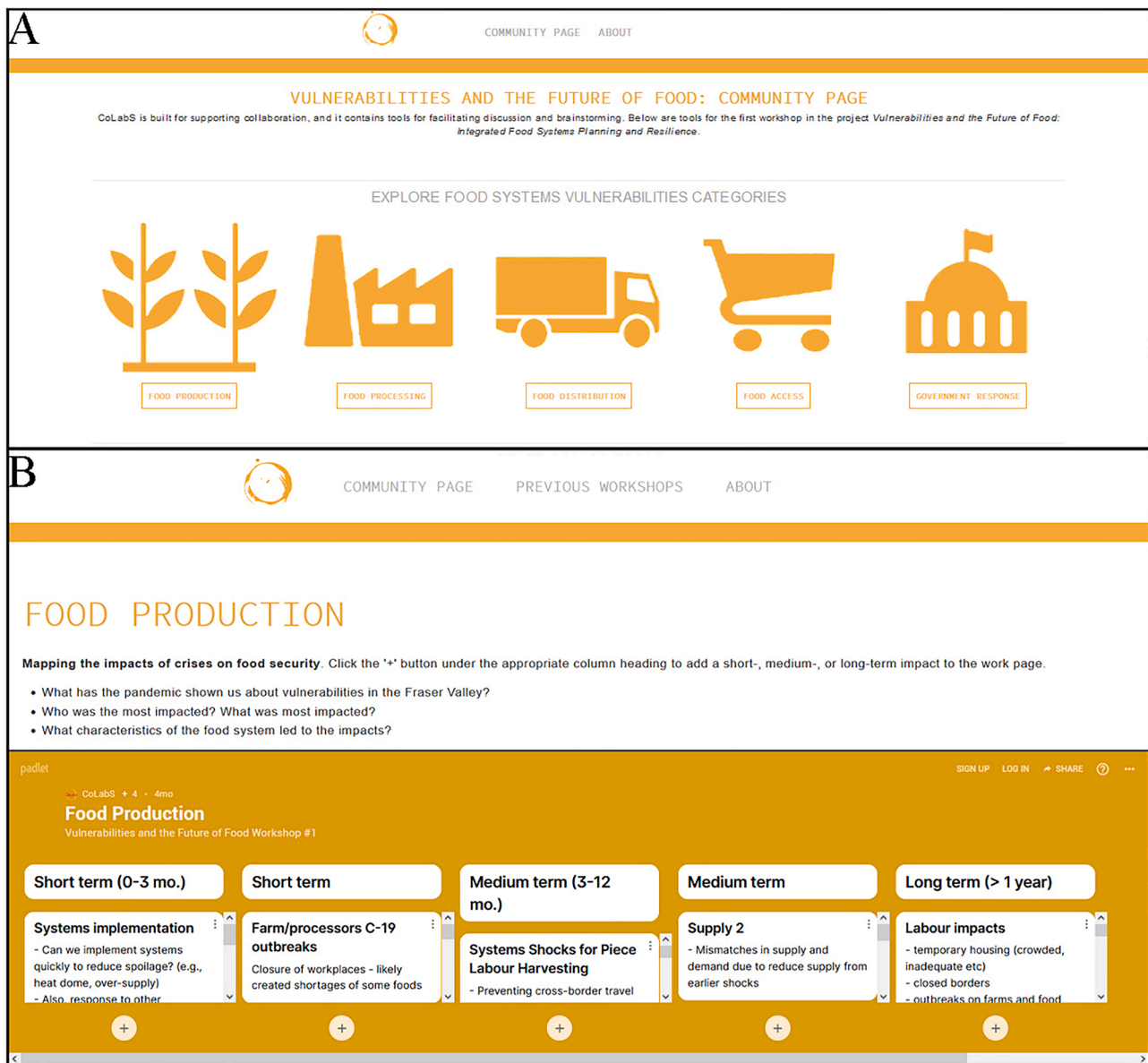


Fig. 2. Screenshots of the CoLabS platform's (a) home page and (b) a working table page.

this provided a richer understanding of the impacts identified through the breakout group exercises and an elaboration on the themes that emerged from the analysis. Due to the open-ended (and less structured) nature of the discussion, the results of the analysis were organized only by theme and not by the food system components and impact timeframes. In some cases, coded data overlapped significantly, meaning the themes related to one another. In these cases, coded data were examined together in broader thematic grouping, similar to an axial coding process (Simmons, 2017). Table 2 provides a complete list of codes and their analytical applications.

3. Results

Table 3 provides a summary of the results from the thematic analysis of the working table data, organized by food system component and timeframes. The following sections provide detailed descriptions of the outcomes from the breakout group exercises and illustrative quotes taken from the working tables. The sections are organized firstly by timeframe and secondly by food systems component.

3.1. Short-term/Medium-term impacts

3.1.1. Production

Themes in the production category of short- and medium-term impacts include labour, supply chains, demand shifts, and public awareness. Labour was a commonly discussed theme with participants discussing farmers experiencing disruptions in recruiting temporary seasonal farmworkers through the Seasonal Agricultural Workers Program (SAWP) due to cross-border travel restrictions. Labour was also discussed in concert with other themes such as supply chains and public awareness. In terms of the former, it was noted that labour was disrupted due to COVID-19 outbreaks among workers, resulting in shortages of some products. With respect to public awareness, participants noted that the challenges related to securing temporary labourers and protecting them from illness placed a spotlight on the issues and fragility of regional (as well as provincial and national) food production systems.

“Cross border travel restrictions highlight the complexity of labour regulation issues farms and agricultural workers face concerning; cash economies, minimum wage, self-contracted workers, income tax evasion, workers compensation, unemployment insurance,

Table 2
Thematic coding framework and application.

Analysis	Food system component	Codes
Short-term / medium-term working table data	Production	Demand shifts, Labour, Public awareness, Supply chains
	Processing	Affordability, Labour
	Distribution	Demand shifts, Policy trade-offs, Supply chains
	Access	Consumer behaviour, Demand shifts, Labour, Policy trade-offs, Supply chains, Vulnerable populations
Long-term working table data	Government response	Affordability, Institutional inflexibility, Labour, Policy trade-offs, Resource limitations, Supply chains, Vulnerable populations
	Production	Compounding impacts, Labour, Organisational disconnect, Public awareness, Supply chains
	Processing	Institutional inflexibility, Resource limitations, Supply chains
	Distribution	Affordability, Institutional inflexibility, Organisational disconnect
	Access	Affordability, Information access, Resource limitations, Vulnerable populations
Plenary discussion transcript data	Government response	Institutional inflexibility, Labour
	All (Processing, Processing, Distribution, Access, Government response)	Vulnerable Populations & Information Access*, Resource Limitations & Compounding Impacts*, Consumer behaviour & Affordability, Policy Trade-offs, Labour & Supply Chains*, Public Awareness, Organisational Disconnect

* The use of the ampersand indicates overlapping themes that were examined together.

business licences, work permit requirement and immigration.” - Participant Comment, Production Working Table

Other themes that emerged from the production breakout group activities include shifts in demand, as eating habits changed in response to pandemic. Restaurants and institutions were initially left with an oversupply of food products due to a rapid shift away from dine-in customers, resulting in a large amount of food waste. Food waste issues were also found within the supply chain theme, particularly in the dairy sector which is a significant industry in the FVRD (BC Dairy Association (n.d.)). Dairy is highly regulated in Canada through a quota system (Findlay, 2012), and dairy farmers produce at rates based on their quota. Supply chain disruptions created challenges getting dairy products to market, which forced farmers to discard marketable goods produced due these quota-based production rates.

3.1.2. Processing

Themes in the processing category of short- and medium-term impacts include labour and affordability. Similar labour issues were identified to those discussed with production, that is, challenges recruiting workers and preventing them from contracting and transmitting the virus in food processing facilities. Participants commented that such challenges are a likely contributor to rises in food prices, thereby affecting food affordability.

3.1.3. Distribution

Themes in the processing category of short- and medium-term impacts include supply chains, demand shifts, and policy trade-offs. One the more apparent short-term impacts involved supply chain issues

Table 3
Summary of results from working table data analysis.

Component	Timeframe	Impacts
Production	Short/medium	Labour shortages due to challenges recruiting seasonal farmworkers, and resulting supply chain issues; Increased public awareness around farm labour issues; Food waste from shifts in eating behaviours and supply chain issues
	Long	Labour shortages due to challenges recruiting seasonal farmworkers, and resulting supply chain issues; Greater awareness around a lack of food system coordination
Processing	Short/medium	Labour shortages and safety issues in processing facilities; Increased food prices due to labour challenges
	Long	Rigidity due to centralized processing/selling of goods; Bottlenecks due to a lack of processing capacity
Distribution	Short/medium	Supply chain issues due to cross-border travel restrictions and closures of restaurants/suppliers; Challenges delivering products due to physical distancing health policies
	Long	Lack of ability for institutions to source local supply; Lack of strong networks for coordinating food distribution and storage for charitable food programs
Access	Short/medium	Vulnerable populations experiencing challenges accessing food and delivery services; Loss of volunteer base for food programs; Shifts in eating behaviour toward unhealthier diets; Increased demand for community garden plots
	Long	Vulnerable populations experiencing challenges accessing information and food services; Increased demand for services to support vulnerable groups
Government response	Short/medium	Temporary worker shortages and related effects on supply chains and food prices; Labour shortages due to financial supports disincentivizing (unsafe) employment; Inflexibility in funding programs for charitable services
	Long	Persistence of labour shortages; Premature completion of funding support programs

related to cross-border travel; however, more nuanced issues were experienced within supply chains due to shifts in demand. The closures of restaurants caused food suppliers and distribution centres to reduce inventories of certain items, and health authority participants noted that this created challenges for healthcare facilities such as hospitals that needed to source some of these items.

“The start of COVID caused some food shortages when food distribution centres stopped carrying inventory of some items due to restaurants no longer requiring particular food items, which in turn caused food item substitutes needing to be sources for healthcare.” - Participant Comment, Distribution Working Table

Health authority participants also identified challenges associated with trade-offs experienced from provincial public health policies and guidelines developed in response to the pandemic. The requirement for physical distancing prevented food delivery workers from entering hospitals beyond loading docks; thus, incoming hospital food goods were often left at the dock. This meant that hospitals had to recruit their already-busy staff to move these goods from loading docks to storage spaces.

3.1.4. Access

Themes in the access category of short- and medium-term impacts include vulnerable populations, labour, policy trade-offs, consumer behaviour, demand shifts, and supply chains (the supply chain comments referred to the aforementioned production, processing, and distribution challenges within this theme). The vulnerable populations theme frequently emerged through the food access working table data,

with participants commenting that seniors were particularly affected by the pandemic due to both stronger health concerns and a lack of familiarity with digital platforms for getting food delivered. In addition, participants commented that groups that rely on public transit for transportation and access to groceries were more exposed to the virus due to increased contact with others.

The vulnerable populations theme also demonstrated relationships with other themes, such as labour and policy trade-offs. It was noted that retired seniors form a large portion of the volunteer base for non-profit and school programs, and their strong concerns about being exposed to the virus resulted in a significant loss of trained and skilled volunteer labour. With respect to policy trade-offs, provincial health policies and guidelines affected food banks as they required changes, such as limiting hours of operation and contactless pick-up, creating new inconveniences and potential barriers for marginalised groups that rely on these services.

The consumer behaviour theme appeared in the access working table, with participants commenting on observed shifts in eating behaviours toward eating more takeaway and prepared packaged foods. Participants noted that increased takeaway consumption had an altruistic basis, as many consumers wished to support their local restaurants through the pandemic-related economic hardship. Others commented on how food behaviours also changed (in the short-term) toward interests in gardening due to the sheltering-in-place public health guidance, which caused an increase in demand for community garden plots and (thus) long waitlists for these plots.

3.1.5. Government response

Themes in the government response category of short- and medium-term impacts include labour, supply chains, affordability, policy trade-offs, resource limitations, and vulnerable populations. Participants again referred to the labour shortages related to SAWP issues, as well as the resulting supply chain problems causing shortages of certain products in food retail outlets. It was once again noted that these challenges contribute to increased food prices and affordability issues.

Comments were also made about policy trade-offs, with such comments referring to how public health policy trade-offs affected vulnerable populations such as children. Participants noted that school closures impacted children and youth in many ways, one of these being the closures prevented access to school lunch/food programs. Other comments were made about how the Canada Emergency Response Benefit (CERB) had the unintended consequence of disincentivizing people from returning to part-time and casual work in food industries, where they would make less money than what they received through CERB and could be exposed to health risks.

“CERB – negatively affected the workforce returning part time and casual positions could make more money not working which in turn may have impacted food production facilities” Participant Comment, Government Response Working Table

Comments were also made that related to the institutional inflexibility theme, specifically with reference to funding programs. Participants working in the charitable food sector noted that their food programs and services were still bound by restrictions and deadlines related to their funding, making it difficult to adapt their programs to the pandemic conditions. These participants also comment on resource limitations, specifically noting that some funders falsely assumed that they had the capacity to scale up and create new food programs as needed.

3.2. Long-term impacts

3.2.1. Production

Themes in the production category of long-term impacts include labour, public awareness, compounding impacts, supply chains, and organisational disconnect. Participants noted that impacts to food

systems labour and worker shortages persisted over a longer-term basis, as did the public awareness and concerns around the poor working conditions for these labourers. Participants also commented on how the pandemic has highlighted supply chain challenges that will occur and compound with other exogenous shocks, in particular health authority participants discussed concerns about climate change disrupting food supply to healthcare facilities. Finally, participants commented on the way that the pandemic revealed how uncoordinated the food system is, with participants discussing the disconnect between the food supply stakeholders/businesses and institutions such as schools, health facilities, non-governmental organisations, etc.

3.2.2. Processing

Themes in the processing category of the long-term impacts include supply chains, institutional inflexibility, and resource limitations. With respect to institutional inflexibility, participants noted how government regulations prevented shifts that would be economically and socially beneficial during supply chain disruptions, such as a decentralised processing of foods and cooperative selling of processed goods. Within the resource limitation theme, participants identified a scarcity of land zoned and available for industrial activities and how this contributes to food processing bottlenecks in supply chains.

“Land supply – space needed for processing local farm products. Competition with other industrial uses.” Participant Comment, Processing Working Table

3.2.3. Distribution

Themes in the distribution category of long-term impacts include institutional inflexibility, organisational disconnect, and resource limitations. Health authority participants noted problems with inflexibility around their food supply systems due long-term supplier contracts. With respect to organisational disconnect, these same participants expressed challenges with pivoting to local supply due to a lack of relationships between healthcare facilities and the local/regional agricultural sector.

Other identified issues within the organisational disconnect theme relate to lack of relationships between food retailers and charitable food programs. Due to the lack of these network relationships, food retailers experienced challenges trying to parse and deliver surplus products to food programs in need. Furthermore, food charities experienced storage capacity issues (i.e., the ‘resource limitations’ theme); thus, surplus foods from retailers could not also be stored by food banks, presenting difficult decisions around what donated products should be accepted as the number of users of their programs/services grew.

“Surplus distribution - Large food producers and retailers (e.g. Saputo and Save-On Foods) often had surplus food to distribute. They save on disposal costs and also help their communities, but there are real capacity issues (esp. cold storage) in our food banks. They often need to divide up the surplus food, but that is hard to do in real time because there is no quick way to connect with everyone.” Participant Comment, Distribution Working Table

3.2.4. Access

Themes in the access category of long-term impacts include affordability, information access, vulnerable populations, and resource limitations. Affordability issues were noted to occur with both persistent increases in food prices and rises in fuel prices, with the latter adding economic stresses as people travel to food retailers or programs. Participants also commented that food programs were confronted with challenges around effectively disseminating information on low and no-cost food programs to all groups in need, which created difficulties for food initiatives to effectively alleviate affordability stresses experienced by people acutely experiencing such stresses. Participants noted that certain vulnerable populations, such as those without access to the Internet, experienced the lack of access to information more so than

others due to an inability to learn about new/enhanced (or changes to) food programs and services through online channels. Finally, comments were made about the persistent increased demand for food programs that support vulnerable groups, such as school lunch programs for children/youth, and how such charitable programs being supported by private donations is a concern in terms of consistently meeting demand with limited and inconsistent financial resources.

3.2.5. Government response

Themes in the government response category of long-term impacts include labour and institutional inflexibility. Participants discussed how labour shortages have persisted, expressing that the drivers of short- and medium-term labour impacts have led to longer-term impacts in this area. Relating to the institutional inflexibility theme, participants commented on how pandemic-related funding for food programs has ended during a time when the pandemic is still exerting pressures on food security. Extending the program in response to the current and prolonged crisis would be advantageous, rather than food charities (that are already over-stretched) needing to seek and reapply for more funds.

“Flood of fiscal funding to be spent by the end of fiscal year – pre-pandemic, the federal government grants to Food Bank Canada contributed <2% of their running costs. During the pandemic Food Bank Canada visit rates increased in some areas by 25% in March 2020. AAFC [Agriculture and Agri-Food Canada] Funding was over 200 million with the requirement to be spent in a year was probably not the most strategic response.” Participant Comment, Government Response Working Table

3.3. Plenary discussion

The following sections report on the analysis of the plenary discussion transcript, and a summary of the results can be found in Table 4. The results displayed in the sections below are organized by the themes applied to the data. This paper does not report on the aspect of the plenary discussion that involved participants identifying research gaps and questions for guiding/informing the future phases of the project.

Table 4
Summary of results from discussion transcript data analysis.

Theme	Impacts
Vulnerable Populations & Information Access	Loss of access to food programs due to school closures; High unemployment among youth; Vulnerable populations experiencing challenges accessing (online) information on food programs and supports; Lack of culturally-appropriate foods in food programs
Resource Limitations & Compounding Impacts	Increased workloads in the social and health sectors, resulting in lack of capacity and reduced/poorer services; Compounding issues (e.g., fentanyl drug crisis) exacerbating social and health sector challenges
Consumer Behaviour & Affordability	Lack of affordable options for high-nutrition foods; Increasing wealth gap and differentiated access to nutritious foods leading to long-term community health effects
Policy Trade-offs	Loss of livelihood and employment due to closures and reduced hours in food services
Labour & Supply Chains	Supply chain issues due to labour shortages; Supply chain issues resulting in increased costs of farm inputs and materials; Loss of volunteer base for food program delivery, resulting in increased workloads in the charitable sector
Public Awareness	Increased public awareness about poor conditions for food and agriculture labourers; Lack of awareness on the importance of food sovereignty
Organisational Disconnect	Revealed lack of coordination and weak networks for supporting food distribution and services; Tensions between health protocols and efforts to achieve food program objectives

3.3.1. Vulnerable populations & information access

The acutely-felt impacts on vulnerable populations were discussed as participants noted that food insecurity impacts were higher among seniors, youth, and Indigenous communities. Participants emphasised points made during the breakout sessions, such as how children and youth relying on the school food programs were particularly vulnerable to the effects of school closures. The high unemployment among youth was also discussed, with participants noting how many in this demographic worked in entry-level positions in food services industries and lost employment early in the pandemic.

Participants also discussed seniors and people with disabilities as vulnerable populations, and mentioned that the pandemic created challenges around providing food and medication to these socially- and physically-isolated groups. Concerns were also expressed around access to accurate and useful information. Participants noted that some isolated people living with disabilities experienced additional stresses due to being presented with misinformation (through online and other sources) and limited ability to access and make sense of large amounts of (sometimes) contradictory information.

“...a lot of fear and information came so quickly about the pandemic and what was happening and when you should leave and when you can’t, what you should do. I still have a couple of people that have still not exited their home in almost 17 months. They have not left their home because they’re too afraid. And I would get them to tell me what was in their cupboard, or did they have any food, and the amount of times we would drive by and just drop off something at the doorstep...” - Participant 4

The discussion around vulnerable populations touched upon issues around equity and justice in the food system, as it was apparent that different demographics were affected unequally by food systems impacts. Participants also noted that responses to the impacts (in addition to the impacts themselves) were also inequitable in terms of who they benefited and supported. For instance, the South Asian community in the Fraser Valley (which is a significant population in the region) were confronted with a lack of culturally-appropriate foods, such as halal meats, when using food bank services.

3.3.2. Resource limitations & compounding impacts

Participants working in social and charitable sectors discussed how pandemic stresses on vulnerable populations resulted in additional workloads for social workers, creating challenges around resource and capacity limitations. Many people living with disabilities rely on non-profit or government social workers to physically check on them during the pandemic, as well as deliver food and other necessities. However, the increased demand for such services was severely limited by capacity issues, and in some cases, these check-ins could only occur once per week.

Other examples of resource and capacity limitation issues discussed include the work of environmental health officers. It was noted that the pandemic-related tasks given to these officers reduced their capacity to perform their ‘regular’ duties to the same level previously done. Such issues have led to unintended consequences, such as a compromised ability to perform thorough onsite health and safety inspections and support food businesses to ensure standards are being met.

Participants working in the social sector noted that compounding issues and impacts are contributing to the resource limitations and capacity issues. In addition to the pandemic, social workers are handling challenges related to the ongoing fentanyl crisis, impacts of climate change, and emotional distress from recent discoveries of unmarked graves of Indigenous children at former residential schools sites. Participants described being unprepared for these multiple compounding effects, noting that increased complexity of their work has them feeling as if they have been required to ‘learn a different job’.

“...highlight the fentanyl poisoning crisis...preceding the pandemic, and then climate change, and then thinking about what’s going on currently in terms of bodies being uncovered related to residential schools. All of those are interconnected and it’s compounding impacts. Yeah, I think the COVID pandemic has had a massive impact on folks providing the kind of service I provide. But I think the biggest burden continues to always be on our client base.” - Participant 6

3.3.3. Consumer behaviour & affordability

Consumer behaviour and shifts in eating habits was a topic of discussion, with participants emphasising points from the breakout sessions that people are moving toward diets consisting of more ready-made and pre-packaged foods. This discussion led to participants expressing concerns about the affordability (or lack thereof) of nutritious foods. Participants commented on how a growing wage/wealth gap coincides with a nutrition gap, as low-nutrition foods often are less expensive. Participants expressed that such trends will have long-term impacts on community health, if these trends persist.

“We have a growing divide in terms of socioeconomic status in our community...what I see happening is that cheap food is the food that is the least nutritional... I anticipate, down the road, that it will have systemic effects on the morbidity of people as they get older. And that will cost us more in terms of our systems. So I’m really concerned about the relationship between affordability and nutrition.” - Participant 3

3.3.4. Policy trade-offs

Participants discussed how economic trade-offs from public health measures, which have been experienced in many places throughout the world, were a severe issue in the FVRD. Those impacted most severely included small businesses and family-operated producers and retailers, and closures and reduced hours of operation for these businesses were common. Mass underemployment and unemployment related to restrictions around business and services impacted many families and individuals. In the case of low-income families and individuals, such impacts exacerbated pre-existing stresses.

3.3.5. Labour & supply chains

The plenary discussion reinforced comments about the pandemic-related issues regarding labour. Participants discussed the challenges with current agricultural systems that rely on international labour. These challenges were compounded by increased costs for agricultural inputs and materials (e.g., equipment, technology, building materials) due to supply chain disruptions. Some participants mentioned they know of farmers that were uncertain as to whether they would plant crops for the season due said challenges.

Other issues within the labour theme that were reiterated/reinforced include comments about volunteerism. Non-profit and charitable organisations experienced a significant loss of volunteers due to seniors being a large part of the volunteer base. This includes food banks and meal programs, and such organisations/programs (thus) experienced a simultaneous loss of volunteer workforce and increased demand. Such issues contributed to significant staff and volunteer stress, fatigue, and burnout.

3.3.6. Public awareness

The plenary discussion related to the ‘public awareness’ included comments about how the pandemic has spotlighted the poor conditions of food labourers. Participants brought forward points about how the pandemic has revealed an aspect of food production systems that should be examined through a social justice and human rights lens. Such comments were explicit in noting that this is something Canadians should not be ‘proud of’, and change is needed.

“...we often rely on, not necessarily well paid labour to provide our food products, I think is something we need to look at more seriously from a food justice lens and a health equity lens and just a human rights lens. It’s really not something we should be proud of.” - Participant 8

The plenary discussion also involved comments related to public awareness that were not captured during the breakout sessions. The large-corporation food retailers (e.g., Costco, Walmart) were noted to have potentially benefited from the pandemic due to their robust linkages with global supply chains. Participants noted the reliance of low/fixed income people on low-cost food retailers (e.g., Walmart). This discussion led to participants identifying a lack of awareness or understanding about the value of food sovereignty and viewing food as a human right. Participants note that this lack of awareness/understanding to be a barrier to changing food systems in a manner that more equitably benefits communities and societies.

“...the corporate food distribution centers like Wal-Mart and Costco, I don’t see they were hurt at all. I think they actually benefited from the global food supply chain. And that’s sad because if you look at a lot of consumers that shop at Wal-Mart, there are marginalized people and they’re the ones who had to pay more.” - Participant 2

3.3.7. Organisational disconnect

Participants reiterated the lack of coordination in the food systems as revealed by the pandemic. Some participants identified a disconnect between frontline workers and various community organisations that could support these frontline workers, expressing a need for stronger networks and collaboration. In addition, many organisations struggled in determining how to implement health protocols while also meeting their own objectives, such as with school meal programs. The discussion highlighted a need for stronger collaborative relationships and coordinated efforts across the region and province for developing and implementing appropriate government policy and advocacy responses, as well as for sharing timely information on effective methods of implementation.

4. Discussion

This research in many ways is a response to literature that has identified COVID-19 as an opportunity for better understanding food systems vulnerabilities to gain insight on how to build local and regional resilience (Carey, Murphy, & Alexandra, 2021). To explore this topic, the study draws upon arguments from previous scholars, who argue that reflections on the pandemic should be done through the lens of integrated planning and policy (Newell & Dale, 2021), and accordingly, the study included comprehensive, regional, place-based, and temporal perspectives and aspects of food systems in its research design. The discussion below centres on how such an approach provided useful insights and knowledge on the ‘lessons learned’ from COVID-19.

Examining food systems comprehensively was useful for understanding the linkages between food and other critical systems that support social sustainability and wellbeing. This was seen through a theme that emerged through the workshop discussion, which involved the issue of resource and capacity limitations and how pandemic-related stresses pushed organisations and people to their limits. The resource/capacity limitations findings illustrated how communities can be vulnerable to ‘downstream’ effects from impacts. Participants working in the social services and programs noted how their workload increased dramatically with the pandemic, and social workers in particular were having challenges addressing compounding impacts from the pandemic, fentanyl drug crisis, etc. Other comments identified how the work of environmental health officers suffered during COVID-19, and pandemic-related tasks distracted these officers from performing other essential duties to the same quality as previously done, such as ensuring food

businesses are meeting health and safety standards. Such findings demonstrate how exogenous shocks can result in cascading impacts, and they suggest a need for ensuring critical supports (such as social and environmental health services) can continue to function when disturbed. In ecosystems, this aspect of resilience is referred to as 'functional diversity and redundancy', where an ecosystem and species could be disturbed but other species are present to maintain ecosystem functioning (Standish et al., 2014). These concepts of diversity and redundancy can be applied to institutional and other support services to increase local and regional resilience (Folke, 2006).

The regional approach employed in this research was useful for identifying both urban and rural food systems vulnerabilities and issues that occur in a common region. With respect to urban issues, some of the organisations represented in this study experiencing resource/capacity limitations operate in the non-profit and charitable sectors, and such organisations generally experience issues related to resource limitations, particularly with respect to funding (Phillips, 2013). However, at the same time, these organisations were observed to fill the role of essential emergency services, ensuring new and existing vulnerable populations have access to food during the pandemic through food banks and other food access programs. Such observations highlight a major vulnerability in food systems, this being that food security and access hinges on the ability of non-profit and charitable organisations and programs to be able to deliver 'normal' and expanded/emergent functions during emergencies. Moving forward, food systems policies could involve stronger public sector involvement in charitable food services and/or ensure more (and consistent) resources are delivered to these organisations, with looser funding restrictions and deadlines to allow for more flexible and adaptable responses to exogenous shocks. Alternatively, responsibilities for addressing food insecurity within and across regions could be shared, while centering local government as responsible for delivering on the 'right to food' (Halliday, 2019; Rocha & Lessa, 2009).

In terms of rural vulnerabilities, the workshop participants identified several impacts that adversely affect the production component of food systems, such as farm labour shortages. Interestingly, they also revealed a pandemic-related effect that could have a potentially beneficial influence on food systems. This effect was captured in this study within the 'public awareness' theme, and it involved COVID-19 spotlighting the poor conditions of food production and processing labourers. Others have made similar observations on these issues, such as Haley et al. (2020) who explain that COVID-19 has highlighted issues around labour and safety due to agricultural and meat processing workers (particularly migrant workers) being especially vulnerable to the virus. Such spotlighting of this issue has led to calls for reform in Canada (e.g., Johnson, 2020) and the United States (e.g., Schlosser, 2020). If such reforms do occur, this could be considered an unexpected benefit of the pandemic, as it would contribute to the health and quality-of-life of agri-food labourers living within the FVRD (and elsewhere), thereby aligning with social sustainability objectives (Dempsey et al., 2011). However, in time, it will become apparent as to whether these calls for action persist and actually lead to change, or if public awareness and advocacy will effectively shift away from this issue.

Working under the understanding that no 'one size fits all' approach exists for strengthening local and regional food systems (Knezevic et al., 2017), this research involved place-based perspectives and employed a community-based participatory approach for exploring food systems vulnerabilities in the FVRD. By employing a participatory approach, the aim was to identify food systems impacts and vulnerabilities that are unique to the particular social, cultural, and economic contexts of the FVRD. When superficially examining the results from this study, one might draw the conclusion that many of the food systems impacts experienced in the FVRD were the same as those experienced in communities across the world, such as supply chain challenges, labour issues, and economic insecurity (Clapp & Moseley, 2020), thusly suggesting that there may actually be common template for food systems vulnerabilities. However, when examining the impacts more in-depth,

the study revealed specific challenges that provide valuable information for place-based food systems strategies. For example, the need for culturally-appropriate foods for local South Asian communities and the supply chain impacts on dairy farmers under state-controlled supply management models are pertinent concerns for FVRD's food systems resilience strategies. Such observations confirm that identifying place-relevant sociocultural and economic factors is important for integrated planning, as it allows for the development of local food systems in ways that effectively align with and integrate the social, economic, and environmental dimensions of sustainability in a manner that is relevant to a locality.

In terms of temporal considerations, food systems impacts were examined in this research with respect to different timeframes, and the thematic analysis illustrated commonalities and differences between said timeframes. Examples of commonalities include labour shortages and affordability issues, which were identified as persistent (and perhaps worsening) through short-/medium- and long-term timeframes. In contrast, the 'organisational disconnect' theme only emerged in the long-term impacts dataset, with comments referring to how a lack of collaboration and coordination in food systems governance exhibited adverse effects over a longer period. The identification of 'organisational disconnect' as a long-term issue reflects the core purpose of performing long-term integrated planning, it being a method for achieving long-term sustainability goals through collaborative approaches that recognize relationships among different local and regional systems (Ling et al., 2009). Such an approach aims to work across silos commonly seen in governance and civil society (Dale, 2001; Hoff, 2011; Karlsson et al., 2020) to be able to effectively address complex sustainability challenges. Willett et al. (2019) argue that working across silos is essential for transitioning to sustainable food systems and addressing cross-cutting issues; for example, promoting sustainable diets requires collaboration among food, environment, and development organisations, as well as others. This study identified areas where relationships across silos should be built, such as those that work in the health and agricultural systems of the FVRD. By identifying such gaps in and between systems, the region can strategically form collaborations to support a more resilient food system.

5. Conclusion

This paper presents results from a community-based food system vulnerability workshop conducted in the Fraser Valley region in Canada. The research identified a variety of pandemic-related impacts, such as those to labour supply in both production and retail, as well as cascading impacts associated with local and global supply chains. Additionally, the research draws attention to the disconnect between local, on-the-ground efforts and coordination with higher levels of government, which ultimately results in further capacity constraints and administrative burdens during emergency response conditions.

Two key implications emerged from this study. Firstly, food security and access relies on non-profit and charitable organisation's delivery of programs under both 'normal' and emergency events. Therefore, capacity and resource constraints faced by this sector will have the greatest impacts to vulnerable populations and those experiencing acute and chronic food insecurity. Secondly, vulnerabilities to downstream impacts arise from simultaneous effects exerted by the pandemic and other critical and emergent issues, such as the fentanyl drug crisis, wildfires, and extreme heat events. As an example, participants discussed how social services and health authority staff experienced dramatic increases to workload, preventing performance of essential duties and impacting staff's mental health.

Moving forward with food systems policies, stronger government involvement is needed in food services and programs, and/or government agencies must ensure more (and consistent) resources are delivered to the charitable organisations running the programs, with looser funding restrictions and deadlines to allow for more flexible and

adaptable responses to exogenous shocks. Additionally, greater coordination is required between food system stakeholders during crises, particularly when crises are multiple and interacting across multiple systems and subsystems, as observed in this study (for example) with the pandemic, environmental hazards, and fentanyl drug crisis.

Further research is recommended to explore the processing and distribution components of the food system framework in the region. These are key aspects of the food system that were not highly represented in the findings. Additionally, it is important to note the challenges when multiple hazards are facing a region, indicating the need for understanding the interactions between multiple simultaneous hazards and food system impacts. These findings support the need for systems-based integrated approaches to long-term planning linked to explicit food system resiliency and broader public good outcomes. Urban food system governance must develop new frameworks to coordinate supply chains to meet local demands for food security and just and sustainable food systems.

Declaration of Competing Interest

None.

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