International Journal of Food Studies | IJFS July 2022 | Volume 11 | pages SI129–SI137

SMARTCHAIN
Towards Innovation-Driven and Smart Solutions in Short Food Supply Chains

F. Javier Casado Hebrard[a], Susanne Braun[a], and Dimitrios Argyropoulos[b*]

[a] University of Hohenheim, Hohenheim Research Center for Bioeconomy, Wollgrasweg 43, 70599, Stuttgart, Germany
[b] University College Dublin, School of Biosystems and Food Engineering, Belfield, Dublin 4, Ireland
*Corresponding author
dimitrios.argyropoulos@ucd.ie

Received: 28 February 2021; Published online: 28 July 2022

Abstract

In recent times, Short Food Supply Chains (SFSCs), i.e., supply chains in which the number of intermediaries between farmer and consumer are minimal or ideally nil, and local markets have flourished in Europe, both in rural and urban areas. SMARTCHAIN is a 3-year Horizon 2020 multi-actor project of 43 partners from 11 European countries, including key stakeholders from the short food supply chain domain – a kaleidoscope of 'actors' where science meets a wide range of non-technical disciplines and stakeholders across the agri-food value chain. Its central objective is to develop a portfolio of technological, organisational, social, and digital innovations, which will be validated in a Living Lab approach (18 pan-European use cases on short food supply chains) ensuring powerful co-creation and testing. SMARTCHAIN will develop 9 national Innovation Hubs and the SMARTCHAIN Innovation Platform, a digital portal for building a stakeholder community, and facilitating engagement, communication, and knowledge exchange across stakeholders. This special issue focuses on the most recent developments with respect to innovation in short food supply chains and publishes original research articles in this field.

Keywords: Short food supply chains; Food system; Innovation; Smart solutions; Sustainability

1 Introduction

In recent times, Short Food Supply Chains (SFSCs) and local food markets, have flourished in Europe, both in rural and urban areas. The EU's rural development regulation (1305/2013) defines a 'short supply chain' as a supply chain involving a limited number of economic operators, committed to cooperation, local economic development, and close geographical and social relations between food producers, processors, and consumers. These represent an alternative to conventional longer food chains. Such food systems have the potential to respond to several needs and opportunities of farmers, food producers and consumers. The development of (different types of) SFSCs is one of the approaches of the Common Agricultural Policy, to increase resilience and promote a more favourable framework for sustainable, healthier, local, and ethically produced food. The increasing attention being paid to SFSCs can be seen in the recent scientific literature (Benedek et al., 2020; Chiffoleau & Dourian, 2020; Collison et al., 2019; de Souza, 2020; Majewski et al., 2020; Malak-Rawlikowska et al., 2019; Moruzzo et al.,

 10.7455/ijfs/11.SI.2022.a1

2020; Pato, 2020; Vitterso et al., 2019). A work published by Bakalis et al. (2020) reported that the effective implementation of SFSCs could offer an additional mechanism to cope with the issue of food resilience. In addition, given the extreme uncertainty around the duration and intensity of the current global crisis, it is essential to strengthen research activities to provide technical and non-technical solutions aimed to improve collaboration in SFSCs and local food production (Cappelli & Cini, 2020).

SMARTCHAIN (https://www.smartchain-h2020.eu/) aspires to foster collaboration amongst all stakeholders involved in the food system, strengthening the transition of SFSCs in the EU from a niche to a larger market share. To achieve this, it takes a full-chain system-based approach, from producer to consumer and beyond. SMARTCHAIN builds on state-of-the-art technologies and systems and develops a blueprint for the implementation of SFSC-related innovations. SMARTCHAIN connects researchers with knowledgeable stakeholders about the short food supply chain domain. This enables a productive interaction between deductive, theory-driven inquiries with empirically rich case studies, i.e., various SFSC models of evolving processes of innovation in a living lab approach. SMARTCHAIN focuses on different European regions to create favourable overall conditions for cooperation, co-creation, and innovation along the agri-food chain. SMARTCHAIN uses cross-case analyses to generate insights into how innovation functions in short food supply chains. SMARTCHAIN builds a fertile ecosystem of scientists, entrepreneurs, policymakers, farmers, food entrepreneurs, associations, and knowledge transfer agencies, open to multiple pathways of innovation, sustainable growth and better performing agri-food value chains.

2 Concept and Approach

SMARTCHAIN is a 3-year multi-actor project of 43 partners from 11 European countries (Fig. 1), including key stakeholders from the short food supply chain domain – a kaleidoscope of 'actors' where science and technology meets a wide range of non-technical disciplines and stakeholders across the value agri-food value chain. It addresses the citizen-technology-environment economics nexus, delivering truly integrated solutions for this complex challenge, and mobilises a multi-disciplinary consortium with the necessary competences, skills, and reach from the fields of science, technology, industry, business, civil society, education, and policy. The consortium includes farmers, agri-food businesses (large, SME, start-up), universities, technology centres, representative groups and not-for-profit organisations spanning the skill sets and resources needed, from research and innovation to implementation in commercial situations. It is a truly multi-disciplinary and multi-actor consortium, with each member contributing to a holistic approach to addressing this multi-faceted challenge.

SMARTCHAIN also recognises the pivotal role of the consumer in 'driving' the market for food in consort with lifestyle and market dynamics. This is achieved through a better understanding of consumer behaviour, lifestyle, and health implications; and how these influence consumption patterns. Consequently, the project addresses the multi-faceted consumer-market dynamics, including socioeconomics, environment, e-commerce, policy, and awareness. A comparative assessment of the 18 SFSC use cases is performed to identify key characteristics of different stakeholders, with a particular focus on farmers and their relationship with consumers. SMARTCHAIN explores the policies and regulatory requirements also considering different national contexts, highlighting regulatory barriers that currently hinder the scaling up of SFSCs.

At its core, SMARTCHAIN is formed by 18 SFSC use cases that demonstrate the business of innovation for several impactful application areas at each stage of the agri-food value chain. The 18 use cases of widespread SFSCs with remarkable social, economic, and ecological impacts on rural, peri-urban and urban communities are evaluated in terms of innovation potential, consumer perspective towards SFSCs, business opportunities in the sector and overall sustainability (environmental, economic and social). The SMARTCHAIN concept and

Table 1: Overview of the actual short food supply chains, directly involved in the project

Short food supply chains	**Type**	**Country**
Netzwerk Solidarische Landwirtschaft (SLW) www.solidarische-landwirtschaft.org	Partnership	Germany (DE)
Einkaufen auf dem Bauernhof (CALS) www.einkaufen-auf-dem-bauernhof.com	Individual & collective direct sales	Germany (DE)
Alce Nero (ALN) www.alcenero.com/en	Collective direct sales	Italy (IT)
Arvaia (ARV) www.arvaia.it	Partnership	Italy (IT)
Natuurlijk Vleespakket BV (NV) https://vleeschenco.nl/	Individual direct sales	Netherlands (NL)
Local2Local (AMPED) www.local2local.nl	Individual & collective direct sales	Netherlands (NL)
Association Gersoise (CTCPA) http://www.foie-gras-gers.com/	Partnership	France (FR)
Couleurs Paysannes (CP) www.couleurs-paysannes.fr	Individual & collective direct sales	France (FR)
Allotropon SYN. PE. (ALT) www.allotropon.gr	Partnership	Greece (EL)
Gaia cooperative (GAIA) www.facebook.com/gaiashops	Collective direct sales	Greece (EL)
Foodhub.hu Non-profit Ltd (FH) http://foodhub.hu/	Individual direct sales	Hungary (HU)
Thermal Valley of Zala (TVZ) www.zalatermalvolgye.hu	Collective direct sales	Hungary (HU)
POLO Čačak (PDC) www.polo-cacak.com	Individual direct sales	Serbia (RS)
Udruženje kompanija (AFV) http://preradjivacivocaipovrca.com	Collective direct sales	Serbia (RS)
La Trufa de Alava S. Coop (TRA) www.latrufadealava.com	Collective direct sales	Spain (ES)
Fundacion Lantegi Batuak (FLB) www.lantegi.com	Individual & collective direct sales	Spain (ES)
Biofruits SA (BIO) www.biofruits.ch	Collective direct sales	Switzerland (CH)
Chèvrement bon (CHE) www.fromagebesson.ch	Individual direct sales	Switzerland (CH)

Figure 1: SMARTCHAIN Consortium: 43 partners across 11 European countries including 18 Short Food Supply Chains, 10 Research Institutes, 6 Technology Transfer Centres, 9 Non-profit Organizations.

approach is schematically presented in Fig. 2. SFSCs are varied in nature and practice throughout Europe. The functioning of SFSCs is dependent upon different territorial conditions such as culture, climate, resources, governing structures, available infrastructure, market access and market conditions. SMARTCHAIN has selected an illustrative database of existing SFSC models in 9 European countries (Table 1). The aim is to generate more precise, quantitative and qualitative data regarding the effect of SFSCs for a determined area and to capture the degree of geographical diversity across Europe.

The analysis takes place at a national level, in 9 Innovation and Collaboration Hubs established in 9 participating countries, i.e., France, Germany, Greece, Hungary, Italy, Netherlands, Serbia, Spain and Switzerland (Fig. 3). Each hub consists of the national actors, the use cases – actual SFSC entrepreneurs, farmers and the other key stakeholders involved in SFSCs. The hubs communicate with the National Rural Networks (NRNs) and promote synergies with regional/national EIP-AGRI Operational Groups (OGs).

In line with today's 'Digital Era', SMARTCHAIN develops the SMARTCHAIN Innovation Platform (https://www.smartchain-platform.eu/), as a major digital channel for building a stakeholder community, and facilitating engagement, communication, knowledge exchange and dissemination across stakeholders (farmers, retailers, processors, consumers, policy, regulators, NGOs. The

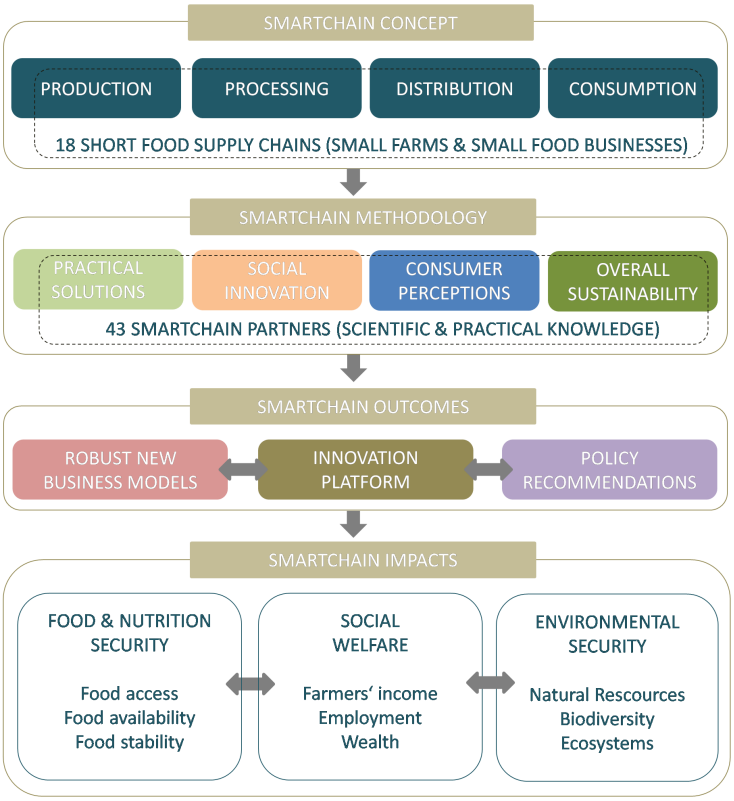

Figure 2: Overall concept, methodology, outcomes and expected impacts of SMARTCHAIN

SMARTCHAIN Innovation Platform – which provides a virtual hub for operational, dissemination and networking purposes – is a key pipeline for awareness-raising and for supporting behavioural change amongst all actors. It provides all stakeholders with the facility to report their experiences of SFSCs, providing useful 'crowd sourced' data and enhancing overall awareness of the extent of the challenge. Furthermore, the SMARTCHAIN Innovation Platform represents an integrated knowledge platform for cooperation, co-creation, and innovation by digitally enabling the capacity building and engagement of relevant stakeholders along the agri-food chain.

3 Methodology and Work Plan

SMARTCHAIN develops a conceptual and operational framework for the comparative analysis of the 18 SFSC use cases. This central strategic approach involves farmers, consumers, researchers, technology providers, policy, and the agri-food sector in evidence-based decision-making processes within a multi-actor environment (Fig. 4). In evaluation of the use cases, SMARTCHAIN's co-creation methodology contains five phases:

- use of multi-actor workshops to refine results towards the needs of end-users under regional conditions,
- a multi-perspective analysis of SFSCs in terms of technological, non-technological innovation potential, social innovation, digital innovation, consumer perceptions, life cy-

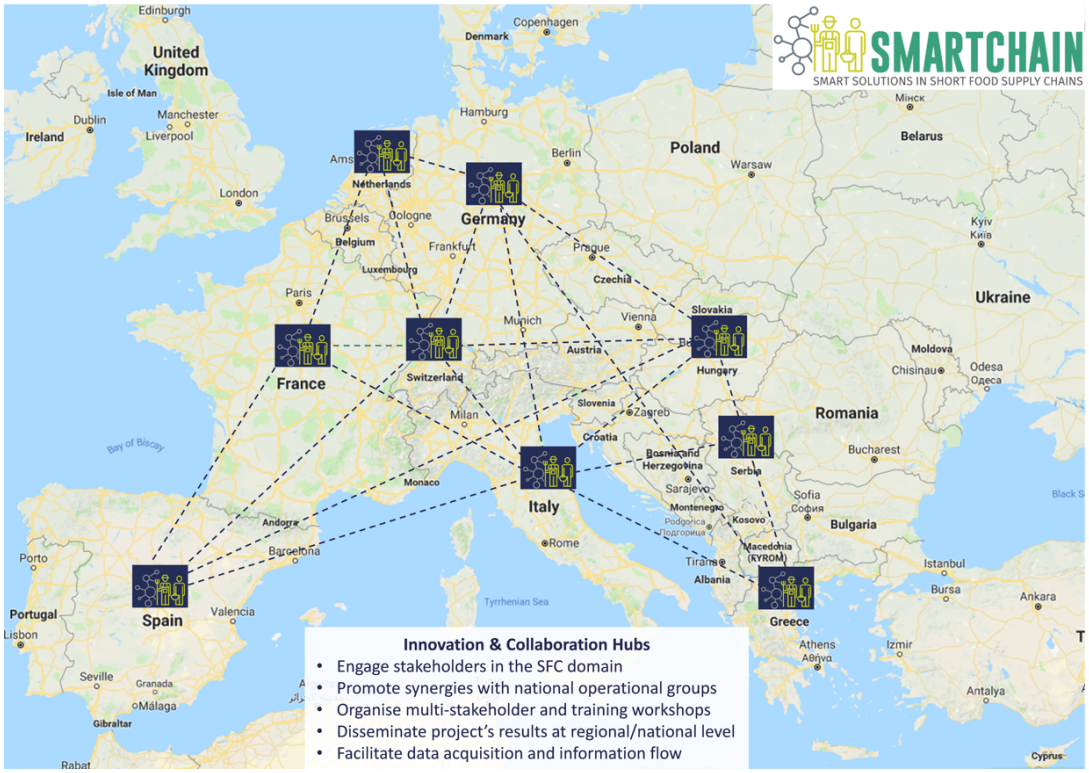

Figure 3: SMARTCHAIN 9 National Innovation & Collaboration Hubs on Short Food Supply Chains

cle sustainability and their national/regional contexts in 7 EU and 2 associated partner countries,

- a compilation of available data on illustrative cases of different types of SFSCs throughout Europe,
- data evaluation performed by strengths, weaknesses, opportunities and threats (SWOT) analysis which includes context, intervention, mechanisms, and outcome and
- use of multi-stakeholder and training workshops for validation, dissemination and know-how transfer. The evaluation will allow concluding remarks on collaborative SFSCs in Europe and on possible policy options to support their development. The use of multi-perspective analysis makes it possible to disentangle the challenges of SFSCs concerning technological, non-technological and social innovations, on the one hand, and linkages with impact on different dimensions of sustainable food production and consumption (such as economic performances, consumer awareness and capacity building, sustainability, and food resilience) on the other. This points out the innovation potential of the studied practical solutions targeted for SFSCs in urban, peri-urban and rural areas across Europe.

The comparison of use cases will offer insights into the role of region-specific (agricultural, environment and landscape), policy-specific (policies, regulations, institutions and governance structures), consumer behaviour-specific and cultural-civil society-specific factors in the development and operation of innovative solutions within SFSCs. This allows exploration of functions and identification of success parameters of innovative solutions at different territorial levels in relation

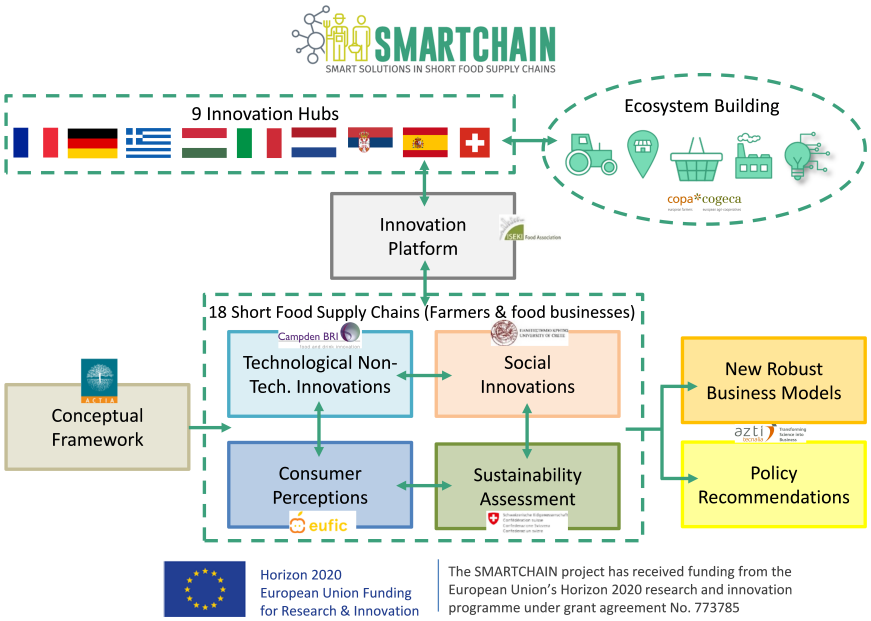

Figure 4: Conceptual structure and workflow of SMARTCHAIN

to regional conditions and their future performance. Based on the selected use cases, a portfolio of innovations is analysed for potential impact on SFSCs. It is determined how they can be most beneficially incorporated and disseminated into regional and European-wide agricultural and food production systems. Policy and business recommendations are developed to assure a governance structure and framework that is regionally adapted, thus enabling solutions which effectively contribute to rural development and improve resilience of European food systems.

4 Conclusions

The results of SMARTCHAIN help to unlock the potential for sustainability by providing a portfolio of innovations to practical problems in the short food supply chain domain, taking steps for a transition towards resilient agri-food value chains in Europe. The project engages with and impacts directly on actors at all stages in the agri-food chain, from farmers right through to consumers, contributing directly to policy formulation. Through the multi-sectoral and pan-European approach, SMARTCHAIN increases our understanding of the industry (farming systems and businesses across food production and the whole supply chain) and citizen (consumer) behaviour in relation to SFSCs, local food production and beyond.

SMARTCHAIN focuses on creating successful business strategies and networking for entrepreneurship in rural areas underpinned by economics that encourages transfer and adoption by industry and social innovations. This strengthens the resilience of farming and food sectors towards shocks and at the same time, fosters their sustainable growth. An effective dissemination, exploitation and communication strategy, and different demonstration activities allow SMARTCHAIN to ensure that innovations are available to farmers, food producers, consumers and other stakeholders involved in the short food supply chain domain during the project lifetime

and beyond via the SMARTCHAIN Innovation Platform.
This special issue focuses on the most recent developments with respect to innovation spanning technological, organisational, social, and digital solutions in short food supply chains and publishes original research articles in this field.

Acknowledgements

The SMARTCHAIN project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 773785.

References

Bakalis, S., Valdramidis, V. P., Argyropoulos, D., Ahrne, L., Chen, J., Cullen, P. J., Cummins, E., Datta, A. K., Emmanouilidis, C., Foster, T., Fryer, P. J., Gouseti, O., Hospido, A., Knoerzer, K., LeBail, A., Marangoni, A. G., Rao, P., Schluter, O. K., Taoukis, P., ... Van Impe, J. F. M. (2020). Perspectives from CO+RE: How COVID-19 changed our food systems and food security paradigms. *Current Research in Food Science*, *3*, 166–172. https://doi.org/10.1016/j.crfs.2020.05.003

Benedek, Z., Ferto, I., & Szente, V. (2020). The Multiplier Effects of Food Relocalization: A Systematic Review. *Sustainability*, *12*(9), 3524. https://doi.org/10.3390/su12093524

Cappelli, A., & Cini, E. (2020). Will the COVID-19 pandemic make us reconsider the relevance of short food supply chains and local productions? *Trends in Food Science and Technology*, *99*, 566–567.

Chiffoleau, Y., & Dourian, T. (2020). Sustainable Food Supply Chains: Is Shortening the Answer? A Literature Review for a Research and Innovation Agenda. *Sustainability*, *12*(23), 9831. https://doi.org/10.3390/su12239831

Collison, M., Collison, T., Myroniuk, I., Boyko, N., & Pellegrini, G. (2019). Transformation Trends in Food Logistics for Short Food Supply Chains - What is New? *Studies in Agricultural Economics*, *121*(2).

de Souza, R. T. (2020). Box-scheme as alternative food network—the economic integration between consumers and producers. *Agricultural and Food Economics*, *8*(1), 18. https://doi.org/10.1186/s40100-020-00162-4

Majewski, E., Komerska, A., Kwiatkowski, J., Malak-Rawlikowska, A., Wcas, A., Sulewski, P., Golas, M., Pogodzinska, K., Lecoeur, J.-L., Tocco, B., Torok, Á., Donati, M., & Vitterso, G. (2020). Are Short Food Supply Chains More Environmentally Sustainable than Long Chains? A Life Cycle Assessment (LCA) of the Eco-Efficiency of Food Chains in Selected EU Countries. *Energies*, *13*(18), 4853. https://doi.org/10.3390/en13184853

Malak-Rawlikowska, A., Majewski, E., Wcas, A., Borgen, S. O., Csillag, P., Donati, M., Freeman, R., Hoáng, V., Lecoeur, J.-L., Mancini, M. C., Nguyen, A., Saidi, M., Tocco, B., Torok, Á., Veneziani, M., Vitterso, G., & Wavresky, P. (2019). Measuring the Economic, Environmental, and Social Sustainability of Short Food Supply Chains. *Sustainability*, *11*(15), 4004. https://doi.org/10.3390/su11154004

Moruzzo, R., Riccioli, F., Galasso, A., Troccoli, C., Espinosa Diaz, S., & Di Iacovo, F. (2020). Italian Social Farming: the Network of Coldiretti and Campagna Amica. *Sustainability*, *12*(12), 5036. https://doi.org/10.3390/su12125036

Pato, M. L. (2020). Short food supply chains – a growing movement. The case study of the Viseu Dão Lafões Region. *Open Agriculture*, *5*(1), 806–816. https://doi.org/10.1515/opag-2020-0077

Vitterso, G., Torjusen, H., Laitala, K., Tocco, B., Biasini, B., Csillag, P., de Labarre, M. D., Lecoeur, J.-L., Maj, A., Majewski, E., Malak-Rawlikowska, A.,

Menozzi, D., Torok, Á., & Wavresky, P. (2019). Short Food Supply Chains and Their Contributions to Sustainability: Participants' Views and Perceptions from 12 European Cases. *Sustainability*, *11*(17), 4800. https://doi.org/10.3390/su11174800