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1 Sustainability impact assessments of different 2 urban short food supply chains: examples from 3 London, UK 4

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9

10 **Abstract**

11 Greater London has a vibrant food scene comprising of many different types of urban and peri-urban ‘short food supply
12 chains’ (SFSCs). This paper reports on exploratory research, which used examples of SFSCs from London to build a
13 more detailed understanding of different types of urban SFSC and their relative performance compared to each other.
14 To do this, we undertook a participatory Sustainability Impact Assessment (SIA) in which local food system
15 stakeholders were asked to rank the perceived impacts of five different urban and peri-urban SFSCs compared to the
16 current ‘mainstream’ food supply system (defined as supermarkets retailing mass-produced, standardised food
17 products). The SFSCs ranked were: (1) Urban Gardening (self-supply) (2) Urban Gardening (commercial), (3)
18 Community Supported Agriculture (CSA), (4) Direct Sale (on-farm) (5) Direct Sale (off-farm). Results from the SIA
19 showed that CSAs were regarded as delivering the highest overall social, economic and environmental benefits,
20 followed by Urban Gardening (commercial), Urban Gardening (self-supply) and Direct Sales (off-farm). The lowest
21 overall rating was for the supply chain Direct Sales (on-farm). All five SFSCs were ranked highest on the social aspects
22 of sustainability. Following the participatory SIA of perceived sustainability, we next developed a questionnaire in
23 order to test the feasibility of measuring the specific (rather than ‘perceived’) impacts of an urban SFSC. We applied the
24 test at a community-led local food market in South London, where we conducted face-to-face interviews with all market
25 stallholders (18 respondents) and a random sample of consumers (51 respondents). Results from the community-led
26 market were similar to those acquired at the SIA workshop, with greater agreement about the social benefits of the
27 market, compared to economic and environmental impacts. The results also suggest that producers underestimated
28 consumers’ willingness to share the risks that the producers face and we identify this as an important aspect for future
29 research. The paper concludes with reflections on the strengths and weaknesses of the SIA methodology.
30

1 **1 Introduction**

2 In the past few decades, short food supply chains (SFSCs), local and regional food systems and attempts to (re-)
3 connect consumers with food producers have attracted increased international research and policy attention (Marsden et
4 al., 2000; Kneafsey et al., 2008; Deakin et al., 2015). The European Union’s rural development regulation (1305/2013),
5 for example, contains a number of measures to promote SFSCs with the primary aim of improving farmers’ incomes
6 and thus helping to support rural economies. In the United States, federal policies to support local food systems were
7 expanded in the 2008 Farm Bill and the 2014 Agricultural Act (Martinez, 2016). Whilst these policies have been
8 oriented primarily towards boosting rural development and farmer livelihoods, many local food systems and short food
9 chains are based in urban and peri-urban contexts (Opitz et al. 2016). They have been stimulated by demand from urban
10 ‘food citizens’ interested in the social, environmental, ethical and health qualities of food (Renting et al., 2012;
11 Sonnino, 2016) and many cities now have well-established food policies and food councils which include amongst their
12 objectives the re-localisation of urban food supply (Chiffolleau et al., 2016). There have been numerous studies making
13 the case for the multifunctional and cultural capacity of urban food systems to promote social inclusion, pro-
14 environmental behaviours, health and well-being in urban communities (Wiskerke, 2009; Zasada, 2011; Mundler and
15 Rumpus, 2012; Dimitri et al., 2016). Moreover, the concepts of urban agroecology, circular economy and urban
16 metabolism emphasise the interaction between urban areas and peri-urban agriculture, via waste disposal or water
17 management, for example, or the establishment of close market relations (Wibbelmann et al., 2013; Tornaghi, 2014;
18 Florin and Renting, 2015).

19
20 Despite this increased general attention to urban and peri-urban food systems, relatively little research has critically
21 examined the impacts of the different types of SFSCs that now operate in urban settings. Several recent studies have
22 proposed typologies of SFSCs (Aubry and Kebir, 2013; Kneafsey et al., 2013), but few have compared the relative
23 merits and impacts of the different types of SFSCs in large cities. Doernberg et al. (2016) have for instance assessed the
24 potential contribution of different regional organic food supply models to a sustainable metropolitan food system, but
25 limiting the comparison to organic retail trade and Community Supported Agriculture (CSA) examples. This paper
26 therefore addresses this knowledge gap by using and adapting a Sustainability Impact Assessment (SIA) methodology
27 to examine a broader variety of SFSCs operating in one of London’s inner city boroughs. SIA is a widely applied
28 methodology (Ness et al., 2007) and is used by the OECD (OECD, 2010), the EU (European Union, 2016) and Food
29 and Agricultural Organisation (Yakovleva et al., 2010; FAO, 2013). Building upon the EU’s approach towards SIA, we
30 developed indicators (Table 1) aiming at the integration of the three ‘classic’ sustainability dimensions: environmental,
31 economic and social. The research was undertaken as part of the Foodmetres project, which modelled the potential to
32 increase food production and short food chains in urban and metropolitan regions surrounding six major cities in the EU
33 and Kenya (Wascher et al., 2015; Zasada et al., 2017). The main objective of this paper is to present the results of two
34 sustainability impact assessments of different SFSCs operating in Greater London. The first reflects the perceptions of
35 various food chain stakeholders who took part in a workshop to compare the performance of different types of SFSCs;
36 the second reports on the viewpoints of food producers and consumers regarding specific sustainability impact areas at
37 a community-led local food market.

2 Concepts and Methods: Short Food Supply Chains and Sustainability Impact Assessment (SIA)

2.1 Short Food Supply Chains in Urban Settings

SFSCs operate with a reduced number of intermediaries between producer and consumer, when compared with 'conventional' complex food chains. The foods involved are identified by the locality, or even specific farms, where they are produced. A vital feature of SFSCs is that the product reaches the consumer embedded with information, which allows the consumer to make 'value-judgements' about the food and the production methods involved (Marsden et al. 2000). In SFSCs, emphasis is placed on building trusting and transparent commercial relationships between producers and consumers. Information about the food, producer and production methods can be conveyed either on packaging or in person through verbal communication at point of sale. Regarding the number of intermediaries typically involved in a SFSC, the idea is that these are kept to a minimum. In France, for example, SFSCs or *circuit court* (direct translation: short circuit) are widely understood as having no more than one intermediary between producer and consumer. Intermediaries can include shops, retailers, restaurants, school canteens and collective groups who enable producers to access markets. In cases where the producers and consumers are in the same region, the term *circuit court de proximité* is used. Similarly, Kneafsey et al. (2013) split SFSCs into 'proximate' or 'distance' types. The former involve face-to-face sales and direct sales and are characteristic of 'local' food systems. The latter can also be direct sales, but often involve an intermediary and may also be based on internet sales. Adopting a slightly looser definition than that used in France, the European rural development regulation (1305/2013) states that a SFSC involves a 'limited number' of economic operators, committed to co-operation, local economic development, and close geographical and social relations between producers, processors and consumers. However, a Commission delegated regulation (11.03.2014) stipulates that support for the establishment and development of SFSCs shall cover only supply chains involving 'no more than one intermediary between farmer and consumer' (Article 11). The EU regulations, in common with the early definitions of SFSC, recognise the importance of social relationships between people involved in the food chain. This point has been reinforced further in a recent report by a European expert focus group on SFSCs, which stressed that they are "much more than simply a tool for improving farm incomes" and can also be seen as "a means to restructure food chains in order to support sustainable and healthy farming methods, generate resilient farm-based livelihoods (in rural, peri-urban and urban areas) and re-localise control of food economies" (EIP-AGRI 2015: 5). The report emphasises the main reason for shortening food chains is to reduce the number of intermediaries in order to achieve more transparent food chains, where the producer retains a greater share of the value of the food that is sold, and where intermediaries act as valued and trusted partners in the chain. For the purpose of the research reported in this paper, five main types of 'proximate' SFSCs were chosen for the SIA. They were identified from an exhaustive list developed in the FOODMETRES project (Zasada et al., 2014) and are described in Table 2.

They were identified as being of most relevance to the context of the Greater London urban food system, based on a review of secondary data and expert advice from representatives of Sustain (Sustain is a national Alliance for Better Food and Farming in the UK, and was a partner on the Foodmetres project). They all feature zero or maximum one intermediary between producers and customers, where the customer is understood as the entity buying the food (e.g. a restaurant, hotel or person).

2.2 Sustainability Impact Assessment (SIA) of SFSCs

The SIA approach adopted in this study consists of a normative approach, which uses a benchmarking method to assess the different SFSCs regarding their maximum benefits in comparison to 'conventional' long distance, complex food

1 chains. The SIA was designed as a tool to enable qualitative assessments to be undertaken by knowledgeable actors
 2 such as food chain participants, civil society organisations, and food chain researchers. Three sets of indicators were
 3 developed to assess the social, economic and environmental performance of SFSCs. The indicators were chosen based
 4 on an extensive review of existing research and the SIA was first pre-tested by the Foodmetres consortium and then
 5 pilot tested by 37 internationally based academic researchers. As a result of the tests, the number of indicators was
 6 reduced from 18 to 15 and many were re-worded (for a detailed description of the methodological development please
 7 see Zasada et al., 2014). Table 1 provides a detailed description of the indicators, which were finally chosen.

8 *Table 1: Detailed explanation of the 15 indicators used for the Sustainability Impact Assessment (SIA)*
 9

<i>Environmental Sustainability</i>
1. Enhance eco-efficiency in abiotic resource use (land/soil, water, nutrients): each food chain type is related to certain farming or gardening systems, which may use abiotic resources more efficiently or not (good input-output-relation under given regional conditions).
2. Enhance provision of ecological habitats and biodiversity: each food chain type is related to certain practices, which may enhance the provision of ecological habitats (hedges, trees), cultivate a wider range of crops and livestock including breeding of traditional or rare species and increase biodiversity in the farming system and beyond.
3. Animal protection and welfare: Farming systems connected to certain food chains may result in different conditions for livestock.
4. Reduction of transportation distance and emissions: a chain type may be related to a shorter transportation distance (“food miles”) and possibly a different mode of transport with less emissions and use of road infrastructure (e.g. trains versus trucks).
5. Recycling and reduced packaging: a chain type may be related to reduction of the amount of packaging along the whole food chain and be able to recycle most or all of the input materials.
<i>Economic Sustainability</i>
6. Generating employment along the food chain: a chain type may create or enhance paid jobs (full- and part time, including opportunities for self-employment and volunteering) within the metropolitan region.
7. Generating long-term profitability: a chain type may generate income and surplus for the actors along the value chain, which can be reinvested and support the long-term economic viability of all types of food enterprises along the chain.
8. Regional viability and competitiveness: a chain type may be related to regional multiplier effects in the metropolitan and nearby rural areas through e. g. regional value added, income and employment generated, tax revenues.
9. Enhance transport cost-efficiency from producer to consumer: a food chain type may enhance or reduce the cost-efficiency of transport which includes e. g. adequate vehicles, capacity utilisation, reducing the number of trips and unloaded drives.
10. Reduction of food waste and losses: a chain type may support the reduction of food waste or harvest losses (e.g. due to marketable yield size) at production stage, but also waste along all stages of food production, supply including consumption at home or out of home (restaurants etc.).
<i>Social Sustainability</i>
11. Food safety and human health: a food chain type may result in the absence of pathogens and pollution in the food. Food may comply more or less with legal limits regarding microbiological, chemical or physical hazards.
12. Food quality (freshness, taste and nutritional value): a food chain type may result in the provision of food which is fresh, tasteful and has good nutritional value.
13. Viability of food traditions and culture: a food chain type may result in increased or decreased preservation of cultural distinctiveness, seasonal variation and local food traditions. This includes the knowledge about its preparation and cultural role including religious, ethnic or spiritual purposes.
14. Transparency and traceability: a food chain type may result in the increase or decrease of both. Transparency refers to information for the consumer about the way the food is produced and distributed. Traceability refers to the availability of information at each stage of the supply chain. Examples are direct trust-based consumer-producer relations or the use of labelling schemes (e.g. regional & fair, PDO, PGI, organic) or tracking of produce with smart codes and website information.
15. Food security and food sovereignty: a food chain type may result in the increase or decrease of both. Food security refers to the availability and accessibility of food, meaning that all people, at all times, have physical, social and economic access to sufficient food. Food sovereignty goes a step further and means that people also have the right to have “a say” or “ownership” (sovereignty) on how their food is produced and supplied, including e.g. how profits, risks and public research inputs are distributed.

10

11

12

1 *Table 2: Description of the five urban and peri-urban short food supply chain types (1-5) being assessed against the*
 2 *current mainstream scenario – supermarket supply chain as baseline or control.*
 3

	SFSC Type	Description	Relation Type
<i>Baseline (Control)</i>	<i>Current mainstream scenario</i>	<i>Global food chains with distribution via large retailers</i>	<i>Corporate chains</i>
1	Urban gardening for private consumption	Food production in the urban setting for own consumption (hobby or professional)	Consumer as (co)-producer
2	Urban gardening for commercial purposes	Community oriented food production in the urban setting (incl. social enterprises)	Business-to-business
3	Community Supported Agriculture (CSA)	Network or association of individual consumers supporting one or more local farms and/or food producers/processors	Consumer-producer-partnerships/cooperatives
4	Direct sales on-farm to private consumer	Producers sell their products directly on their farm or production site	Business-to-consumer
5	Direct sales off-farm to private consumer	Producers sell their product at a market in the urban area or deliver a box-scheme or mail supply.	Business-to-consumer

4 As can be seen in Table 1, the SIA in effect asks respondents to make judgements about the expected environmental,
 5 economic and social impacts of different types of SFSCs. So for example, in the environmental impacts section,
 6 respondents are asked to make assumptions about the type of production systems and transport distances involved with
 7 SFSCs. This reliance on assumptions could be viewed as a weakness of the SIA, but our approach is based on the idea
 8 that gaining an insight into the perceptions and knowledge of different food chain stakeholders is essential for
 9 supporting transitions towards more sustainable food systems. Their assumptions are highly valuable because they are
 10 grounded in the practical realities of trying to build viable sustainable food systems, which deliver a range of public and
 11 private goods in a particular social and spatial context. The information given to participants regarding SFSC and the
 12 baseline is shown in Table 2. In addition, practical examples in London for each type of supply chain were discussed
 13 before the SIA exercise. Further information on how the method was applied is found in section 3.1.

14 **3 Application of the SIA: A Case Study from Lambeth**

15 For this research, we worked primarily with stakeholders in the inner city London borough of Lambeth (population
 16 318,000), which has a history of early and progressive engagement with urban food system sustainability and
 17 governance issues. For example, in 2013 it launched a multi-stakeholder Food Partnership with a vision “to galvanise
 18 organisations and individuals to cultivate a healthier and more sustainable local food culture. By working together we
 19 are greater than the sum of our parts” (Lambeth Food Partnership, 2013). The aims of the Food Partnership are to 1)
 20 Develop stronger and healthier communities, 2) Develop a resilient and sustainable environment and 3) Develop a
 21 vibrant and prosperous economy (Lambeth Food Partnership 2013). Within this context, there is considerable interest
 22 amongst local civil society actors, enterprises and public sector agencies in supporting local food systems and
 23 community-led food trade to deliver health and sustainability outcomes – although the terminology of ‘short food
 24 chains’ is not so widely used. We applied the SIA methodology in two different ways. The first was in a participatory
 25 workshop, organised in Lambeth and the second application consisted of a survey at a local food market in the south of
 26 the borough, in which we developed questionnaires for market stallholders and market customers, based on the
 27 indicators in the SIA.

1 3.1 SIA Workshop

2 The participants at the SIA workshop were citizens, food entrepreneurs, food growers, food researchers and local policy
 3 makers. The invitation to the workshop was shared widely through the network of the Lambeth Food Partnership and
 4 social media. As only interested people participated, the sample was self-selected and based on the people connected to
 5 London food networks. The workshop was held in Lambeth Town Hall in March 2014, and 17 participants were given a
 6 brief introduction to the SIA methodology. Participants were asked to assess the five different types of SFSCs described
 7 in Table 2, using a matrix with the 15 indicators (Table 1). Vegetable supply chains were selected as they are present in
 8 all five urban SFSCs and in the ‘baseline scenario’ which was defined as ‘where most of the urban population’s
 9 vegetable supply comes from – namely supermarkets, long food chains and large-scale producers.’ Following the
 10 introduction to the SIA and the explanation of the matrix, workshop participants were invited to fill in the SIA-matrix in
 11 small groups (each had to reach a consensus on the scoring). Participants were asked to think about how each of the five
 12 SFSCs compares to the current ‘mainstream’ or ‘baseline scenario’. A Likert scale impact measure (from ‘very negative
 13 impact’ (-3) to ‘no impact’ (0) to ‘very positive impact’ (+3) was used to assess what they (as citizens, food
 14 entrepreneurs, local policy makers etc.) would expect to realistically happen if there were increases in the amount of
 15 vegetables supplied through the different types of SFSCs. The participants discussed the timeframe of the impact and
 16 collectively settled on ‘medium term’, which was defined as five years.

17 All stakeholders at the workshop completed the SIA matrix. One form was incorrectly completed and excluded from the
 18 analysis. While for most participants the matrix was self-explanatory and understandable a few questioned the
 19 definitions and wanted to know more detail and clarification. There was a lively discussion in each group about why
 20 and how they rated the impacts as they did. An important outcome was that workshop participants wanted to know if it
 21 would be possible to test the SIA on a specific example of a SFSC, rather than basing results only on their own
 22 perceptions, and it was this suggestion, which led the research team to develop the next phase of the study (see next
 23 section, 3.2).

24 3.2 Sustainability Impact Assessment (SIA) of community-led local food market with urban and peri-urban 25 short food supply chains

26 To gather additional information related to the different sustainability impact areas, we further carried out a
 27 questionnaire survey at a community-led, not-for-profit food market in South London, which aims to support small-
 28 scale, sustainable and local farmers primarily from Greater London and the counties of Surrey, Kent and Sussex. During
 29 two days, we conducted face-to-face interviews with all the market stalls present (a total sample of 18 businesses/social
 30 enterprises). The market stallholders (called ‘producers’ in contrast to ‘consumers’ further on) represented all five types
 31 of SFSCs researched before. In addition, face-to-face interviews were conducted with all consumers willing to
 32 participate during a market day (51 consumers). The interviews were based on a structured questionnaire with mainly
 33 closed questions, following broadly the ‘Environmental’, ‘Economic’ and ‘Social’ issues discussed in the SIA
 34 workshop. It was not possible to extract exactly the same information as in the SIA workshop, but the aim was to try
 35 and gather data which would correspond broadly to the indicators, discussed in the workshop and could be use as proxy
 36 for the indicator. A key consideration was that data had to be collected in a 15-20 minute interview whilst the producers
 37 were working on their stalls, and so the questionnaire had to be relatively straightforward and easy to answer. The
 38 question text can be seen in Table 3 for businesses and Table 4 for consumers. Data were analysed using descriptive
 39 static methods. Means and Standard Errors are shown and a Student’s t-test with two distribution tails and a type 3 test
 40 (two-sample unequal variance (heteroscedastic) test) was conducted to compare the 18 producer data set with the 51
 41 consumer data set. Statistically significant differences were calculated for 0.1, 0.05 and 0.01 significance levels.

1 **4 Results**

2 **4.1 Sustainability Impact Assessment (SIA) of urban and peri-urban short food supply chains by stakeholders**

3 The results (Table 5) showed that there are considerable differences regarding the sustainability contribution between
 4 the different SFSC types compared to the baseline situation of a conventional retail chain. Among the SFSCs,
 5 ‘Consumer-producer partnerships/cooperatives (CSAs) rated highest for the combined social, environmental and
 6 economic impact with a value of 1.98. This was followed by ‘Urban gardening for commercial purposes’ with a rating
 7 of 1.80 and ‘Urban gardening for private consumption’ and ‘Direct sales off-farm to private consumer’ both with 1.70.
 8 The lowest overall rating (1.55) was for the supply chain ‘Direct sales on-farm to private consumer’. Among the three
 9 sustainability dimensions, social aspects show the highest scores for all five SFSCs. Economic and environmental
 10 aspects were rated considerably lower with little difference in between them. There was one notable exception: the
 11 economic impact of ‘Urban gardening for private consumption’ was rated a lot lower than the environmental impact
 12 (1.05 for economic versus 1.74 for environmental). This low economic rating is interesting and may indicate a rating
 13 only of the direct (monetary) economic benefits from urban gardening. Other research (Schmutz et al., 2014) shows that
 14 the indirect economic benefits (from health and wellbeing and from community life and life satisfaction) can be much
 15 higher than the direct (monetary) ones.

16
 17 The results for the individual indicators (Table 6) showed that within the social dimension ‘Transparency and
 18 traceability’ (2.46) closely followed by ‘Food quality’ (2.38) and ‘Food security and food sovereignty’ (2.09) were
 19 rated highest. This was followed by ‘Eco-efficiency of resource use’ (1.94) and ‘Food safety and human health’ (1.89).
 20 ‘Animal protection and welfare’ had the lowest rating (in vegetable supply chains the effects might be mainly indirect
 21 through low-meat, ethical-meat or vegan/vegetarian diets and their effect on demand for systems with different animal
 22 welfare). We conclude that economic issues are regarded as having the lowest expected impact rating and ‘Transport
 23 efficiency’, ‘Employment along the food chain’ and ‘Long-term profitability’ in urban SFSCs are in this bottom triplet.
 24 In addition, ‘Transport efficiency’ also had the lowest rating overall (1.33), and this was for the particular food supply
 25 chain of ‘Direct off-farm’. In other words, participants appear to agree that the current mainstream supermarket supply
 26 chain has a relative strength in ‘Transport efficiency’, especially if compared to other impacts of the current food supply
 27 mainstream. Another low impact (1.36) was on ‘Generating employment along the food chain’ for the supply chain
 28 ‘Urban Gardening (self-supply)’ which is not surprising given that this SFSC is primarily concerned with domestic food
 29 production for private consumption. Urban Gardening is strictly speaking a very short or ‘zero-chain’ food supply
 30 chain. However, since it is very common in London and supplies specific foods (e.g. fruit and vegetables) we have
 31 included it in the assessment. It is also often used in combination with other urban and peri-urban food supply chains.

32 **4.2 Sustainability Impact Assessment (SIA) of community-led market using urban and peri-urban short food** 33 **supply chains**

34 Results from the community-led market survey showed many similar answers from producers (Table 3) and consumers
 35 (Table 4). The majority of producers are certified organic or use organic ingredients, support the conservation of
 36 habitats and biodiversity and breed rare species (67%). Regarding transport efficiency, only a minority (11%) share
 37 transport or use renewable energy (25%). Just over half of the packaging used is recycled and recyclable, but a larger
 38 proportion (88%) think that the market helps contribute to reducing food waste. The average transport cost of £9.20
 39 (10.5 Euro) can be seen as a proxy for local delivery. This is about a 10.5 km return trip with a small delivery van (or 16
 40 km with a car), so the produce delivered to this market is truly local –not just perceived as local as in the SIA workshop.

1 In terms of economic impacts, this was the most difficult section of the SIA to convert into a survey format. Regarding
 2 the economic impact of the market on the enterprises, we found that an average of 33% of their total sales is processed
 3 through the community market. However, this share varies between 5% and 95% for individual producers. In addition,
 4 65% of the enterprises agreed that the market delivered indirect economic benefits to their business. Among the indirect
 5 benefits mentioned were: “other market requests”, “more interest in private, bespoke orders”, “more customers on our
 6 farm”, “larger customer base has increased internet service”, “marketing and testing products”, “difficult to say, but
 7 there are emotional benefits”, while others were “not sure” or had “no” or “not yet” seen any indirect economic
 8 benefits. The average number of people working at a market stall was 2.2 per stall, and almost a third of the enterprises
 9 used volunteer labour.

10 Our findings regarding the social impacts on the producer side are more definitive, with a large majority of cases using
 11 traditional knowledge and skills and providing information on their products. All the respondents agreed that consumers
 12 ask about the products, which underlines the importance of transparency and traceability in SFSCs. A sizeable majority
 13 (83%) agreed that the food at the market is affordable. In relation to customers visiting their farms, 57% said yes and
 14 71% of businesses felt their customers understand the risks weather can cause to producers. However only 38% think
 15 customers are willing to share some of these risks.

16

17 *Table 3: SIA questionnaire of all 18 producers at a community-led market using urban and peri-urban short food*
 18 *supply chains. Data show results for ‘Environmental’, ‘Economic’ and ‘Social’ issues. The question text is slightly*
 19 *shortened to fit the table. All answers are averages (mean) given in percentage (%-yes), £ Pound, persons or days. SE*
 20 *(standard error) for the entire population is also shown.*

21

	Mean	SE
<i>Environmental</i>		
1. Are organic (incl. bio-dynamic) certification or organic ingredients used?	67%	0.11
2. Is supporting habitats/biodiversity important?	67%	0.11
3. Are rare species or breeds used?	60%	0.12
4. Is transport shared?	11%	0.07
5. Is renewable fuel (including cycling or walking) used?	25%	0.10
6. Roughly how much does a trip to the market cost you (£ Pound)?	£9.2	£2.9
7. Is packaging used for your products?	82%	0.08
8. Is your packaging recycled and recyclable?	54%	0.11
9. Do you feel the market contributes towards reducing food waste?	88%	0.08
<i>Economic</i>		
10. How many people work at the market?	2.2	0.41
11. Are you using volunteer labour?	31%	0.10
12. What proportion of your total sales comes from this market?	33%	8.4%
13. Are there any indirect economic benefits to your business from this market?	65%	0.10
<i>Social</i>		
14. How fresh are the products (in days)?	1.47	0.21
15. Are you using traditional knowledge, cultural traditions or artisan craft skills?	91%	0.06
16. Do you give information on the product verbally?	94%	0.06
17. Do you give information on transparency and traceability?	96%	0.03
18. Do you think that food is affordable at this market?	83%	0.06
19. Do customers from this market visit your farm?	57%	0.11
20. Do you feel your customers understand the risks of farming?	71%	0.10
21. Do you feel your customers are willing to share some of those risks?	38%	0.11

22

23

1 *Table 4: SIA questionnaire of 51 consumers at a community-led market using urban and peri-urban short food supply*
 2 *chains. Data show results for 'Environmental', 'Economic' and 'Social' issues. The question text is slightly shortened*
 3 *to fit the table. All answers are averages (mean) given in percentage (%-yes), £ Pound, persons or days. SE (standard*
 4 *error) for the sample is also shown.*
 5

	Mean	SE
<i>Environmental</i>		
1. Estimate your average organic buying percentage (incl. outside of market)?	42%	0.04
2. Is supporting habitats/biodiversity important for you when buying food?	71%	0.06
3. Are you looking for rare species or breeds?	33%	0.07
4. Do you share transport to the food market with anyone?	43%	0.07
5. Do you use renewable fuel (includes walking or cycling) to reach the market?	80%	0.06
6. Roughly, how much does a trip to the market cost you (£ Pound)?	£1.2	£0.6
7. Do you recycle food waste (e.g. your own compost bin or green bin collection)?	96%	0.03
8. Are you actively looking for recycled packaging?	68%	0.06
9. Do you feel the market contributes towards reducing food waste?	72%	0.06
<i>Economic</i>		
10. Question not applicable to consumers		
11. Question not applicable to consumers		
12. What is the proportion of your household food spending at this market?	23%	2%
13. Are there any indirect economic benefits from visiting the market?	90%	0.04
<i>Social</i>		
14. How fresh do you think the product is (in days)?	1.37	0.11
15. Do you think traditional knowledge, cultural traditions or artisan skills are used?	89%	0.04
16. Have you received verbal information on the product?	85%	0.04
17. Have you received information on transparency and traceability?	80%	0.06
18. Do you think that food affordable at this market?	74%	0.05
19. Have you, or would you like to visit a producer/farm selling on this market?	20%	0.06
20. Do you feel you understand the risks of farming?	82%	0.05
21. Are you willing to share some of those risks?	90%	0.03

6
 7 Turning to the results of the consumer survey (Table 4), there are some interesting similarities and differences. The first
 8 point to note is that the consumers spend a relatively high proportion on organic food – the average of 42% is higher
 9 than national figures (the fresh produce share of organic in the UK is 23.5%, but the share of the total food and drink
 10 market in monetary value is currently around 1.5%, Soil Association, 2017). Just over 70% are looking to support the
 11 conservation of habitats and biodiversity through their food purchase. However, only 33% were looking for rare breeds
 12 or species whereas 60% of producers were using these (examples include ‘heritage wheat’ and ‘native’ meat breeds). In
 13 terms of environmental impacts, a higher proportion of consumers share transport and use renewable fuel than
 14 producers. A very high proportion of consumers (96%) recycle food waste and 68% look for recycled packaging,
 15 whereas only 54% of the producers offer recyclable packaging. Seventy two percent of consumers felt that the market
 16 contributes towards reducing food waste, whereas 88% of the producers felt this. Economic data show that consumers
 17 on average allocated almost a quarter of their expenditure at the market and that 90% felt that the market had indirect
 18 economic benefits, compared to just 65% of producers. For consumers these indirect benefits were different to
 19 producers with typical answers like “I now know the people selling”, “It brings happiness”, “It’s fun to hung out”, “A
 20 sense of community”, “Social contact to Transition Town & Edible Garden Communities”, “Knowing people like
 21 stallholders and patchwork farmers”, “Building confidence, trust, loyalty, friendships” “Wellbeing and food quality”,
 22 and “I like supporting things local not super-market”. While the 10% which could not see benefit said “no benefits” or
 23 “they selling just surplus” or “not now, but might be in the future”.

1 *Table 5: Average SIA rating for five different urban and peri-urban SFSCs. The results are shown for all dimensions*
 2 *combined ('SIA-all') and then for the individual dimensions 'Environmental', 'Economic', and 'Social'. The ratings*
 3 *range from -3 'very negative impact' to +3 'very positive impact' compared to current baseline supermarkets, which*
 4 *have a neural score (17 participants, details see section 3.1).*
 5

Urban and peri-urban SFSC	SIA-all	Environmental	Economic	Social
Community supported agriculture	1.98	1.81	1.83	2.29
Urban Gardening (commercial)	1.80	1.69	1.56	2.15
Urban Gardening (self-supply)	1.70	1.74	1.05	2.31
Direct sales off-farm	1.70	1.51	1.71	1.86
Direct sales on-farm	1.55	1.38	1.29	2.00

6
 7 Moving on to the social impacts, consumers had a slightly higher estimation of the freshness of the products (this
 8 question referred to fresh produce like vegetables and fish, cured meat and processed foods like juices were excluded as
 9 not applicable) compared to the information provided by producers - 1.37 compared to 1.46 days (Note: because of the
 10 nature of the two different viewpoints the question was not exactly the same: e.g. producers were asked what they know
 11 about how fresh produce is and consumers were asked what they think about how fresh produce is). The consumers
 12 were very close to the producers in terms of agreeing that traditional knowledge and skills are used (89% and 91%) but
 13 diverged a little in terms of information given on transparency and traceability. Whereas 96% of producers said they
 14 gave this information, 80% of consumers felt that the information was available. Similarly, whilst 94% of producers
 15 said they gave this information verbally, 85% of consumers felt that they had received this. There was a divergence in
 16 views on the affordability of food, with 74% of consumers agreeing it was affordable, compared to 83% of producers.
 17 Only 20% of consumers had either visited, or would like to visit a farm whereas 57% of producers had hosted visits
 18 (unsurprising given the larger number of consumers compared to producers). A particularly interesting finding is that
 19 82% of consumers felt they understood the risks of farming, whereas only 71% of producers felt this to be the case.
 20 Even more striking is that 90% of consumers said they were willing to share some of the risks of farming, whereas only
 21 38% of producers thought this would be the case.
 22

23 *Table 6: Fifteen different indicators with their sustainability dimension ('Environmental', 'Economic', 'Social'), ranked*
 24 *in order of their average rating for all five urban and peri-urban SFSC types.*
 25

Rank	Indicator	Dimension	Rating
1	Transparency and traceability	Social	2.46
2	Food quality	Social	2.38
3	Food security and food sovereignty	Social	2.09
4	Eco-efficiency of resource use	Environmental	1.94
5	Food safety and human health	Social	1.89
6	Recycling and reduce of packaging	Environmental	1.88
7	Reduction of food waste	Economic	1.85
8	Viability of food traditions and culture	Social	1.80
9	Provision of ecological habitats and biodiversity	Environmental	1.71
10	Reduction of transport distance and emissions	Environmental	1.71
11	Regional viability and competitiveness	Economic	1.53
12	Generating long-term profitability	Economic	1.37
13	Generating employment along the food chain	Economic	1.36
14	Transport efficiency	Economic	1.33
15	Animal protection and welfare	Environmental	0.88

1 Using a two-sample unequal variance t-test, we find no significant differences between the answers of producers and
2 consumers for most of the 21 questions. This is remarkable as producers and consumers seem to be in agreement on
3 many issues, there are however a few notable exceptions. First, producers provide more rare species and breeds (60%)
4 than consumers (33%) were actually looking for (0.1 significance level). Second, although 80% of consumers said they
5 received information on transparency and traceability, 96% (0.05 significance level) of producers stated that they had
6 given this information. Third, significantly more consumers (90%) than producers (65%) felt that the market delivered
7 indirect economic benefits (0.05 significance level). Finally, with the highest significance level (0.01) more consumers
8 said they were willing to share risks (90%), than producers believed would do so (38%).

9 5 Discussion and Conclusions

10 This paper has presented the empirical results of a participatory SIA of different urban SFSC types, which is
11 complemented by a survey among SFSC producers and consumers. The main objective was to gain an insight into how
12 stakeholders estimate the sustainability impacts of different types of SFSCs, which are found operating in London. The
13 paper does not compare a SIA of SFSC with conventional retail chains, such as supermarkets, but instead examines the
14 relative performance of different urban SFSCs compared with a common mainstream ‘control’. The results show that
15 stakeholders in the workshop SIA rated SFSCs as generally performing better than mainstream global food supply
16 chains. Emphasising the role of food and the human-centred interaction and behaviour around food and less the
17 economic activity of agriculture and commodity production, models of short food supply are shifting towards an arena,
18 where the food topic is linked to a multitude of other urban policy fields, sectors and functions, such as health,
19 education, social inclusion and civil society, urban renewal and quality of life. Compared to global agri-food systems,
20 the different types of SFSC may have the potential to cross-fertilise these topics directly or indirectly and to develop
21 multiple benefits for them, something which is framed as the “Multi-functionality of food” (Morgan, 2014). In this
22 sense, the spread of SFSC could re-link the food consumption and production domains and thus be a lever to induce
23 societal and behavioural changes, which are linked with a more conscious understanding of food. This includes the
24 reduction of food waste, consumption of healthier and more sustainable produced food, and ethical considerations or
25 increased knowledge and information around food and its origins. These impact areas were found to be relevant and
26 influential within our study, but our data also show that in practical SFSC examples producers and consumers are not
27 totally “in-sync” on everything. Although we found many remarkable similarities in perceptions (freshness, use of
28 traditional skills etc.) there were differences, especially in terms of producers underestimating consumers’ willingness
29 to share the risks producers face.

30 Our results also revealed impact performance differences between investigated SFSC types, which point to a specific
31 strength-weakness pattern of individual SFSCs regarding their contribution to a sustainable metropolitan food system.
32 Whereas, stakeholders believe that SFSCs generally have relevant impacts on the social dimension, particularly on
33 transparency, food safety and security, certain weaknesses or at least a minor contribution to sustainability are
34 perceived, such as for employment effects or transport efficiency. These findings are in line with research concluding
35 that the concept of food miles is of little use when discussing carbon emissions, with transportation mode being as
36 important as distance (Coley et al., 2014). The ability of SFSCs to generate more employment (compared to the
37 ‘control’ current mainstream) and long-term profitability was also in some doubt, although care is needed in
38 interpreting these results. For example, the inclusion of ‘Urban gardening (self-supply)’ has skewed the general results
39 for economic performance. As no commercial food trade is involved and no turnovers are generated, urban gardening
40 for self-supply can contribute little to direct income generation, it can however reduce household spending on food and

1 generate trade at garden-centres, mail order of seeds and other inputs. Already, Krikser et al. (2016) have identified
2 major differences between the various SFSC types, explicitly distinguishing social and commercial oriented models.
3 They also highlighted the special role of SFSC, which are based on self-supply, including the limited economic
4 benefits. Our findings concerning the strong contribution to social benefits mirrors research evidence which tends to
5 agree strongly on the social benefits of SFSCs, but is less conclusive in terms of environmental and economic indicators
6 (Kneafsey et al., 2013).

7
8 Overall, the participatory SIA process fills a gap between quantitative evaluations of certain commodity chains, which
9 focus on environmental effects (e.g. Life Cycle Analysis) and qualitative evaluation of single cases of SFSCs and offers
10 the possibility of a direct comparison of different types of short food chains. The advantage of the approach is that it
11 allows not only statements about the direction of an expected or perceived effect, but also about its intensity.
12 Nevertheless, if the SIA methodology is to be more widely adopted in stakeholder workshops we suggest further
13 refinement. Firstly, further work is needed to clarify the terminology so that all participants have a common
14 understanding of the indicators. Secondly, the pre-selection of the sustainability indicators and the focus on the three
15 ‘classical’ sustainability dimensions (Brunori et al., 2016) can be challenged. Using alternative methods like the ‘theory
16 of change’ used in Social return on investment (SROI Network - Social Value UK, 2012) could help avoiding static
17 categories and pre-selection of indicators and rather capture the values of stakeholders (Garden Organic, 2014, Schmutz
18 et al., 2014).

19 Combining the SIA workshop method with the SIA survey on a real example has proved valuable, because together
20 both methods enabled us to contrast perceptions of sustainability with data on sustainability at a specific site. It was also
21 possible to collect SIA data independently from consumers and producers and contrast them, too. In other words, we
22 conclude the methods might be stronger together than they would be on their own. Our attempt to convert the workshop
23 SIA into a survey-based SIA also highlighted some interesting results and lessons for future research. The most obvious
24 general finding is that both tools produced overall agreement on the social benefits of SFSCs. A valuable element of the
25 SIA survey was the attempt to generate comparable data from producers and consumers. This revealed interesting
26 similarities and equally differences around perceptions of affordability, transparency, and risk sharing. Most notably,
27 producers underestimated consumers’ willingness to share the risks producers face and this requires further research in
28 order to better understand the reasons for the different views; at this stage we do not know whether it is due to a
29 difference in how the concept of ‘sharing risk’ was understood or whether it may be attributable to a sense of caution on
30 the part of producers who are aware of the potential for consumers to change their buying behaviours should economic
31 conditions change. In addition, expressed willingness to share risk does not necessarily mean consumers will actually
32 do this, if this requires behaviour change. Risk sharing in agriculture (Meuwissen et al., 2001) has seen limited interest
33 in academic research and the consumer part of risk sharing has mainly been discussed in the CSA literature (Fieldhouse,
34 1996, Lamine, 2005). For example, Galt (2013) examining qualitative and quantitative data from 54 CSAs in the
35 California (USA) finds that farmers are not sharing production risks - rather than sharing farmers appear to take self-
36 inflicted economic hits and this remains hidden from the CSA members/consumers. Here too farmers/producers might
37 possibly underestimate their ‘consumers’ and supporters within the CSA, they also might not communicate risk
38 associated with farming. Risk sharing with producers as part of a new food culture is only just emerging as a concept. A
39 better understanding of risk sharing may lead to more resilience and trust in food supply chains.

40
41 In terms of the methodology itself, the SIA survey of the market was limited in its ability to evaluate economic impacts,
42 due to limited capacity to collect relevant data. Understanding the economic impact of SFSCs is complicated,

1 depending on whether the impact is measured in relation to a particular enterprise, or a place, for example. Moreover,
 2 farm businesses are often complex, and may make use of a variety of routes to market and unpacking the impacts of
 3 each one of these can be difficult without undertaking a full analysis of the business structures. Another particular
 4 weakness with converting the SIA into a survey format is that we were unable to gain a deeper qualitative
 5 understanding of what respondents had in mind when answering the question about ‘indirect economic benefits’. Any
 6 future research, we suggest, should aim to combine qualitative and quantitative methodologies in order to overcome this
 7 limitation. For both SIAs (workshop and survey) we also recommend that they should take into account a full
 8 understanding of the regional or local context within which SFSCs are operating. In all cases, assessments are highly
 9 context dependent: for example, whether a SFSC delivers well on food safety may depend more on national regulatory
 10 requirements rather than the nature of the SFSC itself and similarly, the economic viability of a SFSC is very much
 11 linked with the general economic health of the region in which it is located. Given these points, it is therefore important
 12 to note that the SIA is primarily a tool for gaining an insight into the perceptions and assumptions surrounding SFSCs
 13 in any given context. We conclude that further research is required in order to identify existing practical solutions or to
 14 develop new solutions, including social and technical innovations, which can improve these sustainability dimensions
 15 of urban and peri-urban SFSCs. A better understanding of the motivations, drivers and constraints of the urban social
 16 entrepreneurs who develop and make novel practical solutions, such as community-led local food markets a reality, is
 17 also required. SFSC have developed from their initial ‘farm income/ rural economy’ focus to social relationships
 18 between people and transparency and traceability (EIP-AGRI 2015:6) within food chains. Our data suggest they could
 19 develop further in the form of knowing, trusting and sharing of risks which farming faces. This could be a collective
 20 urban support and responsibility - sharing risks with the territory around the city.

21
 22

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