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Review

City Region Food Systems: Building Resilience to COVID-19 and Other Shocks

Alison Blay-Palmer [1,*], Guido Santini [2], Jess Halliday [3], Roman Malec [4], Joy Carey [3], Léo Keller [2], Jia Ni [2], Makiko Taguchi [2] and René van Veenhuizen [3]

[1] Department of Geography and Environmental Studies, Wilfrid Laurier University, Waterloo, ON N2L 3C5, Canada
[2] Plant Production and Protection Division (NSP), Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00153 Rome, Italy; Guido.Santini@fao.org (G.S.); Leo.Keller@fao.org (L.K.); Jia.Ni@fao.org (J.N.); Makiko.Taguchi@fao.org (M.T.)
[3] RUAF/Hivos, Grote Marktstraat 47a, 2511 BH The Hague, The Netherlands; j.halliday@ruaf.org (J.H.); j.carey@ruaf.org (J.C.); r.van.veenhuizen@ruaf.org (R.v.V.)
[4] Office of Emergencies and Resilience (OER), Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00153 Rome, Italy; roman.malec@fao.org
* Correspondence: ablaypalmr@wlu.ca

Abstract: Using examples from the COVID-19 pandemic, this paper reviews the contribution a City Region Food Systems (CRFS) approach makes to regional sustainability and resilience for existing and future shocks including climate change. We include both explicit interventions under United Nations Food and Agriculture Organization (FAO-RUAF) led initiatives, as well as ad hoc efforts that engage with elements of the CRFS approach. To provide context, we begin with a literature review of the CRFS approach followed by an overview of the global food crisis, where we outline many of the challenges inherent to the industrial capital driven food system. Next, we elaborate three key entry points for the CRFS approach—multistakeholder engagement across urban rural spaces; the infrastructure needed to support more robust CRFS; system centered planning, and, the role of policy in enabling (or thwarting) food system sustainability. The pandemic raises questions and provides insights about how to foster more resilient food systems, and provides lessons for the future for the City Region Food System approach in the context of others shocks including climate change.

Keywords: resilience; sustainable food system; COVID-19; climate change; policy; infrastructure

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1. Introduction

Using examples from the COVID-19 pandemic reported in academic papers and online resources, this paper reviews the contribution a City Region Food Systems (CRFS) approach can make to regional sustainability and resilience. We include both explicit interventions under FAO-RUAF led initiatives, as well as piecemeal efforts that use elements of the CRFS approach. The work reviewed in this paper draws on observations by experts in the field. As the CRFS approach is still evolving, efforts continue to understand the opportunities and challenges through explicit empirical work. This paper provides insights from these on-going efforts.

To understand the overall CRFS approach, we begin with a literature review of the CRFS approach. We then turn to COVID-19 and the global food crisis, where we outline many of the challenges inherent to the industrial capital-driven food system (e.g., [1,2]). Next, we elaborate three key entry points for the CRFS approach—multistakeholder engagement (MSE) across urban rural spaces including system centered planning; the infrastructure needed to support more robust CRFS; the role of policy in enabling (or thwarting) food system sustainability. For MSE, we explore the opportunity for what Marsden et al. [3] call 'empowerment by association' as a way to build links between the urban and the rural. In exploring needed infrastructure, we identify supportive infrastructure elements

including formal and informal food markets, food processing, food loss and waste, labor including issues around migration and worker health, ending the section with a look at the role technology has played. In the third section on policy, we review emergency financial support, policy coordination and connections, and CRFS preparedness. The pandemic raises questions about how to foster more resilient food systems, and whether there are any lessons from the COVID-19 crisis that can inform the City Region Food System approach in the context of other shocks including climate change.

2. City Region Food System Literature Review

The City Region is increasingly recognized as one constructive entry point to build sustainable, resilient food systems. The City Region Food System (CRFS) approach—developed by FAO and RUAF (with the Wilfrid Laurier University Centre for Sustainable Food Systems and the CGIAR (formerly Consultative Group on International Agricultural Research) Water Land and Ecosystems programme led by International Water Management Institute)—aims to (1) understand the vulnerabilities and strengths of urban–rural food systems; (2) enhance communication and cooperation through multistakeholder, multiscale collaboration and system-centered planning to develop coherence across the rural–urban continuum; (3) coordinate action to help safeguard livelihoods and food and nutrition security. The adaptive and flexible governance required to optimize the food system is assumed to be best set up at city region scale, which is the foundation of the CRFS approach, and is demonstrated in various case studies. This regionalized food system linking food producing regions to cities works best when supported by multiscale policies and programmes from the national down to the local. With this in mind, it is important to recognize that national contexts differ in terms of political structure and the extent of corporate influence and so what can work in one country or region may not work elsewhere. The paper by Blay-Palmer et al. (2018) discusses how CRFS compare to and complement other approaches [4].

This formalized CRFS approach is supported by a toolkit developed through a participatory multistakeholder action research process in five pilot city regions: Colombo (Sri Lanka), Kitwe (Zambia), Quito (Ecuador), Medellin (Colombia), and Toronto (Canada) [4–6]. In the long term, the CRFS approach can help establish a participatory platform to define policies, interventions, and mechanisms of territorial governance for food system transformation, and reinforce cooperation and collaboration among different governments and other actors, which is a key element to build resilience of local food systems. In support of the Milan Urban Food Policy Pact and the SDGs, through its application in small, medium, and large city regions, the CRFS is an approach that can help nourish more people in the world, protect the livelihoods of the most vulnerable, and care for the planet [6,7]. What follows are insights from across the world about lessons learned and opportunities city regions have and can capture by applying the CRFS approach either on their own or as part of CRFS projects [4,8,9].

In the last few years, academics have been assessing the potential of the CRFS using the foundational work by FAO, RUAF, and partners as their starting point [4,8–10]. In a review of existing literature on and related to the logistical flows and impacts of CRFS, Roosendal et al. [11] confirm the need for inclusive multistakeholder engagement (MSE), consideration of the place-based nature of the CRFS innovation and its capacity to integrate urban and rural food systems [4]. Roosendal and colleagues also encourage future research to consider the role of adaptive governance so that "governance starts from the notion that within complex and uncertain environments sudden changes can occur, and that continual learning is required to adequately respond to emerging needs and sudden, unpredictable changes" [11]. As Maye et al. [12] explain, forms of governance innovation require an open, polycentric approach that "involves a city-region perspective as a planning principle, which helps to overcome the silo nature of city planning" [12]. Other work on planning confirms the potential of the CRFS approach as an integrative, human centered entry point that improves life for people from the rural to the urban setting [13].

Additional research considers how site-based policy or initiatives that apply the CRFS approach can expand how people see opportunities for positive change (e.g., [14]). A study of two EU and two African city region food systems reiterated the need for recognizing place-based, site specific challenges and opportunities [15]. The place-specific nature of CRFS requires an approach that is both flexible and provides a range of examples to guide city regions as they strengthen their sustainability and resilience. This is the foundation of the City Region Food System approach and the toolkit, and is demonstrated in various CRFS contexts. Food as a lever for change is inherently multifunctional, offering opportunities to address issues of human health through access to adequate quality food; environment by protecting and reinvigorating soil and waterways; economies through recirculating money into local economies; culture through access to culturally appropriate foods [16,17]. However, these benefits have yet to be properly captured or properly understood. As Marsden, Lamine and Schneider [3] argue, "The still dominating concentric visions which tend to define rural areas mainly as provisioning areas for cities in terms of workforce and food and other natural resources (a kind of domestication of the rural by the urban), should shift to more distributed, open-ended and symmetrical perspectives. These could rely on new emancipatory urban-rural relations which disrupt the earlier domestication-enclosure dialectic; and once again also postulate and design a shift towards a perspective of 'empowerment by association' (here of cities and mutually dependent rural areas). Food appears to be a potential key driver of this emancipatory reconnection between urban and rural; as is shown by many networks, experiences and studies across the world. Yet, the emancipatory and symmetrical nature of this redefinition of urban/rural linkages is still to be analysed" [3: 204]. This paper provides one entry in this analysis of codependent, coenabling urban–rural food relationships.

The disruption to food systems from COVID-19 highlights the opportunities that can be captured by connecting local production and consumption. The proposition is not self-sufficiency or protectionism but to ensure urban areas are not solely reliant on distant sources, with no recourse in case of failure. Cities and their regions that actively coplan for resilient food systems help ensure that (a) the food supply chain is diversified and resilient to future shocks; (b) food access remains at, or swiftly returns to, predisaster levels; (c) the impact on vulnerable food systems actors is mitigated, including small-scale producers, informal traders, migrant labor, low-income and marginalized groups. To foster this process, city region scale multisectoral and inclusive governance can play a significant role to make constructive decisions based on evidence generated through the CRFS assessment. This can enable an understanding of existing resources through evidence-based assessments and support relevant, constructive decision-making [4,8–10]. As Hipel et al. explain regarding nested systems, "In policymaking, one should attempt to live with complexity and uncertainty. That is, large-scale system problems need not be treated in a homogenous and deterministic manner" [17]. In the food context, "a sustainable food system (SFS) is a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" [18].

Accordingly, the CRFS approach requires attention to both specific food value chain nodes (i.e., inputs and production, processing and storage, transportation, distribution, consumption, food waste, and loss management) and cross-cutting systems dimensions including livelihoods and economic development, food security and nutrition, social inclusion and equity, resilience and sustainability (Figure 1). CRFS also benefit from decisions being made at the local/regional scale with the necessary supports from higher levels of government. Therefore, while there is centralization, it would occur at a scale that acts based on subsidiarity.

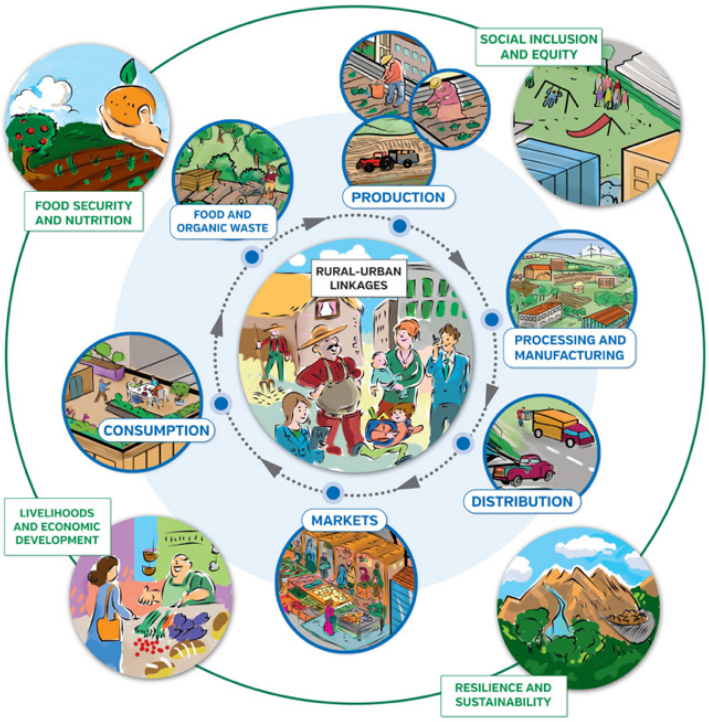

Figure 1. City Region Food System (courtesy FAO). The CRFS approach seeks to establish and reinforce points where systems connections can be established or reinforced between the three rings representing: rural–urban linkages; the flow of materials between food system nodes including production, processing and manufacturing, distribution, markets, consumption and waste generation; the dynamic relationships between livelihoods and economic development, food security and nutrition, social inclusion and equity, and resilience and sustainability. This food system operates within and influences related multiscale economic, environmental, and social conditions.

This paper discusses the cross-cutting CRFS vulnerabilities and strengths revealed by COVID-19 at particular nodes and with knock-on impacts on food from field to fork. We also engage with MSE and the policy dimensions that configure the CRFS and enable and/or impede resilience capacity through explicit CRFS projects or ad hoc interventions.

COVID-19 and the Global Food Crisis

The COVID-19 pandemic has presented complex challenges to social and economic systems, including the global industrial, capital-driven food system. COVID-19 has made structural weaknesses in the food system more apparent. Rigid markets, professionalization, financialization, a lack of adaptive capacities of agribusiness firms and their networks, and the impacts of corporate consolidation are now more evident [19]. While the one-size fits all, just-in-time approach may work for globally traded commodities, perishable foods such as produce and cultural food sources benefit from diversified, shortened supply chains that link producers and consumers more closely [8].

Consistent with other crises, people with low or no-income have been the most impacted by COVID-19 with food insecurity increases highest in the most vulnerable communities. As the pandemic was unfolding, in May 2020 the FAO observed, "For those living in contexts already experiencing food crises as a result of conflict, climate or economic instability, there is no time to waste. Up to 80% of people living in these contexts rely on some form of agricultural production for their livelihoods. Even in countries, such as Yemen, that rely heavily on imports, locally produced food plays an important role in meeting people's needs and especially in ensuring dietary diversity" [20]. Food shortages or the fear of shortages resulted in price spikes (e.g., rice, wheat) and global price surges, with the poorest communities the hardest hit, mean there is now a significant risk of losing

gains made in fighting poverty and improving health, education, and nourishment as we strive to meet the SDGs. A 2020 UNICEF report cautioned that 120 million children in southeast Asia are at increased risk of falling into poverty due to COVID-19 as household livelihoods and remittances have evaporated [21,22].

COVID-19 exposed the interconnected vulnerabilities linking livelihoods and food distribution. There are countless accounts of vendors around the world who could not sell their food as markets closed or hours were cut back, resulting in food losses [23]. Moreover, perishable food that would normally be transported from farms to market, for export or domestic consumption, was left to rot in fields. There are huge and wide-ranging repercussions to people losing their jobs as a result of measures to control the spread of COVID-19 with particular concern for those in the informal economy. In India, for example, where 91% of the workforce is in the informal sector, there is a heavy reliance on daily unsecured wages. The decimation of livelihoods forced people to leave cities and return to their rural roots. This migration created huge bottlenecks for transportation. Lockdowns and physical distancing also meant labor shortages in food and agriculture, in many cases at peak harvest time. This was then layered on by lockdown so that wheat, coffee, grapes, bell peppers, cucumbers, and other produce could not be harvested, processed, transported, or stored in time. This created a gap in inputs for processed food and increased demand as people panicked with hoarding further impacting food shortages. These challenges were compounded as special certificates were required to comply with COVID-19 handling and distancing adding to the delays and fueling black markets and price gouging [23]. In Antananarivo, Madagascar, limited access to supplies such as seeds and fertilizers has constrained the ability of producers to plant on time, with product shortages and increased prices expected in local markets [24].

There have also been impacts from international trade restrictions and interruptions to imports, exports, and distribution. India banned rice exports while Egypt cancelled exports of legumes to preserve domestic supply. The Eurasian Economic Commission, which unites the customs zone of Russia, Belarus, Armenia, Kyrgyzstan, and Kazakhstan, restricted exports of sunflower seed, buckwheat, rice, and rye and decided not to supply soybeans and some vegetables such as onions outside of the union for several months [22]. The movement of food was further disrupted as flights were grounded and cargo ship inspections and port congestion delayed shipping [25]. This compounded the loss of income along the food chain as exports, for example of onions and eggplant from India to Canada, were cancelled [23].

In the Pacific Small Island Developing States (PSIDS), COVID-19 measures meant no tourism, job losses, and decline in remittances, which has shifted the economic focus, especially in food systems. The loss of tourism was expected to result in between an 8–67% decline in GDP. The decline in remittances threatened household food security and forced families into debt to be able to eat. Additionally, supplementary income and related food supply chains were disrupted due to travel restrictions including no public transportation; inability of people to stay at markets overnight as well as reduced business hours; additional food safety requirements; depressed demand for export crops; increased prices; lack of demand from the tourism industry. As urban and periurban areas in the PSIDS are highly reliant on imported food, COVID-19 disruptions to the global food chain made this food less available and more expensive [25].

These challenges are examples of the scale of dislocation, threatened livelihoods, and escalating food insecurity around the world. The pandemic raises questions about how to foster more resilient food systems, and whether there are any lessons from the COVID-19 crisis that we can learn for the future including climate change. It is important to remain critical. While not a panacea, a CRFS approach may help mitigate and adapt to these increasingly pressing challenges. New decentralized city region food systems may address some of the system effects of the globalizing industrial food system and interests of those who benefit from it. The CRFS may also have its own internal characteristics and contradictions that could result in unanticipated and undesirable consequences. Finally,

there is also the risk that CRFS would replicate or reinforce existing challenges from the global food system. In the next sections we review examples that include CRFS type-responses as well as existing planned City Region Food System project cities to understand more about how/whether the CRFS approach works on the ground.

3. Results from the Review

3.1. Empowerment by Association: Challenges and Responses in Building Stronger MSE Urban Rural Linkages

Findings show that CRFS resilience translates into greater flexibility for food provisioning in response to measures necessitated by the pandemic as existing networks and/or the capacity to enable MSE led to rapid, appropriate responses to the COVID-19 challenge [22–27].

3.1.1. Repurpose Existing Resources

Innovative responses have drawn on the capacity to repurpose existing collaborative food chains that connect producers and consumers, including: school food programmes channeled to provide food to children in need via food banks and local community groups; switching to delivery of food baskets (uncooked goods) or grab and go meals; keeping canteens open or set up for parents to collect food baskets with flexible schedules to avoid large gatherings; and/or, home-deliveries of food baskets using idle transportation resources such as school buses, delivery trucks, and bicycles through schools, food banks, and restaurants [22,24,27–29]. Lessons learned from other epidemics, such as Ebola outbreaks in Madagascar, confirm using interventions such as the reallocation of food from school feeding programmes to an overall emergency response aimed at vulnerable households or use of school canteens to reach extremely vulnerable groups [24]. Under COVID-19 lockdowns, many people living in cities in Africa and Asia used urban farming and shorter food chains for more secure food access [26], and urban agriculture initiatives also adapt to local conditions. For example, in Colombo (Sri Lanka) locally grown food was sold from cars within locked-down communities [29].

In Bolivia, existing FAO farmer support was used to train farmers in safe food handling in the COVID-19 context, both allowing farmers to maintain livelihoods and enabling people to have healthy food [30]. In Kisumu (Kenya), where production was already decimated by pre-COVID-19 floods, physical distancing limited the number of farmers that could be trained in safe food handling, with youth and women particularly vulnerable and lacking capacity. However, while the lockdown was in place, farmers were still allowed to work until noon and make direct home deliveries to urban centers by taking appropriate food safety precautions [26]. In Brazzaville (Republic of Congo) old supply chains from sociopolitical crisis of late 1990s have reappeared, such as neighborhood salespeople on foot selling fresh produce and frozen meat [26].

Shortened food chains using accessible technologies have become hyper-local in some places, as governments encourage backyard gardening and local approaches to saving food. In PSIDS, the Caribbean, Colombia, and some states in Australia, national governments provide support for backyard, community, and local gardens using traditional and/or locally adapted varieties [22,25,27,31]. Beans and tubers are encouraged in the Caribbean while cassava, taro, sweet potato, and increasing ponds for fish are responses to build local food resilience [22,25]. In Kibera, a densely populated part of Nairobi (Kenya), households use sack gardens made from local sisal fibers to grow onions and spinach without blocking alleyways [28]. In Kampala (Uganda), locals stack wooden crates around a central composting chamber and use old plastic water bottles for a precision-drop irrigation system to grow kale [26]. In the PSIDS, traditional food harvesting was combined with less wasteful food harvesting and rationing to help ensure medium term food supply. Breadfruit flour, coconut oil, and avocado margarine were used instead of imported products. Traditional food preservation such as drying fish and fruit is also being encouraged to substitute local value-added products for previously imported products [25].

3.1.2. Local Support for Vulnerable Residents

In the UK, some local governments stepped in to support vulnerable residents in the community. Sandwell Council, for instance, set up a food hub and provided a box of nutritious essentials, with participants self-selecting for support by contacting an emergency helpline [22,26].

In China, vegetable basket supply bases were set up around large and medium-sized cities to serve consumers and to provide employment for nearby farmers. Several other initiatives were developed in China to mitigate the impacts of COVID-19. The VAT was waived, and support was provided for cold and preservation facilities on farms and in coops. New delivery services—for example food drop-off and pick-up points; shelves in community buildings; employing laid-off workers to transport and deliver food; integrating food ordering and delivery in gas stations; group buying clubs—were also initiated [32].

In Melbourne and the state of Victoria (Australia), civil society organizations provide food aid to low income households through food boxes, gardening kits, and emergency meals. Community gardens that were closed due to physical distancing restrictions were redeployed to increase urban agriculture for food relief across the state. An alliance of social enterprises provides food relief to low income households by delivering produce boxes, emergency meals, and backyard gardening kits. Where physically and economically viable, direct linkages were set up with small-scale farmers for home or community delivery of fresh foods to maintain, as much as possible, the food supply from small-scale farmers when contractual arrangements were in place [31].

3.1.3. CRFS Project Responses

The CRFS project sites in Quito, Medellin, and Antananarivo demonstrated enhanced capacity to respond to the pandemic in part linked to the adoption of various aspects of the CRFS approach pre-COVID-19 crisis. In Quito, enhanced urban–rural linkages helped build more direct links between growers and consumers. As restrictions led to the reorientation of markets towards neighborhoods, urban farmer networks use home deliveries to overcome transportation problems. COVID-19 also prompted a tri-sector response as private enterprise played a role in the donation and delivery of food rations in partnership with the municipality, the Food Bank of Quito and other humanitarian aid organizations. The response of social movements has been particularly strong, especially in enabling the direct sale of food from production areas to urban households. These initiatives make a significant contribution to addressing mobility problems for people who are unable to use previous food access points under COVID-19. Additionally, in accordance with the proposals in the Resilience Strategy of the Quito Food System, the city's urban and periurban gardens have offered solutions to the food provisioning problems caused by COVID-19 at various scales. The gardens have a production capacity of 1.35 million kg of produce each year with 57% (769,000 kg) consumed by producers and their families and 43% (581,000 kg) sold via short supply chains. Each week, about 11 tons of produce are destined for the city's most vulnerable neighborhoods. The supply of this healthy, diverse food has been uninterrupted throughout the COVID-19 crisis [33].

In Medellin, 47% of the food economy is informal, making it difficult for the government to ensure safe spaces for interaction under COVID-19 both for producers and consumers. Fortunately, the existing CRFS networks created through MSE and policies around food security and nutrition helped government actors to address and respond to the COVID-19 challenges more effectively, as they understood that 30% of food comes from the region enabling a better alignment of market access for growers with healthy food for consumers. For example, at municipal urban and periurban gardens 20 tons of fresh food was mobilized in the first two weeks of the pandemic. Local food was also used for subsidized canteens to provide low income households access to local healthy food, with the city council stepping in with transportation support. Existing CRFS approaches support government action by providing feasible options and fostered integration across the territory [27].

In Antananarivo, pre-COVID-19 work with the urban agriculture department was underway to increase vegetable gardens in schools and in other areas, and to have as many access points as possible in the city for faster and direct access to nutritious food. These allowed more flexible responses in the context of COVID-19 improving food availability for households [24]. These responses all point to the benefits to farmers and eaters of having MSE in place to address challenges in community relevant ways.

3.2. Key Infrastructure: Using the CRFS Approach to Put the Pieces in Place for Resilience and Sustainability

The next sections address key infrastructure gaps, lessons learned, and food system innovations that surfaced during COVID-19. This includes formal and informal food markets, food processing, food loss and waste, technology, and labor, migration and worker health from both CRFS project sites and cities with similar approaches.

3.2.1. Formal and Informal Food Markets: Place-Based Sites of Transformation

COVID-19 has demonstrated the central role that food markets can play in local livelihoods and food security for the most vulnerable. While more needs to be understood about markets' potential as key nodes for food distribution requiring place-appropriate policy, economic and cultural considerations [34,35], wholesale markets are often at the heart of interlinked agri-food systems. In many cities older traditional markets have not been updated or modernized for several decades and suffer from inadequate infrastructure, services, financial viability, management, and governance [6]. These problems complicate a city region's ability to respond effectively to the diverse challenges of a crisis such as COVID-19. Shuttering wholesale food markets has prevented transactions between producers, traders, and wholesalers, and disrupted supplies to retailers, food businesses, and consumers. With no place for transactions, food supply drops, prices increase, and livelihoods and incomes suffer creating major stresses on food security. Insufficient and poor access to dry and cold chain storage compounds marketing problems, leading to increased food loss and waste and vanished profits [6]. For example, as COVID-19 emerged in Brazzaville (Republic of Congo), there was insufficient storage capacity for food arriving to the city on days when it could not be sold directly. Market uncertainty also affected future production incentives. The cost of transporting produce from rural to urban areas went up considerably while the supermarket 'just in time' sourcing model left shelves empty [26].

Based on a CRFS assessment, Antananarivo established a centralized location for supplying food to markets. This reduced the middlemen who can increase prices 4–5 fold and also allows for better coordination [24]. In Toronto, another CRFS site, a public food terminal for fresh fruits and vegetables that dates from 1948 helps ensure ready distribution of fresh food throughout the city and the province to both large and small food stores [36]. A number of good practices as well as lessons learned are emerging from the COVID-19 experience that can be used to increase market resilience in the long term in the CRFS context. This underscores the flexibility of the CRFS approach and its ability to share good practices as an iterative, evolving resource in the context of multishocks and hazards.

In places that adopt elements of the CRFS approach, a small but growing number of countries and cities around the world are investing in upgrading or constructing new wholesale food markets (WFM). This is a strategic investment for many countries with structurally weak food systems as WFMs are bulwarks against future shocks and potential food system disruptions. They provide infrastructure for inclusive and resilient urban development, and for sustainable, safe, and nutritious agrifood systems [6]. In Tirana (Albania), during COVID-19 volunteers set up a centralized warehouse where food packages were prepared daily and distributed to families [19]. In Lima (Peru), on the other hand, the city took an opposite approach of using municipal infrastructure to decentralize a large wholesale food center managed by the municipality, dispersing food out to mobile markets in large park areas in the city [6]. This underscores the place-based nature of food systems and the flexibility required to make city region food systems effective. Whether more

coherent CRFS could strengthen both formal and informal markets could be the focus of future research.

3.2.2. Processing: Local Gaps and Building Connections

During COVID-19 food processing was interrupted or in disarray. A number of strategies were used to address these challenges all pointing to the benefits that accrue from the capacity, or lack of, food system coordination central to the CRFS approach. In Toronto, the lack of medium-scale food processing infrastructure, as identified in the 2018 CRFS report, continues to undermine the medium-term food system stability [36]. Cape Town used city assets to scale up food processing and packaging. In China, some local governments unified purchases, centralized slaughtering, and cold-chain storage, for example, through county cooperatives and enterprises. Domestic supply chain interruptions also curbed processing. Road closures meant cargo trucks were unable to transport goods to processing plants. In Brazil and Argentina, soy and cornmeal were prevented from being processed and exported. This led to lower livestock feed supply which in turn led to increased feed prices around the world.

Meat and Fish Processing Chain Disruptions

Globally, shipping accounts for 90% of all global trade including food. The meat and fish supply chains and food processing more generally provide multiple examples of the lack of capacity under the global industrial food system and point out the gaps that emerge when processing is over concentrated. In Madagascar, a partial lockdown in the capital city region (Analamanga) and in the capital city Antananarivo included curfews from 8 PM to 5 AM with market openings only half days to noon. As Antananarivo, a CRFS project location, is the daily site of retail, stock and distribution, the entire food chain was impacted with particular effect felt for perishable food including milk, eggs, and produce. This was compounded by shortened market hours that meant fewer sales and so lower income for farmers and more food waste. A lack of food processing capacity exacerbated this situation and led to decreased agricultural inputs such as seeds, fertilizer, and feed which was expected to reduce the availability of chicken, eggs, and milk. Anticipating a downward spiral, the federal government stepped in to support food processing (milk to cheese and yogurt; cracking and freezing eggs; processing and freezing chicken) to bolster on-going production, prepare for future shortages, and stabilize future supply. Prepandemic CRFS project work created food flow maps that captured consumer needs and existing/potential supply and trace the role of each actor involved in the food chain. These maps informed planning and action in response to COVID-19 and provide an example of more diversified, locally integrated food systems developed around city regions as a complement to existing food chains [24]. The impact of forward planning is notable as it provides both resources and capacity to understand and address food security and livelihood challenges helping to mitigate more catastrophic results.

Transportation, quarantine, food safety, and labor shortages reduced the availability of fish for local consumption where fish is key source of protein and economically important for tourism and export markets, for example in the PSIDS [25]. Constrained processing in the livestock sector resulted in (1) reduced processing capacity due to staff reductions; (2) compromised storage and conservation due to transport disruptions and changes in retailing and consumption habits; (3) constrained informal business, as much of meat and dairy processing in developing countries is informal. African fish and poultry supply chains were notably impacted [26]. For example, in Kisumu, poultry farmers with mature chickens could not access value chains due to the closure of markets leading to gluts and interruption of food-related logistical services. In Nairobi and Mombasa major markets were closed for fish and poultry but still available to other farmers [26]. In Yemen while work continued at seaports to ensure food arrival, ships arriving were in quarantine for 10 days at sea to prevent infection disrupting protein chains [22].

In the US, Canada, the EU, and UK, concentration and centralization over the last decades limits meat slaughtering and processing capacity to a few labor-intensive slaughterhouses and food processing plants. These workplaces tend to have overcrowded working conditions and a lack of protective gear which resulted in significant COVID-19 outbreaks in workers in the US, Canada, Germany, France, Spain, and the UK [37]. These disruptions lead to closure of plants and a loss of income for workers, and loss of life for some. These tragedies have increased public awareness of the realities of intensive meat production on the health of its labor force and the need for new legislation on health and safety requirements in support of more localized regional meat processing facilities [38,39].

3.2.3. Food Loss and Waste: Closing the Resource Loops in City Region Food Systems

Food loss and waste that ordinarily occurs along the food chain [40,41] has been exacerbated under COVID-19. Small agricultural producers are the principle suppliers of food in most developing countries and while their operations are typically characterized by high levels of food loss, the increased lack of infrastructure and transport systems during the pandemic has created even more waste. On-going CRFS projects by WLE with FAO in Colombo seek out and implement waste reduction and regional closed resource loops to improve city region functioning. As many cities struggle with reduced access to the inputs needed for growing, reliable, local compost could help address urban food insecurity and improve efficiencies. A related concern is the treatment of wastewater and its use in urban and periurban agriculture. While there are methods to deal with excreta contaminated water for safe food production [42], building in circular resource cycles to reduce waste through composting, for example, can maximize the availability of locally produced organic fertilizers [31]. In Nairobi under COVID-19, where access to fertilizers has been constrained and there is an increasing reliance on urban agriculture during the pandemic, systems such as the ones being developed in Colombo could improve food security [29].

As discussed in a previous section, the closure of farmers' markets and stalls for selling fresh fruit and vegetables increased food waste [40]. In Brazzaville, limited markets, lack of storage, and rigid transportation schedules led to significant food loss and waste when produce arrived on days that markets were closed [26]. Various intersectoral and urban–rural links helped to mitigate these losses in some places providing examples that could be taken up elsewhere. In Australia where food services and hospitality were badly impacted by job losses with no government support for workers, some establishments pivoted to provide low cost meals and retain some jobs using their existing links to producers. This has the added benefit of mitigating some food waste [31]. In Tuvalu producers and communities were encouraged to use traditional preserving and storage such as drying fish and fruit, and storing root vegetables, to avoid waste and preserve food for when it is needed. Fiji and Samoa encouraged producers to adopt more controlled harvesting to reduce post-harvest waste [25].

3.2.4. Labor, Migration, and Worker Health: Human Centered Considerations

While the agricultural sector plays an important role in influencing migration patterns, the COVID-19 crisis exposed lesser known labor challenges in food production methods raising important regional and national social justice questions [39,43]. In the context of city regions, this challenges the viability of existing food production methods. In low income countries the reduction in available labor affects labor-intensive food production and puts exports at risk. In high income countries the extensive reliance on migrant labor was brought to light through COVID-19 as a threat primarily to horticulture [44]. In Canada in 2019, 69,000 temporary migrant workers entered the country to work in the agricultural sector. In 2020 under COVID-19, these seasonal migrant workers, who enable food production in Canada, were challenged to get to farm fields. A key concern for migrant workers centers on their health as many live in overcrowded conditions and lack adequate access to health care [39]. In other countries, attempts to address labor shortages resulted in changes to migrant labor travel permit rules, for example from Mexico to the United States,

and put farm workers at risk of virus infection [45]. Most measures in destination areas focus on the extension of working visas to temporary and seasonal migrants (e.g., Italy, Australia, New Zealand). Germany eased entry restrictions for seasonal farmworkers. Portugal has temporarily given all migrants and asylum seekers full citizenship rights, granting them access to the country's healthcare system [22,26].

In Jiangsu (China), where internal migration linked to transportation and labor shortages were an issue, new training and guidelines were developed to support the migrant labor hiring process including child care support with financial relief provided for social insurance costs [46]. In China, the government issued a notice to ensure that the contracts of migrant workers are not terminated in the case of illness or containment measures [46].

These solutions raise many questions from a CRFS approach. Things to consider include local workers who can displace much needed jobs for migrant workers; the care, or lack of, for migrant worker health and well-being; the need for the skilled labor embodied in migrant workers; whether having stronger city region food systems can provide fair-waged jobs for migrants at home.

3.2.5. Technology

There has been a global pivot to create more online direct distribution links between farmers and consumers, and also to connect farmers to labor (e.g., Austria, Germany, France, Viet Nam, China, India, Australia, Canada, US; expansion of Open Food Network). While this deployment of technology has been taken up widely and rapidly under COVID-19, it exemplifies how food system adaptation is place-based with different partnerships, oftentimes government led, enabling the adoption of technology.

In Medellin, social media and online farmers' markets are being used successfully. A new platform reached 12,000 visits and 120 different farmers' markets with 8.2 tons of food from local producers sold in the first 3 days [27]. In South Korea, the Ministry of Agriculture developed an online trading platform that directly links smallholder producers with consumers to ensure market access to the farmers and fresh produce to urban consumers [47]. In Cape Town (South Africa) the city put in place a web-based platform that operates on cellphones to enable people living in townships and informal settlements to access food aid via a voucher at their local "spaza" shops. This avoids the need for transport, keeps the local township economy operational, protects the existing food system, and affords the dignity of the vulnerable. This idea has been taken forward by the private sector and a pilot was completed with favorable outcomes [22]. In Curitiba (Brazil), the city launched a digital platform to help marketing of small food entrepreneurs [22]. In Barcelona, the city collaborated with T-Systems, a digital services subsidiary of Deutsche Telekom, to develop an app accessible by non-government organizations and charity associations to arrange free delivery of fresh produce baskets to vulnerable households [47]. New distribution channels in the PSIDS were supported by the government to get local food to people living in cities through mobile markets, new market locations, online marketing, social media, and bartering [25]. This speaks to the importance of fostering the informal economy as part of resilience.

China used online resources with complementary investments by government in infrastructure including cold-chain storage, deploying needed labor and sharing resources. Online resources were also developed to train farm workers. Communities and neighborhood committees match production with distribution, enable online direct purchasing and government purchasing commitments through online meetings. Online sites were enabled for farmers and consumers through various resources in procurement, logistics, operation. and marketing to maximize links between producers and consumers [32]. In Jiangsu, e-commerce was promoted for direct distribution including for women's groups, large retailers, and citizens to improve access to fresh food including vegetables. For farmers, individual support was provided to facilitate registration, while for consumers, a simple interface was developed to provide vouchers, discounts, and promotions. For example, on TikTok, and using celebrity promotions. Alibaba established USD 141 million to support

farmers and sold 118,000 tonnes of overstocked agricultural products in less than 40 days. JD.com released 25 policies to support farmers and sold 500 tonnes of produce in 5 days. Pinduoduo supported farmers from 400 cities or towns which include more than 230 State poverty counties. Online platforms are also used for production supplies and machinery. Online resources are proving to be very viable and useful and are being considered for future food chains in China [46].

This rapid uptake is evidenced elsewhere. COVID-19 has provided evidence for the capacity of technology to enable city region food systems to the benefit of producers and consumers, and demonstrates how community-scale technology can benefit small-scale farmers and increase food insecurity through more distributed food systems.

3.3. Policy

For the long term, the CRFS approach offers a framework to build a participatory platform that enables actors to codefine policies, interventions, and mechanisms of territorial governance for food system transformation, reinforcing cooperation and collaboration among different local governments and other actors.

3.3.1. Multiscale Emergency Responses for Food Security—Laying the Groundwork for Future Change?

Faced with COVID-19, many countries moved as quickly as possible to protect food security and livelihoods. Given the various responses, it emerged that the CRFS approach can foster resilience and sustainability through more viable long-term social support programmes embedded and relevant to on-going community goals as opposed to rapidly deployed, haphazard emergency measures. Several emergency responses were enacted by national governments to deal with the pandemic and address anticipated health and economic consequences that revealed (1) where capacity is lacking; (2) the centrality of food to community well-being. It also highlights areas where continued support post-COVID-19 can make differences to on-going food security and viable livelihoods for those most at risk. Particularly notable is the place-based focus of initiatives as governments from national and state scales sought to roll out COVID-19 emergency measures, in many cases providing the context for communities to respond based on specific capacities. This speaks to the potential benefits of adopting MSE as city-region food systems need to be supported by facilitative government policies at all scales, from local to national [4].

In India, building from the 2013 basic rationing initiative that provides wheat and rice to the two thirds of the Indian population living in poverty, rations of more and other basic items were added under COVID-19. This expanded action took place at the subnational scale beginning in Kerala, and spread to Tamil Nadu, Andra Pradesh, Punjab, Haryana, and Karnataka. In Kerala, the state government set up community kitchens and monitored food assistance programmes with local authorities given responsibility for distribution and logistics. In rural areas, children under six were given free midday meals with teachers delivering weekly supplies to these families [23]. In Colombia priority has been given to local agroecological production rather than mass production to ensure long-term food security [27].

In Jiangsu Province (China), subsidies were used to reward counties for meeting food production targets, absorb overstocked foods, and/or using online platforms to realize food sales goals. The reopening of agricultural businesses was expedited through working capital loans, loan guarantees, relief on loan interest and overhead expenses including rent for small farms and co-operatives [46]. Subsidies were also provided to large agricultural enterprises as well as low interest loans to agri-tourism industry. Approximately USD 2 million in support was also provided to consumers to stimulate agri-tourism. Other financial initiatives included e-vouchers to stimulate buying especially for vulnerable groups, support to restaurants to develop take-out capacity, and income support to low income groups to prevent their return to poverty [46].

As this section demonstrates, multiscale engagement including system-centered planning encouraged by the CRFS approach can help address emergencies as well as anticipate

future shocks. It is interesting to consider the long-term, sustainable benefits of having variations of these initiatives in place and the impact that creating more secure livelihoods could have on food security and people's health.

3.3.2. Coordination and Connections—Lessons Learned for City Region Food Systems

COVID-19 has also highlighted challenges to coordination and collaboration between institutions in the food supply. There are several dimensions to this coordination problem —between levels, between local government departments or divisions, or between governmental and non-governmental stakeholders. Existing connections within city region food systems helped to cope with the pandemic. Curitiba (Brazil), part of a Food and Nutrition Security Network, has worked with 29 municipalities in the Metropolitan Region for 3 years through an interinstitutional working group. This group includes 13 entities across the municipalities with a mandate to strengthen the integration of food security policies (Armazém da Família) and provide support to family farmers' cooperatives. Through Armazém da Família and in cooperation with 10 municipalities in the metropolitan region the city promoted the sale of 320 items (food and basic necessities) at prices on average 30–35% lower than conventional retail, benefiting 260,000 families in Curitiba and 58,000 families in the metropolitan region. To meet the crisis, the city expanded the food safety stock which supplies the Armazém da Família, for 90 days, ensuring physical stock, set price, and regulatory control for the conventional food basket retail (rice, beans, pasta, coffee, among others). The city expanded the "Mesa Solidaria" programme that offers free meals to the homeless, in partnership with social entities, churches, and volunteer groups to offer up to 1500 free meals/day. The municipality has also moved to provide a financial recovery plan for micro and small food marketing initiatives [27].

The motivation for interconnected initiatives impacts the likelihood of sustained success. In some cases, plans were put in place through unilateral actions, oftentimes as a top-down initiative so stakeholders did not have information to act appropriately or overall coordination was lacking so measures were developed too rapidly and/or without input from key operational actors. In the Philippines, the national government did not consult local governments about COVID-19 policy and programme implementation guidelines even though Local Government Units (LGU) are considered the major front-liners in the implementation of programmes [20]. Several challenges surfaced in South Africa, including a lack of coordination between national and provincial governments. While there is evidence of cooperation between provincial and local governments, already precarious food access in townships and informal settlements was impacted. Fortunately, Cape Town has been able to build on networks it has been fostering over the last nine months with other governments and academic partners to relieve logistical delays resulting from strained local government resources. This network was engaged to change regulations so informal traders could continue operating under COVID-19. They also enabled and verified an NGO database that facilitated food parcel distribution [22].

While COVID-19 has shone a light on deficiencies in the globalized capital-driven food system policies and programmes, it has also shown us the value of multistakeholder, multiscale collaboration as well as system-centered planning. As a central focus of the CRFS approach, it underscores the potential for adopting this integrative framework to reinforce, expand, and diversify existing resources.

3.3.3. Preparedness: Staying Ahead of the Curve Using the CRFS Approach

COVID-19 has demonstrated the possibilities for CRFS projects and CRFS-type initiatives to prepare cities and their regions for multiple hazards and shocks [48], protect livelihoods and food security as the coordination inherent to the CRFS approach builds resilience. In Colombo (Sri Lanka), one of the first pilot CRFS projects, the strong alignment between government taskforce measures ensure sufficient availability of staple foods (and readily available fruits and vegetables). The systemic approach and opportunities for system-centered planning, helps to ensure communities have access to food using alterna-

tive supply chain linkages by coordinating with multistakeholders across administrative boundaries. It addresses issues such as farmers' access to inputs, food affordability, waste management, and establishing hubs for the distribution of farm products [29].

In Quito, a vulnerability analysis of the local food system was undertaken with the support of the Water Land and Ecosystems Programme of CGIAR and RUAF in 2019 as part of the second iteration of the FAO-RUAF CRFS project [48]. The insights from this assessment led the city to develop a Resilience Strategy for the Quito Food System, a clear example of system-centered planning. This strategy reaches from neighborhoods up to the global level, takes an integrated approach to the various dimensions of food security and food system links, and identifies weaknesses that must be addressed to build resilience. Coupled with the initial CRFS project (2015–2018) and related work on indicators, Quito undertook a mapping of bioferias (local markets) and vulnerable communities. Under COVID-19, this was used to identify groups needing emergency food and allowed the Quito special operations committee to make provisions for people not included in the initial plans, in particular the elderly and people with constrained mobility. Food policy council facilitation allowed for the coordination of special directives and communication, including those related to vulnerable household needs, the importance of the informal sector and related markets as they moved from bioferias to more scale-based and family-scale forms of distribution [33].

In Kitwe (Zambia), also one of the first CRFS pilot projects, fear, restricted transportation, and/or physical distancing affected the supply and distribution of fresh food, mainly fruits, vegetables, meat, and dairy products. In addition, many small-scale famers in the city region involved in fresh food production were also particularly affected as most of them constitute households with the highest incidences of poverty. The challenges faced by the country regarding food supply are mainly being dealt with by the central government. Nevertheless, despite the limited power of the local government, the multistakeholder CRFS platform is becoming instrumental in fostering coordination among actors in the supply chain in defining strategies and coordinated actions to mitigate COVID-19 impacts and dealing with post pandemic scenarios [22].

In Melbourne (Australia), pre-COVID-19 pressures experienced by small businesses include the effects of drought and bush fires so that natural disasters and emergencies remain a significant concern for small regional food businesses. These shocks can also propel innovation and prepare the CRFS for other shocks such as COVID-19 [31]. In Antananarivo, the on-going CRFS project has meant that engaged multiple stakeholders across the food system can find relevant solutions, so that "good practices will be capitalised in favor of a multisector food strategy, contributing to a more sustainable, economic and social approach for the benefit of the food system of Antananarivo city region and the whole national territory." [24]. While more research and projects are needed, there is growing evidence that the CRFS approach affords resilience and flexibility to food territories so they can respond better to a range of shocks, including pandemics and climate change.

4. Discussion

COVID-19 has focused attention on the increased importance of local food and the existing or missing connections within a CRFS. Increasing attention to the CRFS approach leading up to and including COVID-19, shows that a consensus is emerging from theory and practice about the necessary processes and tools that optimize the functionality of sustainable CRFS. These include:

- multistakeholder groups across scales that understand how SFS can capture multifunctional food dividends at once and deploy resources, including adaptive governance, that connect actors across the CRFS nested in supportive national laws and policies [11];
- active planning for resilience building from cross-cutting system-centered planning, moving beyond the silos of typical planning processes [12];
- quantitative and qualitative tools that benchmark and track progress over time;

- urban–rural linkages that spread the opportunities and benefits of CRFS from producer to consumer building polycentric food networks [3];
- built infrastructure that supports small-scale farmers and businesses including transportation, food storage, and online tools such as virtual farmers' markets for both formal and informal markets;
- interconnected rings of food provisioning starting with the local and building out to the global;
- inclusion of traditional and indigenous food system knowledge for effective food management; and,
- the recognition that all food systems are place-based [3].

CRFS preparedness can foster resilience and sustainability through more viable long-term programmes that are embedded and relevant in regional needs as opposed to rapidly deployed, haphazard emergency measures. While COVID-19 has shone a light on deficiencies in food system policies and programmes, it has also shown us the value of multistakeholder collaboration, appropriate infrastructure, system-centered planning, and coordinated coherent policy.

Faced with COVID-19 as an actual emergency, many countries moved to fill gaps to protect food security and livelihoods. It is interesting to consider the long-term, sustainable benefits of having variations of these initiatives in place permanently and the impact that creating more secure livelihoods could have on food security, people's health and livelihoods through people-centered planning [13]. Implementing the CRFS approach could help embed these new initiatives.

The examples in this paper, drawing on both CRFS projects or CRFS-type initiatives, demonstrate the value of preparedness for protecting livelihoods and food security where shocks are experienced. As the responses to COVID-19 reported in this paper demonstrate, adopting the CRFS approach strengthens responsive networks, logistical infrastructure and policy needed for sustainable resilient food systems. CRFS can be a key social protection approach given its ability to lever the multifunctionality of sustainable food systems.

There is also room for further improvement by making these strategies more coherent, and supporting them through, joined-up [49] multistakeholder platforms including system-centered planning. As described throughout the paper, in CRFS cities including Quito, Medellin, Colombo, Kitwe, Antananarivo, and Toronto, and cities where elements of a city region food system approach have been informally implemented, COVID-19 has made it clear that the human networks, physical infrastructure, and supportive policies and programmes are key to resilience. These networks allow the needed pathways to be fluid and adapt to rapidly changing circumstances and can position city regions to be resilient to a range of shocks.

As a starting point, cities need to get a sense of their food system and then test it against a variety of risks and vulnerabilities. These would include COVID-19, but droughts and other climate risks too. A stakeholder group that includes government, private sector, and academia is crucial to managing a system that is incredibly dynamic, nuanced, and complex. Acknowledging the complexity inherent in the food system is a necessary starting point towards its management. Based on this starting point, resources can be allocated and mandated to take policies and strategies forward proactively [4,22]. It is important to ensure that the rigidity, concentration, and lack of responsiveness in the global industrial food system not be replicated in city region food systems.

Many tools to help develop these resilient food systems are included in the CRFS toolkit launched in 2018, now being updated to include modules on climate and pandemic resilience. The toolkit provides an approach to (a) assess linkages and resource flows between rural and urban areas, key actors, policies and legislation, sustainability, risks, and current and future vulnerabilities; (b) plan policy actions using indicator frameworks and other resources to build resilience and sustainability. Other work adds to the toolkit. In Latin America and the Caribbean, a series of indicators have been proposed to monitor the impact level of the COVID-19 crisis for emergency planning, mainly including

macroeconomic indicators, price indicators, and food availability indicators. More tools are also being developed to estimate city regional and bioregional food flows to enable evidence-based decisions making [50–53]. This complements original CRFS work on food flows from the pilot city research (e.g., Medellin and Quito, 2015–2018). Karg et al. [54] conducted a detailed analysis of the existing food flows for Tamale, Ghana, and Ouagadougou, Burkina Faso based on more than 40,000 food flow records collected over two years detailing seasonal fluctuations and the extent of regional food provisioning. The authors determined that over 50% of main food groups for urban areas was provided by small-scale farmers within the CRFS pointing to the value of understanding more about where food comes from for resilience planning. Qualitative tools are also emerging to support CRFS analysis, for example participatory narrative scenarios visioning and impact pathway mapping [55,56]. The Milan Urban Food Policy Pact indicators are also relevant in this context as several capture the city region dynamic. The SDGs also serve as a jumping off point for some relevant metrics [4]. The CRFS approach, through its on-going projects, captures and supports this constant learning and fine-tuning of tools, processes, and the framework for resilience. As we have seen, this is a forward moving, iterative process as the multiple shocks that cities and their regions must confront shift and change.

What to do post-COVID-19 is now one of the most pressing issues facing countries as they grapple with the economic consequences of their short-term reactions. There is a significant risk of losing gains made in fighting poverty and improving health, education and nourishment, and protecting the environment as we strive to meet the SDGs [20–22]. However, this also opens doors to invest in city region food systems and bring about long-term sustainable change that provides resilience to future shocks including climate change [57]. These initiatives can direct support to vulnerable groups, especially indigenous peoples, youth, and women. With the opportunity to bolster localized food systems, COVID-19 had also demonstrated that the Global North can learn much about regional food production and delivery from city regions in the Global South. Technology has also emerged as an enabler, multiplying out the capacity to share, learn, and act by connecting to other movements and seeding/reinforcing local markets through online apps. It is imperative that these technologies enable change that benefits small-scale farmers and their livelihoods as well as low or no income communities and does not lead to the co-option of local networks by corporate driven interest. Financial support will also be needed to sustain and restart the economy especially for the most vulnerable rural agriculture businesses and urban poor households [43,49]. It also raises interesting questions about whether the short-term interventions introduced under COVID-19 could enable city region food systems to become more resilient into the future and the role of the CRFS approach in enabling resilience. As de Schutter [58] and others [3,4] have suggested, empirical research into the various direct and indirect costs associated with both the CRFS and the global industrial food system would help direct future decisions and enable evidence-based decision-making. This is increasingly pressing given COVID-19 and climate change demonstrating the imperative to build more shock resilient city region food systems.

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References

1. Rosset, P.M.; Altieri, M.A. *Agroecology: Science and Politics*; Practical Action Publishing: Rugby, UK, 2017.
2. High Level Panel of Experts, World Committee on Food Security. *Agroecological and Other Innovative Approaches for Sustainable Agriculture and Food Systems that Enhance Food Security and Nutrition*; High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security: Rome, Italy, 2019; Available online: http://www.fao.org/3/ca5602en/ca5602en.pdf (accessed on 18 January 2021).
3. Blay-Palmer, A.; Santini, G.; Dubbeling, M.; Renting, H.; Taguchi, M.; Giordano, T. Validating the city region food system approach: Enacting inclusive, transformational city region food systems. *Sustainability* **2018**, *10*, 1680. [CrossRef]
4. RUAF. City Region Food System Toolkit. 2020. Available online: https://ruaf.org/focus-area/city-region-food-systems/ (accessed on 18 January 2021).
5. FAO. *Measures for Supporting Wholesale Food Markets during COVID-19*; FAO: Rome, Italy, 2020. [CrossRef]
6. Berdegué, J.; Proctor, F. Cities in the rural transformation. Available online: https://www.rimisp.org/wp-content/files_mf/files_mf/1421411411Citiesintheruraltransformation_edited.pdf (accessed on 18 January 2021).
7. Santini, G.; Dubbeling, M.; Blay-Palmer, A. Tools for food system change. *Sustain. Food Syst. Assess.* **2019**, 178. [CrossRef]
8. Dubbeling, M.; Carey, J.; Hochberg, K. The Role of Private Sector in City Region Food Systems. Available online: https://ruaf.org/document/the-role-of-private-sector-in-city-region-food-systems/ (accessed on 19 January 2021).
9. Blay-Palmer, A.; Renting, H.; Dubbeling, M. City-Region Food Systems: A Literature Review. Available online: https://ruaf.org/assets/2019/12/City-Region-Food-Systems-literature-review.pdf (accessed on 19 January 2021).
10. Roosendaal, L.; Herens, M.; de Roo, N.; Stuiver, M.; Pittore, K.; Soma, K.; Hetterscheid, B. *City Region Food System Governance; Guiding Principles and Lessons Learned from Case Studies Around the World*; Report WCDI-20-118; Wageningen Centre for Development Innovation, Wageningen University & Research: Wageningen, The Netherlands, 2020; Available online: https://research.wur.nl/en/publications/city-region-food-system-governance-guiding-principles-and-lessons (accessed on 19 January 2021).
11. Maye, D. 'Smart food city': Conceptual relations between smart city planning, urban food systems and innovation theory. *City Cult. Soc.* **2019**, *16*, 18–27. [CrossRef]
12. Cabannes, Y.; Marocchino, C.; Fonseca, J. City Region Food Systems as Human-Centered Planning. *Smart Communities Rev.* **2017**, *13*, 74–83.
13. Kotze, S.; Dymitrowa, M.; Ingelhag, K. Can a city feed itself? Innovations in City–Region Food Systems from a Swedish perspective. In Proceedings of the 4th Global Food Security, Food Safety & Sustainability Conference, Montreal, QC, Canada, 10–11 May 2019; pp. 10–11.
14. Haysom, G.; Olsson, E.; Dymitrow, M.; Opiyo, P.; Taylor Buck, N.; Oloko, M.; Spring, C.; Fermskog, K.; Ingelhag, K.; Kotze, S.; et al. Food systems sustainability: An examination of different viewpoints on food system change. *Sustainability* **2019**, *11*, 3337. [CrossRef]
15. Knezevic, I.; Blay-Palmer, A.; Levkoe, C.Z.; Mount, P.; Nelson, E. (Eds.) *Nourishing Communities: From Fractured Food Systems to Transformative Pathways*; Springer: New York City, NY, USA, 2017.
16. Hipel, K.W.; Fang, L.; Heng, M. System of systems approach to policy development for global food security. *J. Syst. Sci. Syst. Eng.* **2010**, *19*, 1–21. [CrossRef]
17. FAO. Sustainable Food Systems. Concept and Framework. 2018. Available online: http://www.fao.org/3/ca2079en/CA2079EN.pdf (accessed on 19 January 2021).
18. Clapp, J.; Isakson, S.R. Risky returns: The implications of financialization in the food system. *Dev. Chang.* **2018**, *49*, 437–460. [CrossRef]
19. FAO. Coronavirus Disease 2019 (COVID-19) | Addressing the Impacts of COVID-19 in Food Crises: April–December 2020, May Update, FAO's Component of the Global COVID-19 Humanitarian Response Plan. Rome. 2020. Available online: http://www.fao.org/3/ca9192en/ca9192en.pdf (accessed on 19 January 2021). [CrossRef]
20. UNICEF. Lives Upended: How COVID-19 Threatens the Futures of 600 Million South Asian children. 2020. Available online: https://www.unicef.org/rosa/reports/lives-upended (accessed on 19 January 2021).
21. Sustain UK. Food and Covid-19: How Local Authorities Can Support Recovery and Resilience. *Sustain Publication*. 2020. Available online: https://www.sustainweb.org/publications/food-and-covid-19-report/ (accessed on 19 January 2021).
22. FAO. Cities and Local Governments at the Forefront in Building Inclusive and Resilient Food. Systems: Key Results from the FAO Survey "Urban Food Systems and COVID-19". 2020. Available online: http://www.fao.org/documents/card/en/c/cb0407en (accessed on 19 January 2021).
23. Potham, P.; Taguchi, M.; Santini, G. Local Food Systems and COVID-19; A glimpse on India's Responses. 2020. Available online: http://www.fao.org/uploads/pics/COVID-19_and_Indian_food_systems-edited_draft-17-04-2020mt_pepcopy__1_.pdf (accessed on 19 January 2021).

24. Zuleta Ferrari, C. City region food systems in Antananarivo, Madagascar: A sustainable approach to respond to COVID-19 outbreak. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1272226/ (accessed on 19 January 2021).
25. Sherzad, S. Impacts of COVID-19 on the Food Systems in the Pacific Small Island Developing States (PSIDS1) and A Look into the PSIDS Responses. FAO Publication. 2020. Available online: http://www.fao.org/uploads/pics/COVID-19_impacts_on_food_systems_in_PICs_CRFS_.pdf (accessed on 19 January 2021).
26. ICLEI; FAO. Food, Climate and Covid-19: Stories from Our Cities. 2020. Available online: https://www.youtube.com/watch?v=0QuXDBlsAqs&t=58s (accessed on 19 January 2021).
27. Zuluaga Orrego, J.; Santini, G. City region food systems in Medellin, Colombia: A Pathway of Governmental and Territorial Integration to Face the COVID-19 Crisis. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1273338/ (accessed on 19 January 2021).
28. Ikua. The Impact of COVID-19 on the Food System in Nairobi. CGIAR, Water Land Ecosystem Programme. 2020. Available online: https://wle.cgiar.org/thrive/2020/10/15/impact-covid-19-food-system-nairobi (accessed on 19 January 2021).
29. Dreschel, P. Strengthening City Region Food Systems during and Beyond COVID-19. CGIAR, Water Land Ecosystem Programme. 2020. Available online: https://wle.cgiar.org/thrive/2020/04/08/strengthening-city-region-food-systems-during-and-beyond-covid-19 (accessed on 19 January 2021).
30. FAO. Bolivian Urban Farmers Rethink Their Ways of Working: Home Deliveries Help Provide Fresh Food to Cities during the Pandemic. 2020. Available online: http://www.fao.org/fao-stories/article/en/c/1272851/ (accessed on 19 January 2021).
31. Carey, R.; Murphy, M.; Alexandra, L. Insights from Melbourne, Australia during COVID-19: Civil Society Leading the Response to Strengthen the City Region Food System. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/fr/c/1275112/ (accessed on 19 January 2021).
32. Fei, S.; Ni, J. Local Food Systems and COVID-19: A Look into China's Responses. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1270350/ (accessed on 19 January 2021).
33. Rodríguez, A. How Quito's Urban and Peri-Urban Agriculture Contributes to the COVID-19 Response. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1274823/ (accessed on 19 January 2021).
34. Boiko, V.; Kwilinski, A.; Misiuk, M.; Boiko, L. Competitive advantages of wholesale markets of agricultural products as a type of entrepreneurial activity: The experience of Ukraine and Poland. *Econ. Ann. Xxi* **2019**, *175*, 68–72. [CrossRef]
35. Cadilhon, J.J.; Fearne, A.P.; Hughes, D.R.; Moustier, P. *Wholesale Markets and Food Distribution in Europe: New Strategies for Old Functions*; Department of Agricultural Sciences, Imperial College London (Wye Campus): London, UK, 2003.
36. Stahlbrand, L.; Roberts, W. Local Food System Responses to Covid-19: Toronto and Its City Region. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1275076/ (accessed on 19 January 2021).
37. Reuben, A.; BBC. BBC Reality Check. Coronavirus: Why Have There Been So Many Outbreaks in Meat Processing Plants. 2020. Available online: https://www.bbc.com/news/53137613 (accessed on 19 January 2021).
38. Weiler, A.M.; McLaughlin, J.; Cole, D.C. Food security at whose expense? A critique of the Canadian temporary farm labour migration regime and proposals for change. *Int. Migr.* **2017**, *55*, 48–63. [CrossRef]
39. McLaughlin, J. Centering Justice in Canada's Food System. UNESCO Chair on Food Biodiversity and Sustainability Studies webinar. 2020. Available online: youtu.be/RSRzIbf60ZQ (accessed on 19 January 2021).
40. Corrado, S.; Sala, S. Food waste accounting along global and European food supply chains: State of the art and outlook. *Waste Manag.* **2018**, *79*, 120–131. [CrossRef] [PubMed]
41. Jadhev, R.; Thukral, N.; Hunt, N. 2020. Available online: https://www.reuters.com/article/us-health-coronavirus-food-supplies-insi/coronavirus-upends-global-food-supply-chains-in-latest-economic-shock-idUSKBN21L2V7 (accessed on 19 January 2021).
42. Amoah, P.; Keraita, B.; Akple, M.; Drechsel, P.; Abaidoo, R.C.; Konradsen, F. *Low-Cost Options for Reducing Consumer Health Risks from Farm to Fork Where Crops Are Irrigated with Polluted Water in West Africa*; IWMI Research Report 141; International Water Management Institute: Colombo, Sri Lanka, 2011; 45p. [CrossRef]
43. Blay-Palmer, A.; Carey, R.; Valette, E.; Sanderson, M.R. Post COVID 19 and food pathways to sustainable transformation. *Agric. Hum. Values* **2020**, *37*, 517–519. [CrossRef] [PubMed]
44. Allahdua, G. Centering Justice in Canada's Food System. UNESCO Chair in Food Biodiversity and Sustainability Studies webinar. 2020. Available online: youtu.be/RSRzIbf60ZQ (accessed on 19 January 2021).
45. Charles, D. 2020. Available online: https://www.npr.org/sections/thesalt/2020/03/27/821449729/essential-status-means-jobs-for-farmworkers-but-greater-virus-risk?t=1595002841041 (accessed on 19 January 2021).
46. Shen, G.; Liao, X. Response Measures to Ensure the Urban Food Supply System and Farmers' Livelihoods under COVID-19. Experiences from Jiangsu Province, China. 2020. Available online: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1276460/ (accessed on 19 January 2021).
47. FAO. Impact of COVID-19 on Informal Workers. 2020. Available online: http://www.fao.org/3/ca8560en/CA8560EN.pdf (accessed on 19 January 2021).
48. Van Veenhuizen, R. 2020. Available online: https://wle.cgiar.org/news/resilient-and-participatory-how-quito%E2%80%99s-setting-standard-urban-food-systems?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A%20cgiar/jIZS%20%28CGIAR%20Research%20Program%20on%20Water%2C%20Land%20and%20Ecosystems%20Website%20Stories%29 (accessed on 19 January 2021).

49. Béné, C. Resilience of local food systems and links to food security–A review of some important concepts in the context of COVID-19 and other shocks. *Food Secur.* **2020**, *12*, 805–822. [CrossRef] [PubMed]
50. Fenner, C.; Di Rosso, M. Bristol's Covid-19 Community Food Response. 2020. Available online: https://static1.squarespace.com/static/5d77ba51bfcde93040b571c1/t/5f0dda629aba841612a030eb/1594743397599/Bristol%E2%80%99s+Covid-19+Community+Food+Response.pdf (accessed on 19 January 2021).
51. Dorward, C.; Smukler, S.M.; Mullinix, K. A novel methodology to assess land-based food self-reliance in the Southwest British Columbia bioregion. *Renew. Agric. Food Syst.* **2017**, *32*, 112–130. [CrossRef]
52. Zasada, I.; Schmutz, U.; Wascher, D.; Kneafsey, M.; Corsi, S.; Mazzocchi, C.; Monaco, F.; Boyce, P.; Doernberg, A.; Sali, G.; et al. Food beyond the city–Analysing foodsheds and self-sufficiency for different food system scenarios in European metropolitan regions. *City Cult. Soc.* **2019**, *16*, 25–35. [CrossRef]
53. Cardoso, A.S.; Domingos, T.; De Magalhães, M.R.; Melo-Abreu, D.; Palma, J. Mapping the lisbon potential foodshed in ribatejo e oeste: A suitability and yield model for assessing the potential for localized food production. *Sustainability* **2017**, *9*, 2003. [CrossRef]
54. Karg, H.; Drechsel, P.; Akoto-Danso, E.K.; Glaser, R.; Nyarko, G.; Buerkert, A. Foodsheds and city region food systems in two West African cities. *Sustainability* **2016**, *8*, 1175. [CrossRef]
55. Sellberg, M.M.; Norström, A.V.; Peterson, G.D.; Gordon, L.J. Using local initiatives to envision sustainable and resilient food systems in the Stockholm city-region. *Glob. Food Secur.* **2020**, *24*, 100334. [CrossRef]
56. Valette, E.; Schreiber, K.; Conaré, D.; Bonomelli, V.; Blay-Palmer, A.; Bricas, N.; Sautier, D.; Lepiller, O. 2 An emerging user-led participatory methodology. *Sustain. Food Syst. Assess. Open Access Lessons Glob. Pract.* **2019**, *2*, 101849.
57. Gupta, A.; Banerjee, S.; Das, S. Significance of geographical factors to the COVID-19 outbreak in India. *Modeling Earth Syst. Environ.* **2020**, *6*, 2645–2653. [CrossRef] [PubMed]
58. De Schutter, O.; Jacobs, N.; Clément, C. A 'Common Food Policy' for Europe: How governance reforms can spark a shift to healthy diets and sustainable food systems. *Food Policy* **2020**, *96*, 101849. [CrossRef]