

Food System and Circular Economy

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Circular economy can play an active role in solving the unsustainability of the food production system, contributing to the creation of shorter and more resilient supply chains. Some solutions include policy regulations driving consumption towards more sustainable choices and the reduction of food waste: "best before" labels might be scrapped, food sharing initiatives incentivized and organic waste regarded as a high-value raw-material. Bio-refineries can be the catalyst of a green transition, where food waste can generate biofuels, bio-chemicals, plastics, textiles, medicines and much more. Circular practices seem to hold the potential for a win-win solution, simultaneously enhancing sustainability throughout the entire value chain (from production to consumption and post-consumption) and improving its resilience through the introduction of localized supply chains, making the food system less dependent on international trade. The European Union is working towards this direction (as its policy and social media agenda exposes) and will hopefully accelerate the transition to meet its Green New Deal expectations.

Food system

circular economy

Green new deal

resilience

bioeconomy

COVID-19

1. Introduction

Having shown the increased importance placed on the food system in the EU's social media agenda, as well as the growing concerns around the sustainability and resilience of the food system, we shall now discuss how this topic has been integrated into the scholarly and practitioner debate over the circular economy. By extending our analysis beyond social media, we hope to achieve a more finely grained assessment of the nexus between the COVID-19 pandemic and the food system. At the same time, by assessing the link between the food system and the circular economy, we seek to propose some actionable—albeit preliminary—solutions.

As the German philosopher Feuerbach said, "We are what we eat." Perhaps this saying might even extend to COVID-19, as many have pointed out that our global food system (and economy) greatly increases our risk of experiencing a pandemic. In what follows, we will present the results of our comprehensive systematic literature review (drawing on Tranfield et al.'s [\[1\]](#) approach) to assess causes, consequences and circular solutions pertaining to the link between the food system and the COVID-19 pandemic.

Systematic reviews differ from traditional narrative reviews in their replicable, scientific and transparent process, aimed at minimizing bias through exhaustive literature searches of published and unpublished studies and providing an audit trail of reviewers' decisions, procedures and conclusions. Our review began with the definition of our goals: to find and integrate the most recent and relevant literature on the relationship between COVID-19, the food system and the circular economy. Subsequently, we analyzed and selected the most recent available literature on the topic, encompassing both scientific papers and gray literature, such as reports and plans from policymakers and international organizations. No subjective distinction was made between scientific papers and other documents, provided that they respected the rules described hereinafter.

The research was mainly conducted through the SCOPUS and Google Scholar public search engines. Forty-three references were selected and shortlisted on the basis of publication date (published in 2015 or later) and correspondence with specific keywords (i.e., "COVID-19," "food," "circular economy"), with the aim of generating collective insights through a theoretical synthesis of fields and subfields. The search was first conducted with the use of the "AND" Boolean operator, then expanded using the "OR" Boolean operator.

The data extraction process focused on synthesizing key information, based on the abovementioned goal of offering an up-to-date review of the current global food system and selecting the most recent and relevant solutions to enhance its sustainability and circularity.

2. Causes

The World Food Programme [\[2\]](#) recently confirmed that the devastating economic impacts of COVID-19 reinforce the need for investments to prevent future outbreaks of infectious diseases. In so doing, it emphasized the interconnections

between people, animals, plants and their shared environment, as well as the need for stable and sustainable architecture to make economic growth feasible, while respecting the surrounding environment ^{[3][4]}.

There are two primary issues with the current industrial food system. First, intensive livestock production amplifies the risk of disease, since it involves the confinement of large numbers of animals in small spaces, narrowing genetic diversity and fast animal turnover. Second, habitat destruction, unchecked urbanization and land grabbing lead to amplified human–wildlife interaction, which eventually leads to zoonotic spillover ^[5]. It is therefore clear that pandemics, like the COVID-19 one, are not random events, but the logical result of our current food system and, to a wider scale, our economic model.

Another catalyst of pandemics is urbanization, as indicated above. Thirty-five years ago, more than 60% of the global population lived in rural areas; this figure has now dropped to 46%, while the urban population is set to reach 68% by 2050 ^[6]. Cities are already consuming 75% of the world's natural resources and 80% of the global energy supply ^[7]. Urbanization impacts food consumption patterns by increasing demand for processed foods, animal-based foods, fruits and vegetables. Higher urban wages also tend to increase the opportunity costs of preparing food and favor food products that require a large amount of labor, such as fast food, store-bought convenience food and food that is prepared and sold by street vendors ^[6].

China, the alleged epicenter of this and several previous disease outbreaks, has one of the highest urbanization rates in the world, having doubled its level over the past 40 years (from 22.7% to 54.4%) ^[8]. This urbanization has closely paralleled rising animal protein consumption (due to higher wages), increased land conversion and livestock production, higher zoonotic risk (due to closer contact with wild animals) and a more rapid spread of pathogens through the globalized channels of world economy.

3. Consequences

As mentioned above, when lockdown measures were first introduced, stockpiling behaviors prevailed, while governments reassured their residents about the resilience of food supply chains and business continuity in the agri-food sectors. In fact, there are diverging opinions on the actual solidity of the current food system: for some, empty grocery shelves are not just the result of the human tendency to hoard in times of danger, but also an important reminder that our food supply chains are easily disrupted and that many of our food systems lack resiliency and redundancy ^[9]. Many global regions rely on highly centralized food systems, at the expense of strong local and regional systems that could provide a better buffering capacity when needed ^[9]. However, other scholars have countered that if the number of importing countries has risen for most crops, so has the number of exports in many countries. This has made trade more resilient to swings in supply and demand. Supply lines may empty, but alternatives can be found. For instance, when Indian traders stopped signing new export contracts in April, Carrefour, a French supermarket group, found new rice suppliers in Pakistan and Vietnam and opened a beef import route from Romania ^[10]. Nonetheless, even the most optimist commentators acknowledge that the current food system has bottlenecks (as does every global supply chain) and that good harvests in 2019 were able to account for some of the resilience of the food supply chain in the face of COVID-19 ^[10].

Over the long term, consumer food habits might change along three main directions. First, the rapid growth in online grocery delivery services might continue. While many big companies were already implementing this service pre-pandemic, their systems struggled to cope with the sudden expansion in online orders during the lockdown, leaving long time lags before delivery slots were available ^[11]. The same could be said about food delivery systems, which mainly operate via mobile phone apps: since the pandemic hit, such apps have been increasingly used by restaurants, as in-person dining has been severely restricted in many countries. Therefore, to some extent, the crisis has dematerialized and “desocialized” the food sector, speeding up consumers’ adoption of online services. The duration and degree of this trend is still uncertain, but the effect could be noticeable (depending on cultural factors) ^[11].

Second, consumers might demonstrate a revived interest in “local” food supply chains. In fact, interest in “local foods” was established prior to the pandemic, as people understood this food to offer economic, social, environmental and health benefits ^[12]. Local food is usually perceived as fresher and—particularly in the present context—more convenient, as it can be easily bought in smaller stores, allowing consumers to avoid long queues outside supermarkets. During the pandemic, consumers also expressed a desire to support the economic recovery of local small and medium enterprises (SMEs). Again, how rooted and long-lasting this effect will be is still unknown, also considering that local food chains are less cost efficient than global ones ^[11].

Third, the pandemic has forced people to significantly change their daily lifestyles, and these changes might persist over the long term. Staying home all day in what was previously a rushed, globalized society has tested people’s resilience and led them to question their priorities. People have been forced to slow down their rhythms and rediscover new hobbies and

passions (e.g., cooking, instead of buying processed food). It seems that waste recycling has benefitted from these changes ^[13], alongside a general decrease in waste production (due also to the economic slowdown) ^[14].

4. Circular Solutions

As discussed above, the pandemic has put the current food system—focused on a linear and globalized production and consumption model—under high stress. Tjisse Stelpstra of the European Committee of the Regions has said that the devastating situation created by COVID-19 must bring all policymakers together and be the wake-up call for a new economic model that places social wellbeing and environmental sustainability at the core of the EU's economic recovery ^[14]. The circular economy could be a pivotal element of this recovery plan ^[15].

According to an EU advisory scientific study ^[16], achieving a sustainable food system means “*increasing or maintaining agricultural yields and efficiency while decreasing the environmental burden on biodiversity, soils, water and air; reducing food loss and waste; and stimulating dietary changes towards healthier and less resource-intensive diets*”. Jurgilevich et al. ^[17] summarized that the EU Commission have identified three main stages of the food system with reference to the circular economy: production, consumption and waste.

As for the first stage, the “localization” of the food system might represent a more resilient and sustainable solution: localized food systems reduce waste and favor nutrients ^[17]. Combining local and seasonal elements in short supply chains reduces storage and transportation, provides a better supply–demand balance, creates more transparency and tracking and contributes to waste reduction. In addition, consumers seem to place higher value on food purchased in local markets.

Another known issue regarding food production is packaging. Our current food system is based on single-use packaging, although recent trends have shown improvements in both the quantity and the quality of this packaging. Still, many recycling processes are insufficient, as is the case for light PET bottles and multilayer plastic (as opposed to mono-material plastic) ^[18]. In this vein, policymakers should continue to incentivize the reduced use of plastic, in favor of more durable or recyclable materials, such as paper, aluminum, steel and glass, even though these materials do not altogether prevent the accumulation of unwanted metal ions through repeated recycling ^[18]. For this reason, research and development (R&D) in materials science and engineering must be a priority.

As for consumption, policymakers should focus on making sustainable choices the easiest options and transferring costs to unsustainable food choices. One example of a sustainable choice is the avoidance and/or reduction of meat consumption. Through the lens of the circular economy, reduced meat consumption increases the efficiency of material flows within the food system by reducing the amount of energy, land and water used per calorie of food produced ^[19]. Furthermore, policymakers should invest more in food and nutrition education, in order to raise awareness not only amongst the younger generations, but also amongst the older ones, by disseminating information campaigns through both traditional and innovative media channels.

Besides these non-binding actions, more incisive ones (i.e., fiscal and regulatory measures) could force producers and consumers to improve their practices in support of greater sustainability. Policymakers might introduce bans, impose specific production and sourcing requirements, influence demand via public procurement and impose taxes or fees. These fiscal measures might encourage producers, suppliers and retailers to make sustainable choices and/or directly add costs to unhealthy or non-sustainable food for customers, in the form of a Pigouvian tax. Indeed, the SAPEA report ^[20] states that “*examples of relatively imposing instruments that have become increasingly popular include the use of fiscal instruments (e.g., sugar and fat taxes), standard-setting (e.g., on the maximum amount of salt allowed in products), and outright bans (e.g., on trans fats)*” (p. 98).

The final stage of the food system, relating to waste, is perhaps where the circular economy can have the largest and most immediate impact. Indeed, as stated by the European Union ^[16], “*food waste takes place all along the value chain: during production and distribution, in shops, restaurants, catering facilities, and at home. This makes it particularly hard to quantify*” [par 5.2]. Within the larger food system, production accounts for approximately 24–30% of total waste, while the post-harvest stage accounts for 20% and consumption accounts for 30–35%. Cereals account for 53% of the total waste; surprisingly, meat accounts for only 7%—far less than the impact of meat production on the environment ^[21]. According to Stuart, 30–50% of material intended for consumption (including animal material that is fed to animals or discarded as a byproduct) is wasted in North America and the EU at different stages of the food system ^[22]. According to Bajzelj ^[23], the reduction of food waste is essential for achieving a resilient food system.

It is important to distinguish between edible and non-edible food waste, as only the latter is actually defined as waste. Edible food is potentially ready to be consumed, either by its owner or by another person. To reduce food waste, food labelling

policies should be changed and harmonized, as “best before” labels are likely to generate unnecessary waste due to consumer misperceptions of food quality. Indeed, according to Borrello et al. [24], *“Even when consumers try to follow indications of producers, 20% of food is thrown away because of the confusion generated by the dates on product labelling”*. [p. 2]. Policymakers should act to prevent these losses by imposing strict limitations on “best before” labels. In this vein, the EU Commission announced that it *“will examine ways of promoting a better use and understanding of date marking by the various actors of the food chain. The EU [16] has also adopted measures to prevent edible fish being thrown back into the sea from fishing vessels”* [par. 5.2].

Some authors warn that food sharing initiatives might facilitate upstream food waste, as such initiatives allow consumers to get rid of their waste without preventing its generation in the first place. Thus, they act as *“short-term sticking plasters”* that obscure entrenched issues of food poverty. Further research is needed to verify the real impact of these actions, which are very diverse and fragmented in their nature [20].

As regards non-edible food waste, this should remain in the system chain and be regarded as a precious resource—not only for the production of more food, but also for the production of new energy (which can be used as fuel in countries seeking to reduce their environmental footprint) and much more. Some policymakers promote “backyard composting” [25], or self-composting at home. More actions and incentives may be needed to promote this activity, considering that it also facilitates the possibility of growing fruits, vegetables and other plants at home. This would enhance household engagement with the production of clean local food and reduce demand for industrial agricultural products, thereby limiting the use of water and chemical fertilizers.

That being said, food waste can take on many other forms, thanks to “green chemistry” solutions within bio-refineries, which can generate biofuels, bio-chemicals, plastics, textiles, medicines and more from organic waste [27]. While a circular food system should primarily aim at transforming food waste into new food, where this is not possible, the system should reinvest these resources into new energy or material forms, which may be equally socio-economically beneficial.

The present analysis clearly shows that a circular food system should not be entirely self-contained, but it should incorporate a wider reconsideration of the current fossil-fueled, linear and unsustainable economic model towards one that is green, resilient and sustainable model—that is, a bioeconomy powered by circularity. Policymakers should therefore engage more with this transition, with the aim of creating a fertile ground for a more sustainable food system (and society) by:

- Reshaping food production via localized supply chains and improved packaging;
- Guiding consumption towards sustainable choices, through a mixture of tax and education policies;
- Focusing and investing in the conversion of non-edible food waste into energy and materials, via green chemistry and bio-refineries.

References

1. Tranfield, D.; Denyer, D.; Smart, P. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *Br. J. Manag.* 2003, 14, 207–222, doi:10.1111/1467-8551.00375.
2. Joint Statement on COVID-19 Impacts on Food Security and Nutrition|World Food Programme. Available online: <https://www.wfp.org/news/joint-statement-covid-19-impacts-food-security-and-nutrition> (accessed on 3 September 2020).
3. D’Adamo, I.; Falcone, P.M.; Martin, M.; Rosa, P. A Sustainable Revolution: Let’s Go Sustainable to Get Our Globe Cleaner. *Sustainability* 2020, 12, 4387, doi:10.3390/su12114387.
4. D’Adamo, I.; Rosa, P. How Do You See Infrastructure? Green Energy to Provide Economic Growth after COVID-19. *Sustainability* 2020, 12, 4738, doi:10.3390/su12114738.
5. FAO. COVID-19 and the Crisis in food Systems: Symptoms, Causes, and Potential Solutions. Available online: <http://www.fao.org/agroecology/database/detail/en/c/1271231/> (accessed on 11 September 2020).
6. Food and Agriculture Organization of the United Nations (FAO). The Future of Food and Agriculture. Available online: <http://www.fao.org/publications/fofa/en/> (accessed on 11 September 2020).

7. Food, Cities and the Circular Economy. Available online: <https://www.ellenmacarthurfoundation.org/explore/food-cities-the-circular-economy> (accessed on 3 September 2020).
8. Wu, T.; Perrings, C.; Kinzig, A.; Collins, J.P.; Minter, B.A.; Daszak, P. Economic Growth, Urbanization, Globalization, and the Risks of Emerging Infectious Diseases in China: A Review. *Ambio* 2017, 46, 18–29, doi:10.1007/s13280-016-0809-2.
9. Five COVID-19 Reflections from a Food System Perspective—And How We Could Take Action—The Rockefeller Foundation. Available online: <https://www.rockefellerfoundation.org/blog/five-covid-19-reflections-from-a-food-system-perspective-and-how-we-could-take-action/> (accessed on 3 September 2020).
10. The Economist. A Dangerous Gap: The Markets v the Real Economy. 9th May 2020. Available online: <https://www.economist.com/weeklyedition/2020-05-09> (accessed on 3 September 2020).
11. Hobbs, J.E. Food Supply Chains during the COVID-19 Pandemic. *Can. J. Agric. Econ. Rev. Can. D'agroéconomie* 2020, 68, 171–176, doi:10.1111/cjag.12237.
12. Cranfield, J.; Henson, S.; Blandon, J. The Effect of Attitudinal and Sociodemographic Factors on the Likelihood of Buying Locally Produced Food. *Agribusiness* 2012, 28, 205–221, doi:10.1002/agr.21291.
13. Rifiuti a Roma, Meno 12% a Marzo Aumenta la Differenziata LA GUERRA AL COVID-19—Corriere.it. Available online: https://roma.corriere.it/notizie/cronaca/20_aprile_06/rifiuti-meno-12percento-marzoaumenta-differenziata-a281dccc-7760-11ea-9a9a-6cb2a51f0129.shtml (accessed on 3 September 2020).
14. Coronavirus in Lombardia, Meno 27,5% di Rifiuti a Milano. Da Oggi Nuovo Ciclo di Sanificazione—La Repubblica. Available online: https://milano.repubblica.it/cronaca/2020/04/14/news/coronavirus_in_lombardia_meno_27_5_di_rifiuti_a_milano_da_oggi_nuovo_ciclo_253954812/ (accessed on 3 September 2020).
15. D'Adamo, I. Adopting a Circular Economy: Current Practices and Future Perspectives. *Soc. Sci.* 2019, 8, 328, doi:10.3390/socsci8120328.
16. EU Commission. C. No. 98, 11th M. 2020, Para. 5. 2. EUR-Lex-52020DC0098-EN-EUR-Lex. Available online: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:98:FIN> (accessed on 3 September 2020).
17. Jurgilevich, A.; Birge, T.; Kentala-Lehtonen, J.; Korhonen-Kurki, K.; Pietikäinen, J.; Saikku, L.; Schösler, H. Transition towards Circular Economy in the Food System. *Sustainability* 2016, 8, 69, doi:10.3390/su8010069.
18. Geueke, B.; Groh, K.; Muncke, J. Food Packaging in the Circular Economy: Overview of Chemical Safety Aspects for Commonly Used Materials. *J. Clean. Prod.* 2018, 193, 491–505, doi:10.1016/j.jclepro.2018.05.005.
19. Mylan, J.; Holmes, H.; Paddock, J. Re-Introducing Consumption to the 'Circular Economy': A Sociotechnical Analysis of Domestic Food Provisioning. *Sustainability* 2016, 8, 794, doi:10.3390/su8080794.
20. SAPEA. A Sustainable Food System for the European Union. Available online: <https://www.sapea.info/topics/sustainable-food/> (accessed on 3 September 2020).
21. Vilariño, M.V.; Franco, C.; Quarrington, C. Food Loss and Waste Reduction as an Integral Part of a Circular Economy. *Front. Environ. Sci.* 2017, 5, 21, doi:10.3389/fenvs.2017.00021.
22. Stuart, T. *Waste: Uncovering the Global Food Scandal*; WW Norton & Company: New York, NY, USA, 2009.
23. Bajželj, B.; Quested, T.E.; Rööß, E.; Swannell, R.P.J. The Role of Reducing Food Waste for Resilient Food Systems. *Ecosyst. Serv.* 2020, 45, 101140, doi:10.1016/j.ecoser.2020.101140.
24. Borrello, M.; Caracciolo, F.; Lombardi, A.; Pascucci, S.; Cembalo, L. Consumers' Perspective on Circular Economy Strategy for Reducing Food Waste. *Sustainability* 2017, 9, 141, doi:10.3390/su9010141.
25. Illmer, P. Backyard Composting: General Considerations and a Case Study. In *Microbiology of Composting*; Springer: Berlin/Heidelberg, Germany, 2002; pp. 133–142, doi:10.1007/978-3-662-08724-4_11.

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