The logistics of the short food supply chain: a literature review

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ABSTRACT
The sustainability of food chains is an issue consumers, policy makers, researchers, food producers and suppliers are increasingly interested in. This interest is also confirmed by the considerable development of short food supply chain (SFSC) initiatives as an alternative to the globalised food chains typical of the contemporary food industry. However, while SFSCs have grown over the recent years, their logistics is still a challenging issue affecting their performance. Previous SFSCfocused literature reviews have neglected this particular aspect, concentrating primarily on the different forms of supply chains and the benefits and limitations associated with SFSC. The goal of this paper, instead, is to increase researchers' and practitioners' knowledge of the role and potential of logistics in improving the effectiveness and sustainability of SFSCs. This work, in fact, focuses on this specific and relevant aspect of SFSC and highlights its possible impact on SFSC development. From a logistics perspective, it identifies a series of actions to be implemented to effectively improve SFSC: to make environmental sustainable choices during all the phases of food distribution, to optimise the location of supply chain nodes, to improve the distribution route and restructure the supply chain. In addition to these actions, farmers are required to adopt an open approach to innovative distribution systems, vertical and horizontal collaboration as well as to cooperation with researchers. The paper's conclusions provide suggestions for future research development and underline the necessity to adopt a holistic and integrated approach and abandon a retrospective evaluation analysis in favour of a more dynamic and futureorientated attitude.

1. Introduction

Since the second half of the nineteenth century, the food system has been strongly affected by the phenomenon of globalisation. Direct relationships between farmers and consumers have been replaced by a complex system of actors which includes several intermediaries (Dunne et al., 2011). The entry into a market of large wholesalers and supermarket chains has increased competition to the detriment of small farmers (Renting et al., 2003; Maye and Kirwan, 2010). Globalisation has also led to a collapse in biodiversity and ecosystems, an increase of obesity and food poverty and the impossibility for consumers to have adequate information about food provenance and quality (Qaim, 2017; Pulker et al., 2018). However, nowadays, consumers are becoming more and more aware of the negative externalities of a globalised food system and they are willing to reestablish a direct connection with farmers, support local communities, consume healthy food (Duram and Cawley, 2012) and reduce the environmental impact of their food consumption (Feldmann and Hamm, 2015; Bloemhof et al., 2015). Short Food Supply Chain (SFSC), one of the pillars of food sovereignty (Steering Committee of Nyeleni, 2007), responds to these emerging needs. An increasing body of literature has examined the benefits of SFSC and its positive impact on human health and wellbeing (Schönhart et al., 2009; Hand and Martinez, 2010 ; Chang and Iseppi, 2012 ; Brown and Guiffrida, 2014; Peano et al., 2014; Bimbo et al., 2015; Benis and Ferrão, 2017). However, many case studies have demonstrated that the consumption of local food does not automatically reduce negative externalities (e.g. Martinez, 2010 ; Mastronardi et al., 2015). Logistics is one of the main weak points for the development and the effectiveness of SFSC, therefore its improvement represents a challenge that can actively contribute to transforming SFSC into a concrete and sustainable alternative to the globalised food system (Blanquart et al., 2010; Nsamzinshuti et al., 2017).

1.1. The short food supply chain

There is no shared and unique definition of SFSC within the scientific community (Kneafsey et al., 2013). The most intuitive and frequently cited feature of SFSC is geographical proximity, that is, the closeness between producers and consumers (Ilbery and Maye, 2006; Kebir and Torre, 2013). This closeness can be concepualised in terms of political boundaries, that is, in terms of regions or countries (Zepeda and LevitenReid, 2004 ; Engelseth and Hogset, 2016), or in relation to distance, whether measured in kilometres (Chambers et al., 2007 ; Durham et al., 2009) or in time (Zepeda and LevitenReid, 2004). However, with regards to the latter, the distance between producers and consumers is not unambiguously defined, but it is a function of the morphological and demographical characteristics of a territory as well as of the actors involved and their objectives. For most literature, it varies from 30 to 100 km (Pretty et al., 2005 ; Blanquart et al., 2010), but the upper limits can also be higher, for example, 160 km in the UK, 250 km in Sweden (Nilsson, 2009), 644 km in the US (Kremer and DeLiberty, 2011 ; Engelseth, 2016). The distance measured in time ranges between 5 h to 1 day (Ilbery and Maye, 2006 ; Zepeda and LevitenReid, 2004). Yet, the geographical proximity itself is not a guarantee of quality (Goodman, 2004 ; Watts et al., 2005). Marsden et al. (2000) put the "emphasis upon the type of relationship between the producer and the consumer in these supply chains, and the role of this relationship in constructing value and meaning, rather than solely the type of product itself". SFSC is based on the direct contact between farmers and consumers and their ensuing relationships based on trust and honesty. SFSC is characterised by a small number/absence of intermediaries (Parker, 2005 ; Kneafsey et al., 2013). The chain and any possible intermediates must provide a means of communication between farmers and customers: farmers can supply consumers with information and receive their feedback in return (Galli and Brunori, 2013). The European Union (Reg.1305/13) provided a broad definition that includes both 'social' proximity (minimum or null number of actors) and geographical proximity (physical distance between farmer and consumers): SFSC is "a supply chain involving a limited number of economic operators committed to cooperation, local economic development, and close geographical and social relations between producers, processors and consumers" (European Union, 2013). The Slow Food association provides another exhaustive and deep definition (Slow Food, 2013): "A short food supply chain is created when producers and final consumers realise they share the same goals, which can be achieved by creating new opportunities that strengthen local food networks. It is an alternative strategy that enables producers to regain an active role in the food system, as it focuses on local production decentralised regional food systems that minimise the number of steps involved and the distance travelled by food (food miles)".

According to the definitions provided, SFSC can be categorised as a form of sustainable supply chain (Rajesh, 2018), as it encompasses environmental objectives, but it also focuses on a social and ethical matter. SFSC is described as a Value Chain: it ensures social and economic benefits for supply chain actors, and it does not permanently deplete natural resources (FAO, 2014a). It implicates a high level of trust, transparency, cooperation and shared governance between supply chain actors (Taylor, 2005 ; Stevenson and Pirog, 2008). Schmitt et al. (2018) identified seven criteria of localness: distance, supply chain size, number of intermediaries by the typology of sales channels, percentage of direct sales, local knowhow, product identity in relation to territory, governance (degree of control of local actors). The different combinations of these criteria are associated with a different degree of localness. SFSC is a multifaceted phenomenon and, as for the lack of a shared definition, there is a lack of standard categorisation. Table 1 reports the more broad classifications available in scientific literature and provides some examples for each category/subcategory.

Regardless of the specific form it assumes, SFSC represents an alternative food system that aims to achieve sustainability goals. Sustainability is not a status to be achieved, but a continuous process (Li et al., 2014 ; Brunori et al., 2016). Therefore an interesting approach could be reasoning in terms of the objectives pursued
by SFSC. By analysing the main goals of alternative food systems (Cleveland et al., 2015) it is possible to highlight the sustainability objectives they aim to reach. The structure proposed by the SAFA (Sustainability Assessment of Food and Agriculture systems) guidelines (FAO, 2014b), a holistic global framework for the assessment of sustainability along food and agriculture value chains, are taken as reference. As for the SAFA vision, the food and agriculture systems worldwide are characterised by four dimensions of sustainability: good governance, environmental integrity, economic resilience and social wellbeing. Each of these four dimensions of sustainability are refined in a set of 21 core sustainability issues (themes) that can be considered universal and can provide a shared understanding of the "sustainability" concept in practical contexts. Fig. 1 summarises the main sustainability goals of SFSC (Cleveland et al., 2015 ; FAO, 2014b ; Canfora 2016 ; Kneafsey et al., 2013 ; Dunay et al., 2018).

As from literature, the short supply chain seems to want to impact on each of the four dimentions of sustainability and on ma ny of the core sustainability issues. A considerable number of papers have demonstrated the improvements and benefits brought by SFSCs in terms of sustainability also in comparison with traditional food systems (see e.g. Galli and Brunori, 2013 ; Aubert and Enjolras, 2016). However, authors that analysed specific case studies adopting a multidimentional approach to verity if local food supply chains are more sustainable than global food supply food chains are not able to achieve a clear and univocal answer (Schwarz et al., 2016 ; Brunori et al., 2016 ; Schmitt et al., 2017). These authors also doubted the validity of the question posed. Therefore, a good design of SFSCs and their continuous improvement is essential for the achievement of sustainability goals.

1.2. The logistics of SFSC

Logistics can be described as "The process of planning, implementing, and controlling procedures for the efficient and effect ive transportation and storage of goods including services, and related information from the point of origin to the point of cons umption for the purpose of conforming to customer requirements. This definition includes inbound, outbound, internal, and external movements." (CSCMP, 2013). Kukovi cˇ et al. (2014) compared 26 definitions of logistics in the agrofood system. They highlighted that agriculture logistics includes agriculture product production, purchasing, transportation, warehousing, loading and unlo ading, handling, packaging, processing, distribution and information processing. These logistical activities are not just technical services that can be optimised individually. In fact, they are also strategic coordinating mechanisms that enable the cooperation betw een SFSC stakeholders.

The benefits of an efficient logistics system are well known. For example, an efficient management of logistics operations is crucial for the achievement of traceability in the food supply chain (Ringsberg, 2014) and it plays an essential part in the implementation of environmental strategies, too (Markely and Davis, 2007 ; Bask and Rajahonka, 2017). Logistics strategy is considered one of the critical factors for the success of local food producers.

SFSCs imply specific logistics solutions which depend on product, distribution system and network characteristics. Supply cha in reengineering and logistics innovation are strategic tools for the improvement of local food supply chains (Oglethorpe and Heron, 2013). In some cases, the logistics of local foods adapts mainstream logistics to the logistics of short distances (Engelseth, 2015 ; Engelseth and Hogset, 2016), but the adaptation process is neither easy nor banal. Appropriate logistics arrangements have the considerable potential to improve the environmental impact of SFSCs (Kneafsey et al., 2013) and can also increase economic and social performances of short food systems (Blanquart et al., 2010). Logistics improvement can contribute to overcoming the main weaknesses of SFSC revealed by different SWOT analyses (Sini, 2014 ; Rapisarda et al., 2015 ; Kneafsey et al., 2013 ; Casolani, 2015):

- Niche market due to high prices;
- Limited variety and quantity of products;
- Problems in supplying public institutions with adequate product quality and quantity;
- Organisational and coordination difficulties;
- High logistics and transportation costs when compared with other conventional distribution systems;
- Limited logistics and commercial organisation;
- No scale economies due to the small size of farms;
- Consumers do not always know how and where to get products;
- Problems with getting to the selling points;
- Limited resources (budget and skill) for marketing and communication;
- Limited capacity to expand for some small farms;
- Possible 'burnout' caused by small workforce and reliance on key multitasking individuals.

Table 1
SFSC categorisations.

Source	Classification	Examples
Gilg and Battershill (2000)	True direct selling	On-farm selling, Farmers' Markets, Market Halls, Home deliveries, Trade fairs, Collectives with consumers
	Arm's length direct selling	Restaurants, Speciality food shops, Supermarkets
	Regional labelling schemes	Certified for the denomination of origin
Marsden et al. (2000) ; Renting et al. (2003)	Face-to-Face	Farm shops, Farmers' Markets, Pick-Your-Own
	Proximate SFSC	Community Supported Agriculture, Consumers' cooperatives
	Spatially extended	Certification labels
Bertazzoli et al. (2010)	Single SFSC - Single farm direct selling	
	Business to consumer (b2c)	On-farm selling, Farmers' Markets, Home deliveries, Box Schemes
	Business to business (b2b)	HoReCa, Local retailers, Specialised shops
	Networked SFSC - Selling thanks to a network of farms	
	Business to consumer (b2c)	Farmers' Markets, Outside markets and Box Schemes whose access is ensured by the network, Home deliveries, Informal offer groups
	Business to business (b2b)	HoReCa, Local retailers, Specialised shops, Cooperatives / Consortiums, Large retailers
Kneafsey et al. (2013)	Sales in proximity	
	Community Supported Agriculture	
	On-Farm Sales	Farm shops, Farm based hospitality, Roadside sales, Pick-Your-Own
	Off-Farm Sales – commercial sector	Farmers' markets and other markets, Direct sales to consumers' cooperatives, retailers, HoReCa
	Off-Farm Sales – catering sector	Sales to hospitals, schools
	Farm Direct Deliveries	Box schemes
	Sales at a distance	
	Farm Direct Deliveries	Box schemes, Internet sales, Speciality retailers
Casolani (2015)	Direct sales to consumer	Farm shops, Farmers' Markets, Pick-Your-Own
	Sales to food channel	Direct sales to hospitals, schools, retail; HoReCa
	Sales to organised buying group	Community Supported Agriculture, Purchasing Groups, Organised groups of supply and demand
Chiffoleau et al. (2016)	Short food supply chains in direct selling (sold by the producers themselves)	
	Individual	Farm shops, Open-air markets, baskets ordered on the Internet
	Producer/consumer collective	AMAP (Association pour le maintien d'une agriculture paysanne), Purchasing groups
	Collective of producers	Farmers' Markets, Collective baskets or stands, Collective farmers' shops
	Short food supply chains with one intermediary	
	Collective	Farm shops, Associative intermediaries, Cooperative intermediaries, Private intermediaries, Sale to Communities
	Individual	Restaurants, Artisan food production, Retail shops, Supermarkets

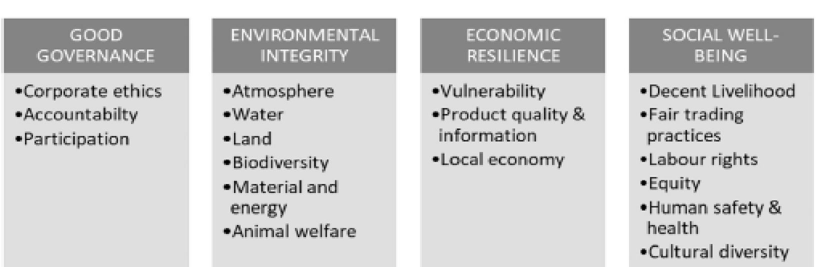


Fig. 1. SFSC sustainability goal

Table 2
Main focuses of the literature reviews about SFSC.

SFSC Literature reviews-main focuses	Bazzani and Canavari, 2013	Fabbrizzi et al., 2014	Feldmann and Hamm, 2015
SFSC features	v		
Classification and forms of SFSCs	v	v	
Benefits of SFSCs	v	v	
Critics to SFSCs	v		
Consumers and SFSCs		v	v

Commonly, small farmers themselves are responsible for logistics activities. Sometimes, local food firms (Bourlakis and Bourlakis, 2001 ; Oglethorpe and Heron, 2013) regard logistics as a secondary function and don't engage in the implementation of a deliberate logistics strategy that should lead to an increased logistics efficiency. Nevertheless, this point of view is not shared by all farmers. Lutz et al. (2017) applied a participatory method (Social MultiCriteria Evaluation) on Austrian farms already involved in local food networks and found that improvement in logistics is seen as the most valued pathway for economic, social and ecologic development.

Because of its strategic role, the topic of logistics requires specific attention and the improvement of SFSC logistics is a challenge that needs to be tackled. However, despite its importance for the success, sustainability (Fredriksson and Liljestrand, 2015) and performance improvement of food systems, few researchers have addressed the subject of logistics of SFSCs (Blanquart et al., 2010), focusing, instead, on ethical and socioeconomical aspects. Three literature reviews about short food supply chains have been previously published: Bazzani and Canavari, 2013 ; Fabbrizzi et al., 2014 ; Feldmann and Hamm, 2015 . Their main focuses are summarised in Table 2 .

Despite the importance of the topic, it is clear that logistics was a completely neglected aspect. This paper aims to fill this gap. It focuses on the specific topics of logistics of SFSCs and, it tries to answer the following reseach questions:

RQ1: How did academics face the challenge of SFSC logistics?

RQ2: Which improvements can be implemented to make SFSCs more sustainable and competitive compared with traditional food systems?

RQ3: Which topic of logistics should be further investigated by academics in order to give a contribution to SFSC development?

The rest of the paper is organised as follows. Section 2 presents the research method adopted, explaining the steps of the literature review performed in detail. Section 3 illustrates and discusses the results obtained. The paper ends with conclusions in Section 4 .

2. Methods

Literature review was selected as the research method for this paper. A structured literature review makes it possible to identify trends and current gaps in scientific literature (Lagorio et al., 2016), integrate and synthesise existing studies, generate new insights, generalise research outcomes (Friday et al., 2018) and discuss future research implications (Touboulic and Walker, 2015 ; Carter and Rogers, 2008). A literature review is characterised by a welldefined research protocol and detailed documentation of the steps performed, to ensure the study's reliability, validity, robustness, replicability and transparency (Tranfield et al., 2003 ; Kupiainen et al., 2015). The literature review adopted follows the fivestep approach proposed by Denyer and Tranfield (2009) and Wong et al. (2012) : i) Formulation of the research questions; ii) Location of studies; iii) Selection and evaluation of studies; iv) Analysis and synthesis and v) Reporting and using the results.

The fundamental step of a literature review is to determine the scope of the study or, in other words, to identify specific and valid research questions. The definition of the research questions is of strategic importance for the following steps of the review process: the research questions drive the identification of the inclusion criteria, the selection of relevant papers, the decision on what data to extract and how to analyse and synthesise them. The research questions of this paper have been illustrated in the previous section.

The electronic database sources used for this paper were: Elsevier ScienceDirect, SpringerLink, Emerald Insight, Wiley, Scopus, Taylor & Francis. These databases captured several journals that publish articles related to logistics and supply chain literature. The search strings used to search in the databases were "short food supply chain" OR "local food systems" OR "alternative food network". The strings contained synonyms and super categories of the topic investigated (SFSC) so as to make the search as comprehensive as possible. The same strings were used to perform a search in each online catalogue. The search was applied to the title, abstract and full text of papers. The strings intentionally did not contain any limitation or direct reference to logistics and its elements, because the inclusion of elements related to logistics (Kukovic et al., 2014) (e.g. warehouse, distribution) or their synonyms (storage and travel) could have caused significant papers to be left out from the search. Of course, it was then necessary to manually screen the high number of papers retrieved through the automatic search to identify those dealing with the topic of interest. Fig. 2 shows the flowchart of the search and selection process.

In the first filtering phase, the following set of inclusion criteria were applied to title, abstract and full text of the articles in the online databases:

Fig. 2. Literature Review filtering phases.

Table 3
Papers included in the Literature Review distributed by the main topic.

Topic	Papers
Elements of logistics affecting the environmental impact of SFSC	Pirog et al., 2001 ; Jones, 2002 ; Wallgren, 2006 ; Van Hauwermeiren et al., 2007 ; EdwardsJones et al., 2008 ; Glettner, 2008 ; Mariola, 2008 ; Coley et al., 2009 ; Auld et al., 2009 ; Rizet et al., 2010 ; Cleveland et al., 2011 ; Mundler and Rumpus, 2012 ; Page et al., 2012 ; Kulak et al., 2013 , Kulak et al., 2015 ; Torquati et al., 2015 ; Rothwell et al., 2016 ; Battini et al., 2016 ; De Cara et al., 2017 ; Yang and Campbell, 2017 ; Christensen et al., 2018 ; PerezNeira and GrolmussVenegas, 2018 ; Vitali et al., 2018 ; MalakRawlikowska et al., 2019 ; Mancini et al., 2019 ; Striebig et al., 2019 .
Location and route optimisation	Bosona and Gebresenbet, 2011 ; Bosona et al., 2011a , 2011b ; Nordmark et al., 2012 ; Tong et al., 2012 ; Bosona et al., 2013 ; Saetta et al., 2015 ; Korhonen et al., 2017 .
Improvement of SFSC logistics through supply chain restructuring	Vogt and Kaiser, 2008 ; Izumi et al., 2010 ; Bloom and Hinrichs, 2010 , 2011 ; Cohen and Derryck, 2011 ; Diamond and Barham, 2011 ; Jablonski et al., 2011 ; Levkoe and Wakefields, 2011 ; Schmidt et al., 2011 ; Horst et al., 2011 ; Van der Ploeg et al., 2012 ; Matson and Thayer, 2013 ; Stroink and Nelson, 2013 ; Volpentesta and Ammirato, 2013 ; Rogers and Fraszczak, 2014 ; Cleveland et al., 2014 ; Klein and Michas, 2014 ; LeBlanc et al., 2014 ; Martikainen et al., 2014 ; Klein, 2015 ; Clark and Inwood, 2016 ; Le Velly and Dufeu, 2016 ; Mittal and Krejci, 2017 ; Milestad et al., 2017 ; De Bernardi and Tirabeni, 2018 ; Paciarotti and Torregiani, 2018 ; Manikas et
Other logistics related issues	Heer and Mann, 2010 ; Maciejczak, 2014 ; Mack and Tong, 2015 ; Todorovic et al., 2018 ; Collison et al., 2019 .

- Keywords: "short food supply chain" OR "local food system" OR "alternative food network";
- Language: English;
- Document types: Articles;
- Source types: Research papers published in journals;
- Time interval: 14 years, between January 2006 and December 2019.

The only exception was made for those papers that did not fall within the inclusion criteria indicated but that are cornerstones and reference points for the subject matter investigated. The electronic search process resulted in the identification of 2306 articles. In the second filtering phase, the authors removed duplicates and then conducted a paper screening independently by reading the titles and abstracts of the papers identified. They then discussed their decisions and the papers they both agreed should be included in the survey were included, while those they had a discordant opinion on were only provisionally included (Kitchenham and Brereton, 2013). The third phase of the selection was based on full text reading and snowballing. The filtering was applied to the content level by reading the papers in their entirety. A snowballing procedure was then employed. In particular, to make sure no relevant articles had been left out by the broad, automated search, forward and backward snowball techniques were used on the papers previously identified as a complementary method (Wohlin, 2014 ; Badampudi et al., 2015). Backward snowballing means using the reference list of a set of papers to identify new papers to be included. Forward snowballing means identifying new papers by screening the papers citing the paper selected. The papers identified in the first step of the snowballing procedure entered the snowballing procedure, and the process went on iteratively until no new papers were found. As a result of the entire selection process, 66 studies were included in the literature review.

3. Results and discussion

3.1. Paper distribution

This section presents the distribution of the papers identified by year of publication, scientific journal of publication and topic. This distribution was performed to understand how the interest in logistics related to SFSC has developed over time, in which areas of research, and how the articles identified can be categorised. Each of the topics of interest detected is then discussed in detail.

The distribution of the papers selected by year of publication (see Appendix 1) shows the evolution of the scientific literature body over time and highlights an increasing trend in the number of papers on SFSC logistics and a stable focus on the subject during the last decade. A peak in publications during 2011 is due to a Special Issue on the topic. By analysing the number of publications per journal (see Appendix 2), it is evident that, apart from the exception of the abovementioned special issue, the papers identified are widely distributed amongst numerous journals belonging to different research areas: from Agronomy to Industrial and manufacturing engineering; from Renewable energy, Sustainability and Environment to Strategy and Management; from Business, Management and Accounting to Geography, Planning and Development and Sociology and Political Science.

The papers were categorised to identify the main logistics topics and related trends and gaps and the following four themes were identified by recursively considering the issues found in the papers (Melacini et al., 2018):

1 Elements of logistics affecting the environmental impact of SFSC (26 papers);
2 Location and route optimisation (8 papers);
3 Improvement of SFSC logistics through supply chain restructuring (27 papers);
4 Other logisticsrelated issues (5 papers).

Table 3 lists all the papers included in the literature review and the key theme of each paper.

3.2. Elements of logistics affecting the environmental impact of SFSC

Investigations on consumers' motivation for purchasing local products highlight the critical role played by environmental considerations. There is some evidence that the choice of buying locally produced food is perceived as an ecofriendly option (Brown et al., 2009 ; Burchardi et al., 2005 ; Carey et al., 2011 ; Feldmann and Hamm, 2015). Furthermore, environmental sustainability is also one of the reasons that have led farmers to adopt direct sales (Tudisca et al., 2015). In the following subsequentions those elements of logistics that affect the environmental impact of SFSC are analysed in detail.

3.2.1. Transportation

The short geographical distance between producers and consumers is intuitively linked to a reduction in food miles and, consequently, a potential decrease in externalities connected to transport, such as Greenhouse Gas, CO2 emission and noise (Duram and Oberholtzer, 2010). Early studies comparing local and conventional food systems used the concept of food miles: "a food mile is the distance food travels from where it is grown or raised to where it is ultimately purchased by the consumer or enduser" (Pirog et al., 2001). They calculated the carbon emission related to the transport phase per unit of product. These estimations took into account the travel distance, the amount of food transported (vehicle load), transportation modes, the vehicle used for transport and its emission factor. The case studies proposed by Pirog et al. (2001) , Jones (2002) , Auld et al. (2009) , and Torquati et al. (2015) confirmed the idea that the low food miles of local food systems imply lower fuel consumption, lower CO2 emission and fewer distribution phases compared to conventional food systems. At the same time, however, other studies focusing on the transport phase and analysing different SFSC configurations in different contexts came to contradictory conclusions: according to their findings, there was no significant difference between the total energy used for food transportation in local and conventional systems, and in some cases, traditional food systems outperformed the local ones (Wallgren, 2006 ; Glettner, 2008 ; Cleveland et al., 2011).

Although many authors have demonstrated the greater environmental sustainability of SFSCs compared with long food supply chains (e.g. Torquati et al., 2015 ; Striebig et al., 2019), the short distance between producers and consumers does not necessarily imply a decrease in emissions (Mariola, 2008 ; EdwardsJones et al., 2008). Therefore, the common assumption that the short travel distance of local food systems is the crucial aspect for a positive environmental impact and is sufficient to state that SFSC generates less CO2 related to transport compared to conventional food systems is confuted. It is possible to identify conditions under which local distribution systems are more impacting than long sales chains (Coley et al., 2009). The environmental benefits of short distances can be offset by different factors such as the lack of an efficient coordination in transport logistics, the increasing use of private cars (Paloviita, 2010) or the frequent journeys with low load factors required (Kulak et al., 2015 ; MalakRawlikowska et al., 2019).

3.2.2. Consumer trips

Consumer trips are a particular logistics element that, even if belonging to the transportation phase, has received specific attention from some authors. Although many authors (Pirog et al., 2001 ; Wallgren, 20 06 ; Glettner, 20 08 ; Auld et al., 2009 ; Cleveland et al., 2011 ; Kulak et al., 2013 ; Torquati et al., 2015 ; Rothwell et al., 2016 ; Striebig et al., 2019) have neglected the repeated, notoptimised, energyintensive, lowload journeys of consumers to different farms to buy just a small amount of products (Mariola, 2008), Kulak et al. (2015) revealed that environmental impact is highly sensitive to consumer transport and consumer transportation choices for shopping. In particular, consumer trips have a high impact for those products, like bread, that have low Greenhouse Gas emissions. Coley et al. (2009) quantified the threshold length of a consumer's route that makes direct food provision from a producer less environmentally impacting compared to provision from mass distribution systems: if a consumer's roundtrip is shorter than 7.4 km, carbon emissions are lower than those of a largescale distribution system of food baskets. Also, Mancini et al. (2019) and MalakRawlikowska et al. (2019) analysed cases in which the contribution of consumers' purchase trips to environmental impact is higher in the short food supply chain than in the long one.

3.2.3. Food storage, handling, administration and packaging

An evaluation in terms of 'food miles', however, is not sufficient, and it is inadequate to guarantee SFSC environmental sustainability (Yang and Campbell, 2017 ; Vitali et al., 2018). Indeed, the impact due to transportation from the place of production to the place of purchase is only a part of the total impact associated with the entire food system. Van Passel (2013) argues that, for a complete sustainability assessment, it is necessary to take into account also the external costs of other processes and activities of the supply chain. In line with this suggestion, many authors have included the energy consumed for food storage, handling and administration along the supply chain (Jones, 2002 ; Van Hauwermeiren et al., 2007 ; Coley et al., 2009 ; Rizet et al., 2010 ; Page et al., 2012 ; Mundler and Rumpus, 2012 ; Kulak et al., 2013 ; Kulak et al., 2015 ; Rothwell et al., 2016 ; Vitali et al., 2018 ; PerezNeira and GrolmussVenegas, 2018 ; MalakRawlikowska et al., 2019) in their evaluation of environmental impact. However, none of them worked to improve the efficiency of these parameters.

Packaging is another essential element of food products and a fundamental source of environmental impact and waste (GarcíaArca et al., 2014 ; Roy et al., 2009 ; Simon et al., 2015). However, only the authors applying Life Cycle Assessment (LCA) have included packaging in their analysis of SFSC. Along conventional supply chains, fruits and vegetables are moved between distribution centres, which implies the production of additional waste such as pallet and wrap (Kulak et al., 2013). An environmental benefit connected to a short supply chain is the limited use of packaging for food protection and preservation during its transport and storage (Plassmann and EdwardsJones, 2009). In the three case studies proposed by PerezNeira and GrolmussVenegas (2018) packaging proved to be a fundamental element for the environmental sustainability of local supply chains, and it may benefit from further technological improvement and innovation. Many other studies dealing with packaging simply stated that local food consumption usually strives to minimise packaging (Paloviita, 2010 ; Pearson et al., 2011) and that the potential benefit associated with reduced packaging is one of the reasons for consumers to join SFSCs (Bougherara et al., 2009 ; Balázs et al., 2016 ; Pearson et al., 2011). Some authors just reported the type of packaging used in their case studies without any further analysis (Bosona et al., 2011b ; Petropoulou, 2016). Battini et al. (2016) illustrated the development of two types of boxes for perishable local food products and compared them by simultaneously evaluating economic and environmental factors.

3.2.4. Methodological approaches

With regards to the methodology adopted by the authors of the different papers calculating SFSC environmental impact, two main methodological approaches can be observed. The first approach focuses on two main factors: energy used in food transport and energy consumed for food storage, handling and administration along the supply chain. All the papers adopting the first approach evaluated relative CO_2 emissions. More precisely, the first energy amount is calculated as a function of travel distance, fuel consumption, emission factor and vehicle load. The impact resulting from the storage, handling and administration phases are calculated as a function of i) emission per product unit for the storage, handling and administration phases; ii) energy consumed during storage, handling and administration stages such as electricity, natural gas and energy for internal handling vehicles; iii) emission factor per Mega Joule; iv) units of products stocked and/or handled. However, the papers differ in the selection of data source: reference reports, databases and scientific publications. To manage more detailed and representative data, other papers add ad hoc surveys and interviews to the sources above. The second approach is the LCA approach. In recent years, LCA has become a widely applied approach for the evaluation of the environmental sustainability of SFSCs. LCA is a commonly used methodology for accurately estimating the environmental impact of a product or process throughout its life cycle, from resource extraction to its use and disposal. For example, in the transport phase, the LCA approach makes it possible to take into account not only the impact of the fuel consumed during transport but also the impact of the production of the vehicles themselves. LCA provides an extensive suite of indicators, which include Global Warming Potential, eutrophication (amount of PO_4 emitted), land use (hectares of land area utilised) and water use (litres or cubic metres of water used).

In summary, most of the authors that focus their attention on the environmental topic have carried out comparisons between local and conventional food distribution systems to investigate their relative environmental impact. They compared short food supply systems like farmers' markets, specialised stores, farm shops, food basket systems with conventional systems. A direct comparison between the results they achieved is neither easy nor meaningful. In fact, distribution systems with different structures are analysed in specific contexts, and many logistics variables influencing environmental impact cannot be isolated. Christensen et al. (2018) investigated the emissions of five Community Supported Agriculture realities located in a single region, all with similar sale channels and adherent to agroecological farming practices, and found a large amount of variability also between the same form of alternative food network. De Cara et al. (2017) developed a partialequilibrium model of ruralurban systems and exhibited cases and conditions under which pure localfood configurations where regions are selfsufficient do not minimise emissions from local food transportation. Therefore, the tendency of researchers to try to give a definitive answer to the debate "Is short food supply chain better or worse than conventional food systems as far as environmental impact is concerned?" seems to be senseless.

Albeit outside the scope of this study, it is interesting to underline that, besides logistics factors, environmental impact is strongly influenced also by production phase and product type (Notarnicola et al., 2017 ; Kulak et al., 2013). It is worth noting that shifts in dietary customer choices like seasonal produce consumption (Page et al., 2012), the passage from a diet consisting mainly of red meat/dairy products towards a more vegetarian diet (Weber and Matthews, 2008), along with changes in the production system, e.g. Hitech greenhouse production vs open field production (Page et al., 2012 ; Rothwell et al., 2016) can all contribute to a more significant emission reduction than the consumption of local food.

3.3. Location and route optimisation

Supply chain design impacts the performance of the supply chain. Also in SFSC location and route optimisation, supply chain design can contribute to obtaining an improvement in the distribution system. The improvement can be evaluated in terms of distance travelled [km], vehicle emissions [kgCO2], transport costs [€], delivery time [hours] and number of routes. In the papers examined, both the collection and distribution of local food products have been taken into account. The distribution system is initially described in its current configuration. Within the area investigated, the members of the network are localised: local food producers, wholesalers (collection and distribution points) and customers/delivery points (e.g. food retailers, restaurants, cafes, hotels, final customers, etc.) are identified and mapped using maps or geographic information system softwares. The distribution system is then further described through the collection of relevant data such as truck employment, daily sequence of trips, time required for delivery, delivery timewindows, annual production quantity/quantity of delivery from each producer, product delivery distance, type of vehicles, load rate of vehicles, annual revenue, production type, delivery frequency and weight, product distribution cost, customers' demands.

From this asis analysis, a fragmented and uncoordinated distribution system emerged, and authors proposed different ways for its improvement:

- The different producers are clustered on the basis of their geographical proximity (Bosona and Gebresenbet, 2011).
- The location of collection/distribution/selling centres is optimised using CentreofGravity, LoadDistance, Location Factor Rating Techniques and vehicle routing based analysis (Bosona et al., 2011a ; Nordmark et al., 2012 ; Bosona and Gebresenbet, 2011 ; Bosona et al., 2013 ; Korhonen et al., 2017). In addition, Tong et al. (2012) proposed two mathematical models for the

selection of selling locations and service schedules that incorporate spatial and temporal consumers' constraints. The models focus on people's daily activities and travel patterns to maximise accessibility to farmers' markets.

- Routes for collection and distribution are simulated and optimised mainly using vehicle routing softwares available for sale, which minimises travelling distance and time (Bosona et al., 2011a, 2011b ; Nordmark et al., 2012 ; Bosona and Gebresenbet, 2011 ; Bosona et al., 2013). The ad hoc generic algorithm developed by Saetta et al. (2015) also includes different objective functions such as minimum numbers of trucks involved, total cost and number of stops. Route optimisation analysis considers constraints concerning delivery days, frequency and timewindows.

- The clustering, logistics network integration, optimisation of collection/distribution centres, route optimisation approaches allow remarkable improvement, which is observed and estimated by all the authors in terms of economic and environmental impact.*3.4. Improvement of SFSC logistics through supply chain restructuring: hybrid food HUBs and innovative distribution patterns*

3.4.1. Hybrid food HUBs

Martikainen et al. (2014) detected the need for specialised and costeffective logistical services that could be provided by a thirdparty logistics service provider, as expressed by different chain participants in the local food supply chain in Finland. This explains the emergence of Hybrid Food Hubs (HFHs) as an innovative organisational model of aggregation and distribution aimed at strengthening the connection between producers and consumers (Horst et al., 2011 ; Matson and Thayer, 2013). In academic literature, HFHs are also called local food hubs, hybrid food valuebased supply chains, hybrid food value chains, producers' platforms (in the European context). HFHs incorporate physical infrastructures (e.g. logistical skills, IT management system, contracts and invoices) and operational infrastructures (e.g. vehicle fleet, packaging equipment, storage structure) of conventional food systems. They are potentially able to achieve many of the advantages of both alternative and conventional systems while overcoming the main critical logistics issues of SFSCs (Manikas et al., 2019). HFHs offer a wide range of services that go well beyond the resources of individual farmers. Besides distribution, aggregation, storage, packaging and processing services, HFHs can provide further services for farmers (e.g. liability insurance, training) and community members (employment opportunities, educational programmes). On the basis of the type of organisation driving the process, the HFH distribution model can be classified as a producerdriven, retaildriven, nonprofitdriven, and consumerdriven distribution model (Diamond and Barham, 2011).

From the illustration and qualitative analysis of the different case studies presented, it is possible to identify the main benefits of HFHs, which are summarised in Table 4 .

Stroink and Nelson (2013) considered HFHs as Complex Adaptive Systems. Identifying the phases of adaptive cycles can be a useful way to conceptualise and analyse the dynamics of the systems and understand their vulnerabilities and strengths. Mittal and Krejci (2017) approached HFHs by developing a hybrid simulation modelling framework for improving inbound logistics operations. An agentbased model is used to model the

Table 4
Benefits of Hybrid food hubs.

Hybrid food hub benefits	Authors
HFHs facilitate the cooperation and a more direct connection between farmers and consumers, help build up fluid and transparent communication between food chain actors and improve their relationships.	Cleveland et al., 2014 ; LeBlanc et al., 2014 ; Klein and Michas, 2014 ; Cohen and Derryck, 2011 .
HFHs offer fair prices for farmers who receive the rightful reward for their work.	Schmidt et al., 2011 ; LeBlanc et al., 2014 ; Cohen and Derryck, 2011 .
HFHs are vehicles to make the food supply chain more flexible and shorter and reduce the time from field to plate.	Klein and Michas, 2014 ; Cleveland et al., 2014 .
HFHs allow savings in terms of time and costs associated with storage, distribution (transport and packaging) and marketing.	Cleveland et al., 2014 ; Jablonski et al., 2011 ; Schmidt et al., 2011 .
HFHs are vehicles for consistent and timely deliveries.	Diamond and Bahram, 2011 .
HFHs can offer new distribution channels and new market opportunities for small and mediumsize farmers and, in the meantime, facilitate access by communities to local products.	Clark and Inwood, 2016 ; Cleveland et al., 2014 ; LeBlanc et al., 2014 ; Schmidt et al., 2011 ; Cohen and Derryck, 2011 ; Jablonski et al., 2011 ; Bloom and Hinrichs, 2010 ; Klein and Michas, 2014 .
HFHs enable smallscale farmers to supply institutions by providing a channel for information flow, supporting logistics, increasing the ability to satisfy institutions' requirements for consistency, quantity and quality. From an institutional point of view, HFHs offer a real opportunity to access local food and reflect a more sustainable food system in their food procurement.	Cleveland et al., 2014 ; LeBlanc et al., 2014 ; Izumi et al., 2010 .
HFHs facilitate the improvement of the nutritional status of school children by enabling access to fresh and . nutritious food.	Vogt and Kaiser, 2008
HFHs increase the quality, quantity, variety and consistency of available products by aggregating food from different farms.	Schmidt et al., 2011 ; Jablonski et al., 2011 .
HFHs play an educational role: they increase the awareness of short food supply chain goals amongst communities and farmers, which is a prerequisite for a longterm local food system development.	Cleveland et al., 2014 ; LeBlanc et al., 2014 .
HFHs increase transparency and convey farmers' identity along the supply chain.	Jablonski et al., 2011 ; Cohen and Derryck, 2011 ; Klein, 2015 ; Klein and Michas, 2014 .
HFHs help supply local food to lowincome community members.	Jablonski et al., 2011 ; LeBlanc et al., 2014 ; Cohen and Derryck, 2011 ; Levkoe and Wakefields, 2011 .

delivery scheduling behaviour of producers, which is a tradeoff between convenience and autonomy. A discreteevent simulation model captures producers arrival and inbound operations. The simulations make it possible to observe the effect of the scheduling behaviour of producers on the efficiency of inbound operations.

There is a significant risk connected with HFHs that needs to be taken under control: the commercial motivations of a distributor may prevail over those of the alternative food network, and the alternative systems may end up turning into conventional ones (Izumi et al., 2010 ; Bloom and Hinrichs, 2011). Further, scaling up local organic food systems by introducing a third actor can generate tension between the will to involve a large number of local farmers and the related practical economic and logistical difficulties connected (Milestad et al., 2017). Specific vulnerabilities have been detected for Nonprofit HFHs. Nonprofit HFHs initially rely on grant fundings, which are external and unstable funding sources, and this means they have to face economic sustainability challenges. Besides, Nonprofit HFH workers are often volunteers, which means they could be unreliable or unqualified, and this could compromise service quality (LeBlanc et al., 2014 ; Jablonski et al., 2011 ; Klein and Michas, 2014).

Rogers and Fraszczak (2014) examined four platforms in France and found that platforms are not seen as an "intermediary", but as a "tool". Nevertheless, some farmers, are sceptical about adhering to a platform, probably due to their not complete understanding of how platforms work. Paciarotti and Torregiani (2018) investigated the introduction of a platform to promote local food consumption amongst restaurants. In agreement with Rogers and Fraszczak (2014) , they highlighted the need for a raiseawareness campaign to promote a deeper understanding of platforms' scope and operation mode. Individualism, lack of trust and lack of willingness to cooperate thwart the establishment of successful initiatives (Volpentesta and Ammirato, 2013).

3.4.2. Innovative distribution patterns

The introduction of innovative distribution patterns has made it possible to overcome some of the logistics limitations of SFSCs. This section illustrates four innovative distribution systems described in scientific literature.

Case study 1 (Le Velly and Dufeu, 2016).

The five fishermen of "AMAP Poisson" on the French island of Yeu Marée faced coordination problems related to the preparation, shipping and distribution of fish boxes by reengineering their distribution system. They established two separate associations: a cooperative and an economic interest group (EIG). The cooperative buys the fish from "AMAP Poisson" fishermen at auctions, just like other intermediates, and prepares and ships fish boxes to the EIG on the continent. The EIG takes care of payment operations and deliveries to pickup points. At each pickup point, one or two consumers order the fish boxes at the beginning of the year and coordinate the management of the fish boxes during the distribution to final consumers. The innovation in logistics results in higher income for fishermen, but requires a further improvement as far as the connection between producers and consumers is concerned. "AMAP Poisson" is a hybrid system that combines the characteristics of alternative and conventional chains: it uses existing food supply chain infrastructures and processes for alternative fish distribution.

Case study 2 (Van der Ploeg et al., 2012).

In the Netherlands, a group of 85 farm shops are interconnected by circular patterns. There is no linear and hierarchically controlled structure, but each farm shop operates as both an entry and exit point in the supply chain. In addition to their own products, the farm shops also sell products from other farmers. Further, they exchange products outside their production with other farm shops. This structure leads to an increased catchment area and a widening range of products available in each farm shop. In order to further increase the catchment area and flexibility, the farm shops also sell through farmers' markets, box schemes and the Internet. The high level of intertwining between the farm shops creates significant synergies and contributes to the stability of the system.

Case study 3 (Van der Ploeg et al., 2012).

In Brazil, the rural movement Ecovida developed a system that connects several local markets located in different ecosystems through selforganised transport lines. Ecovida farmermembers use their small trucks to transport the surplus products of a market, whether their own or of other farmers, to another market where those specific products are in shortage. Instead of oneway deliveries, the food flows through routes, with a consequent higher load rate of vehicles. The Ecovida distribution pattern provides higher prices for famers and reduces sales uncertainty. The expansion of the distribution system makes it possible to connect different ecosystems and, consequently, enlarge the range of products available to consumers, which is no longer limited to a particular season.

Case study 4 (De Bernardi and Tirabeni, 2018).

The Food Assembly (FA) was originally launched near Toulouse (France) in September 2011, but it has then spread to other countries such as Spain, Italy, Germany, Switzerland, the Netherlands, Belgium and Denmark. It is a hybridorganised market that merges the structure of a farmers' market and that of an online purchasing group, thus combining the facetoface benefits typical of farmers' markets with a technological web platform. Structurally, the FA has a hierarchical organisation: at the top, an administrative team maintains the online platform, coordinates and promotes the service. At a national level, the "Mother Hive" (the national FA) is the network coordinator for the "Local Hives" spread all over the national territory and is responsible for management, strategy, research and development as well as communication. The actors in the "Local Hives" are a Leader Assembly, producers and consumers. The Leader Assembly contacts, selects and controls local producers who want to be part of the "Local Hive", finds the place and decides the date for the distribution and collection of products. The "Leader Assembly" also has the task of promoting the initiative through activities that strengthen the connection between local producers and local community. Producers are responsible for entering their farm data on the web platform and listing the quantities and prices of their available products. Consumers order directly via the online platform and collect the preordered goods at the popup market. The management of payments and invoices takes place directly between single producers and consumers. The success of the service depends upon the energies and efforts of all the actors involved. Further, technology plays an essential role in service realisation.

The case studies illustrated do not propose traditional linear supply chains but rather supply chain networks (Lu and Wang, 2008) where the actors involved play different and complex roles. The flows of food between the different physical nodes of the network (production sites, farm shops, farmers' or local markets, pickup points and consumers' homes) are summarised in Appendix 3 . One of the main strategies to overcome logistic limitations is to adopt horizontal and vertical integration between the actors of the chains, which has proved to be strategic in various sectors (Pomponi et al., 2015 ; Brekalo and Albers, 2016) and it is also crucial for SFSCs (Engelseth, 2016). As it emerges from the case studies illustrated, strong cooperation between actors makes it possible to build an innovative and efficient logistic model and increase the probability of success of SMEs in the food sector (Wagner and Young, 2009). In cases 4, Information and Communication Technologies play a crucial role. Virtual cooperation is strategically used for achieving a broader market and increasing sales volume; it also enables farmers to exploit profitable opportunities in a volatile context. New technologies allow small producers to be competitive in the current market (Todorovic et al., 2018 ; Collison et al., 2019).

The new logistical models proposed try to aggregate small producers, so they can share costs and open to a broader market which they would not be able to support alone. The short distance between the different actors encourages the establishment of reciprocal help and dependence, which makes the chains more efficient and makes it possible to fill the supply gaps of single producers. It is thus deduced that the efficiency of SFSCs is maximised with the creation of a structured network, where the flow of goods and information follows a precise, nonfragmentary path.

3.5. Implications for practitioners

Compared to the actors in conventional food systems, small farmers often own only small resources for investment in production, processing, logistics and marketing. Thus, their capacity to expand their business and compete within the largescale food industry is limited, and this could determine their exit from the business. The short food supply chain can represent a way to reevaluate farmers' role and control of their products along the supply chain as well as an opportunity to achieve higher market shares and higher income, establish direct contact with final consumers, and expand their business (Feagan and Henderson, 2009 ; Bazzani and Canavari, 2013). Short supply chain practices are becoming more and more widespread in recent years, however their economic impact, sustainability and chance of dissemination seem to be hindered by the lack of experience and knowledge (Jarz ˛ebowski and Bezat, 2018). To successfully achieve the potential benefits of SFSCs, one of the first key factors is to be aware of the strategic importance of logistics: small farmers have to deal also with logistics activities, and this should not be perceived as a minor and noncore function. Farmers must become the first actors in reaching logistics efficiency. To this aim, with regards to their attitude, farmers should be open to:

- innovative distribution systems, where the roles of the main actors involved can be modified, exchanged or enriched (Le Velly and Dufeu, 2016 ; Van der Ploeg et al., 2012 ; De Bernardi and Tirabeni, 2018).
- vertical and horizontal collaboration (Engelseth, 2016), because reciprocal help and dependence increase full chain efficiency and make it possible to overcome the weaknesses of individual farmers. Moreover, they should make an effort to achieve a deep understanding of scope, operational modes and potential benefits of tools like logistics platforms (Rogers and Fraszczak, 2014 ; Paciarotti and Torregiani, 2018). Further, they should be willing to collaborate with other farmers or other supply chain stakeholders.
- cooperation with researchers in order to provide an indepth analysis of the current situation and find and implement a solution for the weaknesses identified. Optimised cooperation should be based on user orientation, decentralisation, informal modes of experimentation, externalisation of tacit knowledge and economic considerations (Hoffmann et al., 2007).

From a logistics perspective, several improvements can be implemented to make SFSCs more sustainable and competitive compared to traditional food systems. In Table 5 the different ways in which it is possible to act and the dimensions of sustainability on which these actions could have a direct positive impact are summarised.

Table 5
Logistics Improvement opportunities.

Logistics Improvement opportunities	Sustainability dimension of impact
Optimise and pay attention to all the phases of food distribution, from storage to handling, from packaging to consumer trips	Environmental integrity, Economic resilience
Make careful choices for the transportation phase, e.g. type of vehilcle, fuel, transport load	Environmental integrity, Economic resilience
Optimise routes in the distribution phase	Environmental integrity, Economic resilience
Optimise the location of the strategic nodes of the supply chain network	Environmental integrity, Economic resilience
Restructure the supply chain by creating or adhering to Hybrid Food Hubs or innovative distribution patterns fitting the features of local territories	Good governance, Social weebeing

4. Conclusions

Logistics is one of the six core processes that contribute to the functioning of SFSCs (Maciejczak, 2014) and it is a complex and dynamic element which can be characterised by different maturity levels. Logistics is the main challenge to be faced for the development of short food supply chains that are able to represent a concrete alternative to the globalised food model (Nsamzinshuti et al., 2017).

This paper summarises the literature on logistics to make the topic more understandable and transparent for practitioners and researchers and highlight possible future research and development areas. The main research themes that emerged from the analysis carried out are: elements of logistics affecting the environmental impact of SFSC, location and route optimisation, improvement of SFSC logistics through supply chain restructuring and other logisticsrelated issues. From the literature analysis it emerges that supply chain reengineering, logistics innovations, network creation or improvement, cooperation between actors and logistics services are all strategic tools for the sustainability and development of SFSCs. Logistic literature proposes a shift from inefficient systems to new coordinated scenarios with an optimal positioning of critical network nodes. The new models proposed try to find a balance between local civic agriculture values such as transparency, environmental protection, health promotion and social fairness, and the typical factors of large supply chains such as efficiency, standardisation and accessibility.

Based on the analysis of the different papers considered, the following broad areas seem to need further investigation from researchers which may lead to promising results:

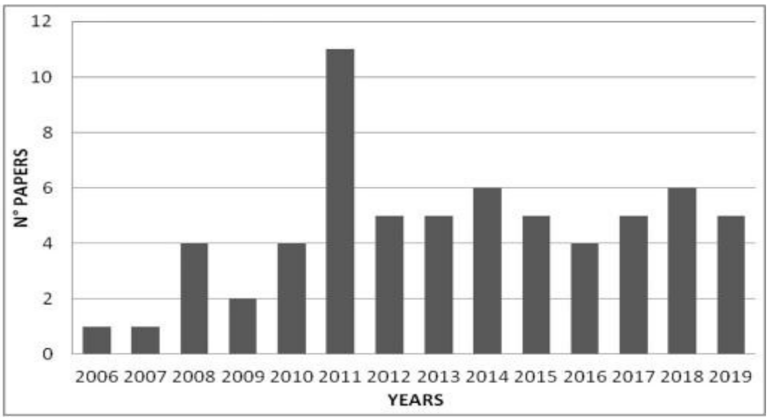
1) It seems to be impossible to state whether local food systems produce lower emissions compared to conventional ones (EdwardsJones et al., 2008). The parametric approach (Coley et al., 2009 ; De Cara et al., 2017) could be an interesting way to define under which conditions the short supply chain has lower environmental impact than the conventional one. In the authors' opinion, the parametric approach should be further developed and implemented. Based on the analysis of the papers on the matter, the main parameters affecting SFSC environmental impact are food supply chain structure, locally available infrastructures, supply chain supporting activities, food storage, vehicle load factors, consumers' trips, packaging, vehicles used, type of production, geographical distribution of consumers, retailers and producers and vehicle routes. Further research should develop a parametrical model applicable to different contexts. The model could provide a useful tool to better understand the environmental impact of SFSCs during both the planning and the reengineering stages.

1) The papers that include consumers' trips in their research consider the trips consumers make from their home to a single sales point to purchase a single product. However, consumers might need to go to several sales points to meet their dietary needs. This aspect could be taken into consideration in future studies. In this way, the comparison with conventional markets, where consumers can purchase a whole range of food products all in the same place, would be more meaningful. Likewise, the papers do not consider the trips of all the farmers that supply a farmers' market, which, however, should be taken into account to have a complete view of the impact of the whole system (Mariola, 2008).
2) As far as the methodological approach is concerned, the LCA used by academics in their research on SFSC could be enriched through contextualisation and integration with other scientific domains and disciplines to improve the interpretation of results (Sala et al., 2017). LCA should be applied in combination with social and socioeconomic Life Cycle Assessment. It is an assessment technique that "aims to assess the social and socioeconomic aspects of products" and services "and their potential positive and negative impacts along their life cycle encompassing extraction and processing of raw materials; manufacturing; distribution; use; reuse; maintenance; recycling; and final disposal." (UNEP/SETAC, 2009).
3) It would be interesting and useful to launch a discussion, amongst researchers and practitioners, on the current use of the studies on location and route optimisation analysis. Do farmers actually implement the clustering, logistics network integration, optimisation of collection/distribution centres and route optimisation approaches in their logistics activities and supply chain design? If this is not the case, these approaches remain only theoretical academic models, with a lot of potentials in terms of time, cost and environmental impact savings which, however, are not exploited. Then the focus should be moved to detecting possible implementation barriers and identifying practices and strategies to make research findings and developments more exploitable and applicable to and from the main actors of SFSCs.
4) Often, SFSC systems are developed and implemented by local and small actors with both low resources and IT knowledge. It could be useful to develop, validate and provide an online platform that can be easily used by stakeholders interested in a new implementation of HFHs.
5) The innovative distribution patterns proposed by literature are remarkable and rich in information and details, but they cannot be generalised or compared. Local food systems, in fact, operate within specific communities and are usually structured and organised differently, follow different strategies, and use dissimilar practices (Thornton et al., 2012). Future researches could analyse more case studies at both a national and international level and try to perform a comparative analysis. It would be interesting to test the replicability of specific and innovative SFSCs. This means verifying whether the chains can be replicated, expanded, scaled or adapted to different locations and by different communities. Heer and Mann (2010) surveyed 500 local food networks in Germany and showed that a broad spectrum of actors involved (vertical penetration) is of particular importance for the success of the networks. Along the same line, future research on innovative distribution patterns could focus on the critical factors of success, that is, those factors, variables or circumstances that may lead to success or failure.
6) More and more often, innovative distribution models, like the thirdparty logistics service providers involved in SFCS networks, are moving to bring ebusiness into their logistics operations. A topic that has not been developed yet concerns for those SFSC systems that use IT platforms. Consumer data analytics consists in the systematic gathering and analysis of information related to consumers and their buying behaviours. This information can be useful to better plan production and improve logistics services to meet consumers' requirements.
7) In the papers examined, existing methodologies are not used in combination (Matopoulos et al., 2015), and they are mainly focused on technical issues and leave out people involved and their behaviour. The inclusion of factors representing human habits (Mittal and Krejci, 2017) and behaviours (Mack and Tong, 2015) in SFSC models is a remarkable and useful approach to build models that fit reality better and should therefore be encouraged and developed. Further, this strongly interdisciplinary matter requires multicriteria methods (Schmitt et al., 2017) as well as synergies between natural and social science approaches so as to obtain an overall and more realistic understanding (EdwardsJones et al., 2008).

SFSC is a complex supply chain which is deeply connected to the territory and has a strong impact on it. It is a Valuebased supply chain that includes social, health and environmental values and implications. The development of a SFSC has both strong internalities and externalities for people, the planet as well as for profit/prosperity. Results coming from monoperspective technical analyses should not be taken as the only driver for building strategic decisions or orientating policies. When assessing SFSCs, a thorough analysis should take into account environmental, social and economic criteria. An analysis of SFSC logistics requires a holistic and integrated approach. Further, following Yang and Campbell (2017), the authors of this paper believe successful results could be obtained by abandoning a retrospective evaluation analysis in favour of a more dynamic and futureorientated point of view, introducing creative and innovative thinking, reinforcing the positive aspects and emphasising the use of scenario analyses.

Appendices

Appendix 1.

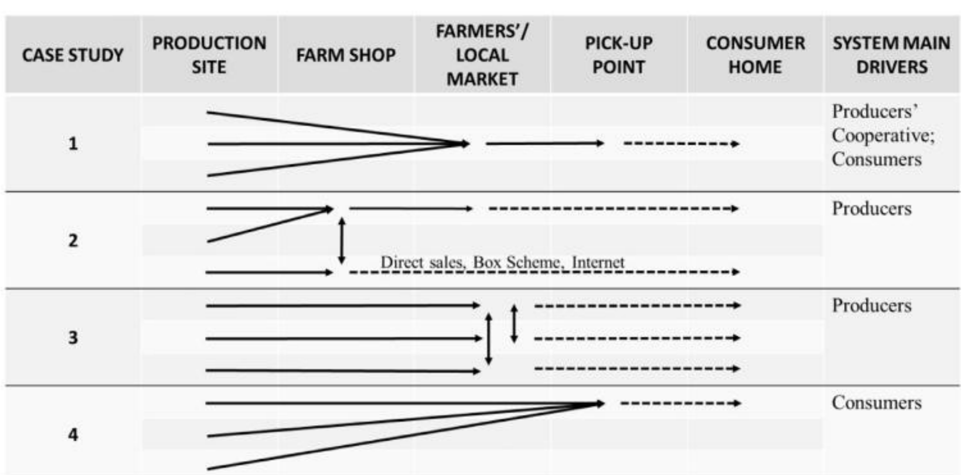


Appendix 2.

Number of publications per journals.

Journals	Number of papers
Journal of Agriculture, Food Systems, and Community Development	10
Agriculture and Human Values, Sustainability	5
Journal of Cleaner Production	4
British Food Journal, Journal of Rural Studies, Journal of Service Science and Management	3
Food Policy, Landscape and Urban Planning, Local Environment, Renewable Agriculture and Food Systems	2
Applied Geography, Biosystems Engineering, Emerging Science Journal, Environmental Management, Environmental Science and Technology, European Countryside, Food Transportation, International Journal Integrated Supply Management, International Journal of Business and Management, International Journal of Computer Integrated Manufacturing, International Journal of Production, Economics, Journal of Central European Green Innovation, Journal of Environmental Policy and Planning, Journal of Hunger and Environmental Nutrition, Journal of Peasant Studies, Journal of Regional Science, Journal of Simulation, Journal of the Scien ce of Food and Agriculture, Leopold center for Sustainable Agriculture, Packaging Technology and Science, Procedia Social and behav ioral Sciences, SocioEconomic Planning Science, Sociologia Ruralis, Studies in Agricultural Economics, Trends in Food Science & Technology	1

Appendix 3. Innovative distribution patterns.



LEGEND Continuous lines represent the food flow carried out by producers. Dotted line represent the food flow carried out by consumers.

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