



Envisioning the Future of European Food Systems: Approaches and Research Priorities After COVID-19

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The COVID-19 pandemic unveiled the fragility of food sovereignty in cities and confirmed the close connection urban dwellers have with food. Although the pandemic was not responsible for a systemic failure, it suggested how citizens would accept and indeed support a transition toward more localized food production systems. As this attitudinal shift is aligned with the sustainability literature, this work aims to explore the tools and actions needed for a policy framework transformation that recognizes the multiple benefits of food systems, while considering local needs and circumstances. This perspective paper reviews the trends in production and consumption, and systematizes several impacts emerged across European food systems in response to the first wave of pandemic emergency, with the final aim of identifying challenges and future strategies for research and innovation toward the creation of resilient and sustainable city/region food systems. The proposal does not support a return to traditional small-scale economies that might not cope with the growing global population. It instead stands to reconstruct and upscale such connections using a “think globally act locally” mind-set, engaging local communities, and making existing and future citizen-led food system initiatives more sustainable. The work outlines a set of recommended actions for policy-makers: support innovative and localized food production, training and use of

information and communication technology for food production and distribution; promote cross-pollination among city/region food systems; empower schools as agents of change in food provision and education about food systems; and support the development of assessment methodologies and the application of policy tools to ensure that the different sustainability dimensions of the food chain are considered.

Keywords: city/region food system, SARS-CoV-2 pandemic, sustainable food systems, food initiatives, food security

INTRODUCING CITY/REGION FOOD SYSTEMS: THE FOODE VISION

A diffuse concern about food systems' resilience has grown throughout Europe in face of the current COVID-19 crisis (Bakalis et al., 2020). Although scarcity of food was not a real threat, the crisis increased awareness on the potential exposure of food systems to new shocks and crises, especially in terms of food access (Béné, 2020), consumer behavior, small-scale productions, and alternative food networks (Galanakis, 2020). The pandemic and the related lockdown measures favored more formal and consolidated national and global supply chains, particularly in urban contexts. In fact, localized and sustainable food production and distribution experiences had to face additional challenges, such as interruptions in the supply or demand chains due to the lockdown and the need to identify new distributions channels (FAO, 2020a,b). Under these circumstances, a policy framework that takes into consideration local needs and conditions and recognizes the multiple benefits associated with localized and sustainable food production and distribution experiences (Nicholls et al., 2020) becomes more urgent than ever.

The international sustainability agenda has started to acknowledge the urgency of this shift, recommending increased diversity of plant-based foods, reduced consumption of meat, substantial cuts in food waste, and re-localization of supply chains (SCBD, 2020). Similarly, the Sustainable Development Goals Target 2 has mandated countries to ensure sustainable food production systems and double productivity and incomes of small-scale food producers (United Nations, 2015).

With reference to urban food systems, after the Global call for action conference of the World Urban Forum (2014), the City/Region Food System (CRFS) approach started to gain increasing attention within the international debate. At that time, stakeholders were already aware that a territorial and holistic food system approach was the most suitable way to tackle the upcoming global challenges.

Afterwards, the CRFS framework was introduced by Jennings et al. (2015) and defined as: "the complex network of actors, processes, relationships that has to do with food production, processing marketing, and consumption in a given geographical region which includes a more or less concentrated urban center and its surrounding peri-urban and rural hinterland."

Other than representing a multidimensional way of action, the CRFS approach entails two significant innovations. First, it aims at creating a food governance structure that considers local circumstances, understanding that cities exist within a

geography and that decisions about food should operate across the urban-rural continuum. Second, such an outlook recognizes the ecological, socio-economic, and governance linkages that characterize food systems. These different dimensions not only deserve equal attention but are also recognized as mutually reinforcing (Jennings et al., 2015).

The CRFS has then become a new lens of analysis, paving the way for a more sustainable, resilient, fair, and healthy food system worldwide (World Urban Forum, 2014), and can help today in the identification of innovative solutions to cope with the aftermaths of the COVID-19 crisis.

This paper builds on the FoodE H2020 project, which sees the collaboration of 24 partners from eight European countries and aims to engage local organizations in the design, implementation, and monitoring of environmentally, economically, and socially sustainable CRFS. The goal of this paper is to offer a systematic view of European food systems response to COVID-19, highlighting the major trends and impacts and discussing the potential policy implications related to the future of CRFS.

METHODOLOGY

The work adopted a mixed-method approach integrating a literature review with the opinion of experts and stakeholders from a wide range of organizations and European countries.

Starting from the CRFS definition, a literature review was carried out to identify the most critical food system areas affected by the COVID-19 pandemic. The literature was systematized by a mixed method of research based on scientific papers and materials coming from gray literature. Concerning the peer review literature, the high number of documents acquired and revised have been collected through SCOPUS and Web Of Science. The gray literature review was carried out through Google Scholar, expert opinions, direct interviews, as well as daily press in various languages, and blogs. Collected information was clustered into five food system areas: (1) agriculture, fisheries, and production systems; (2) innovative business models for increased resilience and sustainability; and (3) evolving technologies; (4) consumers behavior changes and adaptations; and (5) schools and education. For each area a dedicated working group was created. Working groups were composed of 4–5 experts belonging to a wide range of food stakeholders types including universities and research institutes, small and medium enterprises, non-governmental organizations, and municipalities.

TABLE 1 | Involved participants in the stakeholder's workshop, per country, and organization.

Country	Organization	Number of participants
Italy	Alma Mater Studiorum – Università di Bologna	15
	Comune di Bologna	3
	Università degli Studi di Napoli Federico II	3
	Flytech	3
France	Institut des Sciences et Industries du Vivant et de l'Environnement	1
	Institut National de Recherche pour l'Agriculture, l'alimentation et l'environnement	1
	Commune de Romainville	2
Germany	Fachhochschule Südwestfalen	2
	Institut für Landes- und Stadtentwicklungsforschung gGmbH	2
	Nolde Erwin and Partner	1
Netherlands	Hague Corporate Affairs BV	3
	Stichting Wageningen Research	2
Norway	Gallis Miljø Og Kommunikasjon - Nabolagshager	1
	Polar Permaculture Solutions	1
Romania	Asociația Mai Bine	1
Slovenia	Arctur Računalniški Inženiring	3
	Društvo Urbani Cebelar	1
Spain	Universitat Autònoma de Barcelona	5
	Universidad de La Laguna	1
	Total participants	52

The work was organized in three rounds. In the first round each working group collaborated independently to gather data, summarize relevant information, and discuss ongoing trends. The second round was represented by a large workshop engaging a wider number of stakeholders (**Table 1**) providing feedbacks and opinions on each of the five areas. The third round consisted in an iterative consultation process within the five working groups with the aim to integrate and review expert inputs. The joint revision enabled the systematization of the process and the harmonization of all provided contents. To follow a food supply chain logic the five groups were then reduced to three: (1) food production, covering agriculture, fisheries, and production systems, (2) food distribution, covering innovative business models for increased resilience and sustainability and evolving technologies, (3) food consumption, covering consumers behavior changes and adaptations and schools and education (EP, 2020) (**Figure 1**).

FOOD TRENDS RELATED TO THE COVID-19 CRISIS

The first wave of the COVID-19 outbreak did not lead to a major disruption of the European food systems, but it shed light on some specific challenges for each segment of the food chain,

revealing footprints of a shift citizens might wish to embrace. The subsequent sections outline and discuss the main observed effects in food production, distribution, and consumption stages.

Food Production

Production suffered from a consistent limitation of transport lines and a generalized closing of borders. Suddenly, during the spring season, workers were unable to reach their farms, making it harder to carry out the harvest, catch and management of seasonal products. Simultaneously, the compulsory social distancing and personal protective equipment hampered the daily work in the fields. Safety measures created difficulties in production at all stages, especially for those informal chains where health and safety conditions were already limited. In these cases, implementing such measures proved challenging and led to either increased likelihood of infection or reduced production.

To buffer the labor shortage burdens, a variety of public and private actors developed apps and online platforms to match farmers' demands of seasonal staff and support mitigating production activities logistical disruptions (Laborde et al., 2020; Mitaritonna and Ragot, 2020). Despite having a consistent success, these services could not fully offset the problem, and food losses remained a major tangible concern (IOM., 2020). Other than the challenges in the fields, the stocking of products which could not reach the market at the pre-COVID19 rate, became a central issue. Only those commercial facilities having extensive capacity and enough flexibility, were able to transform products through canning or freezing techniques, while many others were left with unsold fresh products in the warehouses.

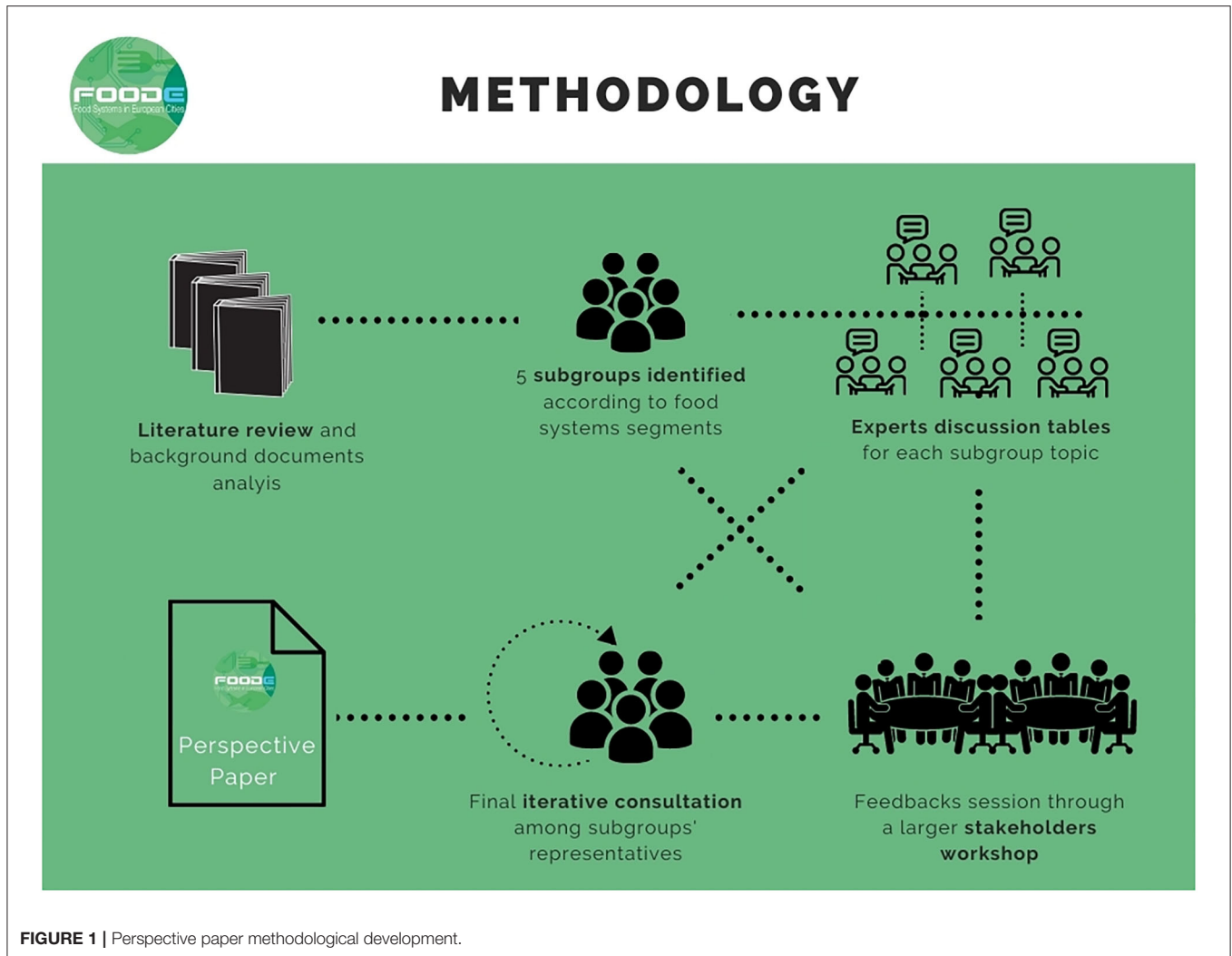
Finally, the shutdown of the *Hotellerie-Restaurant-Café* services, which represent a crucial market for many farmers and small producers, worsened the difficulties, reducing the sales volumes of many.

Food Distribution

The shift toward online shopping and takeaway consumption, both for fresh ingredients and ready to eat meals, led to a structural transformation of small and medium food initiatives, deeply modifying the customer relationship and sales channels. For many CRFS, whose major value proposition consists of the relational connections delivered inside and outside their organizations, the effects of social distancing measures were perceived as more severe than those experienced among more traditional food suppliers (Pulighe and Lupia, 2020). Only, in some cases, both newcomers and experienced online platforms developed communication tools that allowed maintaining such relational dimension.

Workers, but also volunteers, struggled to reach their food initiatives, creating also in this case a labor shortage (especially for food delivery) that ultimately resulted in a consistent gap within the food chain operational structure. Similarly, the logistic disruption led to inputs shortages (OECD, 2020), which made it harder to proceed with the business as usual especially for the initiatives with lower bargaining power (FAO, 2020a).

The shutdown of food and farmers' markets, together with restaurants and school canteens, contributed to the failure of



local offer and alternative food networks. Only consolidated distribution hubs, such as supermarkets and conveniences stores, remained open at an early stage, reducing the range of choices for food actors. In some countries, as in the case of Italy, consumers were encouraged to shop in the nearest store (Gazzetta Ufficiale della Repubblica Italiana., 2020).

Large retailers were less endangered than specialist and niche shops, which were often obliged to rely on local governmental support to overcome structural and technological barriers (FAO, 2020c).

The closure of the Hotellerie-Restaurant-Café sector also had additional implications. The sector usually purchases products with different packaging as compared with home consumers. Thus, part of the packaged products was no longer marketable, leading to increased food waste (Petetin, 2020).

Food Consumption

The consumer trends that have emerged during the COVID-19 pandemic represent a major signal of change. From a household perspective, a typical consumer was motivated to maintain his or her physical and mental health and had more time available,

while being more cost-conscious due to the uncertain economic situation (Accenture, 2020). As a result, consumers often adopted a back-to-basics approach to nutrition, with more home cooking and baking (Bernstein, 2020; Nielsen, 2020; OCU, 2020). Notably, citizens also stockpiled non-perishable goods, such as canned food, tomato sauce, pasta, flour, and yeast (OCU, 2020; Rogers, 2020).

Meanwhile, an increased sensitivity toward food sustainability, healthier diets, and an effort to establish stronger bonds with the origin of food emerged (Cohen, 2020; Rodríguez-Pérez et al., 2020). As an example, higher attention was given to ingredients selection, recipes scouting, and online cooking classes.

A surge in demand for short-supply chains and home delivery options, often supported by digital solutions, was observed in many countries (Hobbs, 2020). Local small-scale suppliers received larger attention by consumers since they were associated with higher safety standards and better food quality (Rizou et al., 2020). In some cases, the consumers' demand on online delivery channels consistently far exceeded the available distribution capacities (Hobbs, 2020; Nielsen, 2020).

With regards to food waste, the preliminary evidence provided by large national surveys (Roberts and Downing, 2020; Waste Watcher, 2020) confirmed a reduction of household food waste thanks to more time for in-home food management and cooking and a better planning for grocery shopping.

Despite observing several positive trends, vulnerable groups faced severe barriers in food consumption during the lockdown. Primarily, the shutdown of school canteens affected food security and habits for entire families. According to the United Nations, World Food Programme (2020), about 320 million children saw their schools temporarily closing due to COVID-19.

Pre-COVID-19 policies in European school canteens enabled to offer high-quality food, with relevant positive effects on pupils' dietary intake (Clinton-McHarg et al., 2018; Micha et al., 2018). Consequently, the lockdown measures likely put poorer children under nutritional stress, since the school meal might represent their only adequate food intake (Dunn et al., 2020). This effect was further aggravated by the difficulties of food banks, which experienced a drop in financial resources and a shortage of volunteers (FEBA, 2020).

Impacts on Food System

Due to the exogenous nature of this shock, the COVID-19 provoked a series of new behavioral shifts. Changes were quite unpredictable, leading to layered environmental, economic, governmental, and social impacts. As analyzed, observed adjustments immediately shaped consumption and production habits leading to new supply chain patterns. Depending on the governmental attitudes and capabilities, some of the rapidly emerging trends along the entire supply chain are probably destined to have a temporary nature. Others are likely to have longer-term implications.

Thanks to specific policy interventions detrimental reactions that have not shown to improve European food systems, should succeed in remaining short-term and limited to the emergency period, while beneficial shifts should be framed to guarantee their long-term viability. The results from such an uncertain and challenging period will depend on the diffused ability to correctly manage these positive and negative impacts cycles as described in **Figure 2**. The extent to which these mutual cycles will be reiterated will determine whether more resilient and sustainable food systems will emerge from the COVID-19 crisis.

Short-Term Impacts

Short-term impacts emerged clearly. For instance, the negative impact of social distancing measures that prevented the *Hotellerie-Restaurant-Café* service from using table service for their customers, has led the increasing home delivery options as a possible solution for restaurants (Laguna et al., 2020). However, this trend is likely to disappear once the emergency period will end. However, the effect might depend on the time extension of these measures, as reduced capacity would not be economically viable for an extended period (Dube et al., 2020).

In general, the relational dimension of CRFS limited by the crisis will likely be re-established or re-designed over time, creating new interactive formats, and making it easier for all

actors to start working back on what CRFS initiatives consider as their core value proposition.

Similarly, the home cooking trends, connecting more deeply consumers and producers, will probably change once workers will start getting back to their regular work shifts and workplaces (Fernández-Aranda et al., 2020). Despite not leading to a long-lasting positive modification of consumers eating habits, the pandemic cooking pattern might influence the food consumption vision for quite some time. Time availability and more simple food planning and management (e.g., in most of the cases all the meals were consumed at home by all the members of the family) represented key drivers in reducing food waste. However, although some of the new skills and habits might remain, the return to the pre-COVID-19 working schedule and lifestyle will probably limit the progresses obtained during the lockdown.

In certain countries, the effects of COVID-19 on household income and food security have been dramatic and were extended to a rather large share of families (Power et al., 2020; The Food Foundation, 2020). This was worsened by the changes in children's consumption patterns whose social programs and school canteens were suspended. Parents with lower awareness of healthy diets and less disposable time for cooking might have offered a less virtuous alternative to school canteens, both by reducing the attention to their children's food care and by offering them more packaged and ready-to-eat products. This phenomenon did not only affect children's diets but might have contributed to higher consumption of foods featuring larger environmental impacts and lower nutritional values.

Similarly, in some cases, new consumption behaviors also produced further unintended environmental consequences, depending on the type and amount of food purchased, as well as the related packaging. The diffusion of food delivery and last-mile emergency logistics might have resulted in increased pollution, even though partially outpaced by lockdown traffic reduction. Additionally all delivered food, required great amounts of packaging materials, whose sustainable alternatives were often too expensive to be adopted by small-scale activities.

As anticipated, according to individual priorities, these immediate changes might be converted into long-term behavioral trends, positively affecting people's daily lives. Somewhat consciously, people changed the perception of the food systems, possibly giving higher importance to local networks and adapting their shopping preferences to a new level of awareness (Béné, 2020). Growing demand for environmentally and socially ethical products has gone hand in hand with higher awareness, and these jointly will boost local food production and consumption (Hobbs, 2020). If such an intention were properly sustained, the diffusion of proximity production and distribution systems such as urban gardening and local scale farming may encourage the implementation of shorter food chains.

Long-Term Impacts

Considering long-term implications, lockdown trends also showed an increase in the online demand for foods and beverages. Once consumers have sunk the learning costs required

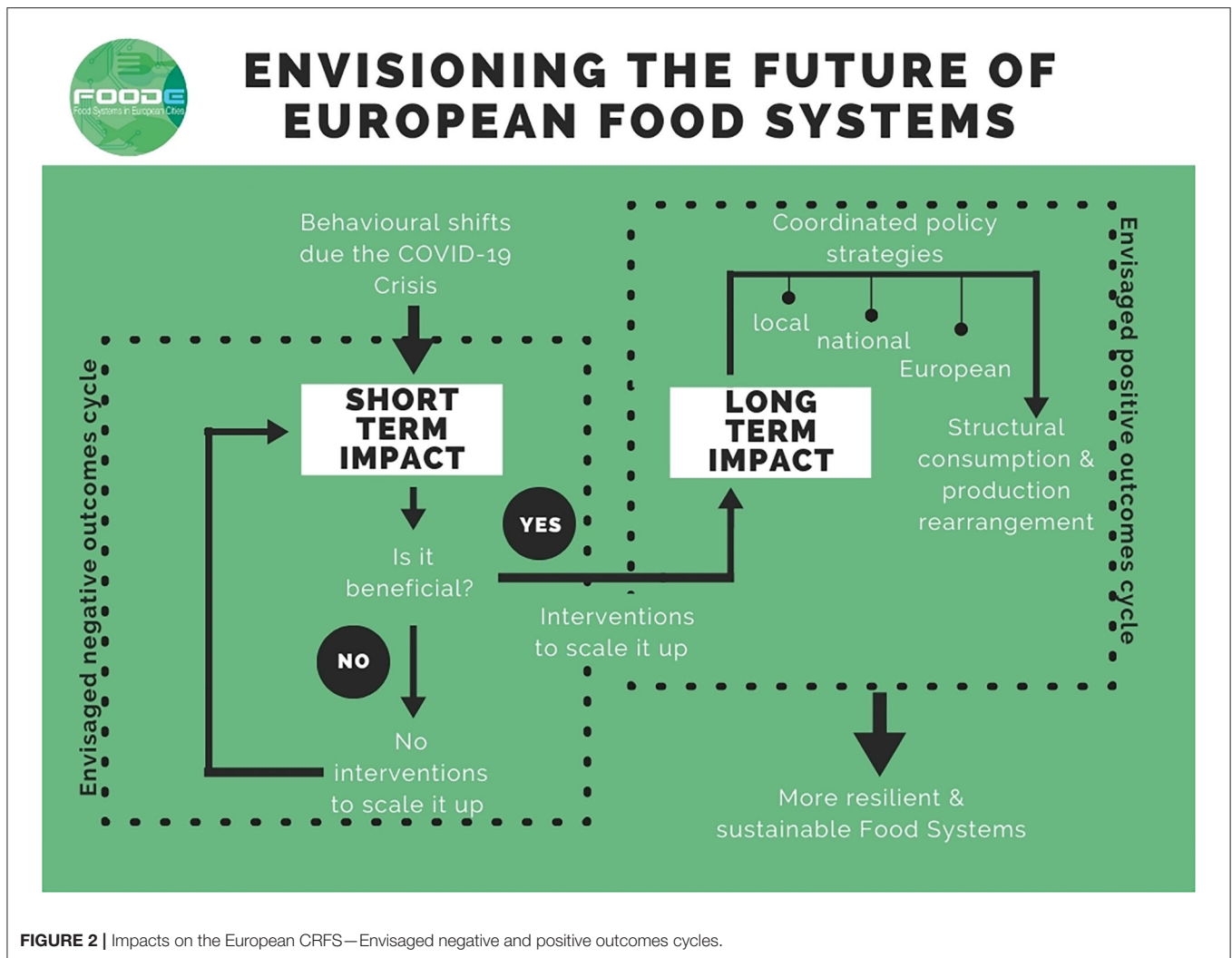


FIGURE 2 | Impacts on the European CRFS—Envisaged negative and positive outcomes cycles.

to adopt these types of food delivery and firms have adapted their spaces and operations to these shifts, changes are likely to persist well beyond the COVID-19, even though to a reduced extent.

If these digital accelerations can be seen as a virtuous innovation phenomenon for the whole sector, such a rapid transition may risk excluding smaller CRFS, ensuring major benefits only for more consolidated structures (Belavina et al., 2017; Arnalte-Mur et al., 2020). Moreover, smallholders may already face larger difficulties in recovering from the economic effects of the crisis, due to their lower business capacity.

The pandemic helped food stakeholders understanding the importance of strategic and local partnerships, both to increase their value and improve their ability to cope with possible future crises. If correctly handled, this might entail a higher number of cooperative initiatives, open innovation ecosystems, and shared networks.

Given the increased time children spent at home and the largest number of meals shared with the family, the lockdown period could have raised parent's awareness on the importance of the daily meal, giving them more time to understand children

food habits, preferences, and food attitudes. Once school catering started to re-open, such dedication might end up in an increased parents' involvement in food education activities and in the design of school food quality, in terms of both food types and producers' selections. Food supply might be rethought, taking advice on the economic impact its management has on local farmers.

POLICY-IMPLICATIONS: TOWARD THE FOOD SYSTEM WE WANT AND NEED

The COVID-19 outbreak and the related responses allow to understand and evaluate the kind of possible and, indeed, desirable reforms, from a systemic point of view. In many aspects, bottom-up actions by producers and participatory consumer proposals prove to be in line with the emerging European policy agenda (EC, 2020), which indicates the commitment to address food systems imbalances.

To reinforce this perspective and improve resilience in food supply chains local, national, and European governments should consider to:

- Encourage a diversification in food provision, including local food production, as a mean for a more resilient supply chain, promoting more substantial and innovative small-scale production systems, whose social contribution has been highlighted by the pandemic. The strategy might include actions aimed at promoting the existence of local CRFS, favoring investments into marketing and information and communication technology use for those activities that are lagging through. Examples include *ad-hoc* training, call for actions, and public competition opportunities. In the long run, this could help accelerate CRFS and improve competitiveness with respect to more consolidated channels.
- Promote open discussion tables and forums, partnerships, and reciprocal learning to ensure cross-pollination and best practices exchange among CRFS. Besides facilitating reciprocal supports, this will help increasing the bargaining power of CRFS initiatives, making them more equipped against future time of crisis.
- Address schools as a central re-starting point. Involving teachers, families, and students in the definition of sustainable diet patterns, promoting food educational campaigns, and responsible shopping choices can help to transform cheerful consumer's behavioral change into systemic and long-lasting habits. To this scope, the provision of food in schools should put those principles in effect and should be combined with educational approaches on the community and territorial services. Similarly, open-air educational projects as urban or school vegetable gardens (Pennisi et al., 2020) can represent promising alternatives.
- Ensure that the development of policy tools include evaluations on different sustainability dimensions of the food chain. Given the evidence of the multifaceted benefits delivered by food initiatives, it is crucial to make sure all food values and attributes are considered when making decisions.

CONCLUSIONS

The first wave of the COVID-19 outbreak emphasized the need to establish new governance mechanisms engaging public authorities, citizens, small and medium enterprises, and non-profit organizations in the conceptualization and design of new models for sustainable CRFS that deliver environmental, societal, and economic benefits. The second wave of the outbreak and the related lockdown measures will offer the chance to assess whether previous adaptations resurfaced (in case of short-term) or continued (in case of long-term) and whether policies put in place to scale up beneficial transitions were successful.

Further research commitment and stakeholders' involvement should aim at unveiling the most urgent questions, offering reasonable ground to drive the envisaged food planning.

How new systemic organizational structure and policy frameworks transforming the positive shifts into more permanent and sustainable behaviors can be created? Which type of measurements are needed to support a more holistic and integrated view on food production, distribution, and consumption to ensure equal importance at economic, societal, and environmental needs? What should be the role of government in this transition? The ability to make city/regions more resilient will crucially depend on policy stakeholders' commitment to prioritize these challenges in the local and global sustainability agenda.

DATA AVAILABILITY STATEMENT

The original contributions generated for the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

MV, GB, SB, FC, AM, FO, JP, MP, KS, and FD equally contributed to the concept of the study, its framework, the coordination and activities of subgroups, and writing of the manuscript. SA, A-MA, TB, IB, ACo, ACr, ACu, RF-K, AG, AL, PM, EN, JP-F, GP, BP, LR-D, IR, YR, VS-G, AS, SS, MdS, ST, PT, GT, BV, and GV equally contributed to the activities of subgroups and the review of the manuscript. All authors contributed to the article and approved the submitted version.

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