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HOW SUSTAINABLE SHORT FOOD SUPPLY CHAINS ARE?

A QUANTITATIVE ASSESMENT APPROACH

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Abstract

There is an on-going scientific and policy debate how to utilize the local food systems and Short Food Supply Chains (SFSC) in order to provide beneficial solutions to the society and rural areas. Producers that participate in these systems are supposed to gain a higher share of the value added and contribute to the development of local territories. It is believed, that local food systems and shortened food supply chains provide also benefits to the natural environment. However, to date, very little empirical evidence exists on the quantitative impact of varied types of food supply chains.

Given the shortcomings in the literature this presentation focuses on the quantitative assessment of economic, environmental and social sustainability of selected Short Food Supply Chains. The evaluation of an impact of SFSC draws upon a set of indicators developed within the Strength2Food project.

This contribution presents the first preliminary results of case studies conducted in Poland and France. A variety of products were investigated to explore and compare diverse value chains.

Our results confirm that farmers usually participate in more than one chain, diversifying distribution channels. Some farmers participate both in short and long channels. In economic terms, (price premium, added value) SFSCs are found to be more beneficial for farmers, while it seems that „long supply" channels generate less negative environmental impacts per unit of production measured by carbon footprint. Our findings also suggest that farmers participating in SFSC perceive a greater bargaining power in comparison to their counterparts involved in longer market chains

Keywords: sustainabilityy, short food supply chains, quantitative assessment.

1. Introduction

There is an on-going scientific and policy debate how to utilize the local food systems and Short Food Supply Chains (SFSC) in order to provide beneficial solutions to the society and rural areas. Following Kneafsey et al. (2013), SFSC are understood in the paper as characterized by "(…) *a minimal number of intermediaries between the producer and the consumer; they include many types of organisation schemes, from community-supported agriculture (where consumers support producers), on-farm direct sales, sales by farmers at the place of consumption (farmers' markets, delivery schemes, etc.) or sales to collective catering systems (schools, hospitals, etc.)*".

These systems are expected to provide producers with a higher share of the value added, contribute to local territories development, have lower food miles and carbon footprints. However, to date, very little empirical evidence exists on quantitative assessments of impacts of various types of food supply chains. IPTS (2013) and Kneafsey et al. (2013) summarise recent research on SFSC, discussing their potential benefits and providing some empirical evidence. However, as the authors of this report acknowledge, there is a need for more rigorous, quantitative assessment of socio-economic and environmental impacts of SFSC.

In this paper preliminary results of quantitative assessment of economic, environmental and social sustainability of selected Short Food Supply Chains are presented. The evaluation of SFSCs draws upon a set of indicators developed within the Strength2Food[1] project. In practical terms, the results for short chains are evaluated in comparison to the mainstream, long chain alternative represented by a hypermarket chain. The list of indicators contains among others: price premium, chain value added, food miles, carbon footprint, labour intensity, gender equality, bargaining power and chain evaluation.

This contribution is based on the results of pilot case studies concerning local SFSC initiatives like producer group of organic products Ekołan, local farm shop and PGI producers group. Fresh (organic grains, apples, vegetables and free-range eggs) and processed products (Korycin cheese, goat cheese, and boiled ham) were included in the analysis.

[1] S2F – Strength2Food Project - Strengthening European Food Chain Sustainability by Quality and Procurement Policy. This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 678024.

Altogether 10 distribution channels used by farmers were identified: (6 types of short sales channels and 4 types of long chains). Data were collected at the farm level through farm surveys. Additional, secondary data from retail sector were also used in the analysis.

2. Types and roles of SFSCs[2]

For defining short food supply chains basically two criteria are being used: distance between the point of production and the point of sale, which can be considered the main criterion for distinguishing local food chains (LFC) and number of intermediaries in the food chain. SFSCs aim at reducing number of intermediaries between producer of raw materials (farmer) and the end consumer. It is a common specific characteristic of SFSCs that they are highly value-laden and meaningful for their participants. The direct relationship between the producer and the consumer includes knowledge, value and importance of the product and its background, production and consumption. Marsden (2000) clearly stated "*it is not the number of times a product is handled or the distance over which it is ultimately transported which is necessarily critical, but the fact that the product reaches the consumer embedded with information*".[3] The actual meaning of SFSC is different in social groups, institutions and regional contexts. It is based on certain characteristics of SFSCs and values associated with them. In general, SFSCs are viewed as restoring the authenticity of production and consumption.[4]

Two criteria are needed to define SFSCs physical and social proximity. Physical distance refers to the distance of transportation, or food miles of the product from production to point of sale. However, because of the diversity of cultural and regional food systems there is no well established optimal physical distance. Social distance in formal terms means the number of intermediaries between producer and consumer – it is commonly accepted, that in the case of SFSCs this number equals zero or one. Due to this, "*social proximity implies communication between producers and consumers, that give producers the possibility to control information given to final consumers and to receive feedback from*

[2] the literature review of definitions was provided by Agata Kisiel in her master thesis " Consumers` Perception of Short Food Supply Chain of Organic Food Produce on the Example of BioBazar defended at WULS, Warsaw 2017.

[3] Marsden T. K., Banks J., Bristow G., Food supply chain approaches: exploring their role in rural development, 2000, p. 424-426.

[4] Wittman H., Beckie M., Linking local food systems and the social economy?, Hergesheimer 2012, p. 36-61.

them, regarding not only the name of the producer, food quality features or farming practices but also the ethical and social values of the process"[5].

Marsden and later Renting (2003) proposed three main types of SFCs, which create some form of "relationship" between consumer and producer of food. Based on the number of intermediaries, organizational arrangements and the physical distance they distinguished:

- *Face-to-face SFSCs:* consumer buys a product directly from the producer on a face-to-face basis, allowing for authenticity and trust in the personal interaction (e.g. on-farm sales, farm shops, farmers' markets, Pick-Your-Own).
- *Proximate SFSCs:* products are produced and sold in a given region of production. Consumers are aware of the "local" nature of the goods at retail level (e.g. consumers' cooperatives, community supported agriculture).
- *Spatially extended SFSCs:* information about the place of production, producers is transferred to consumers. The value and importance of the product is delivered to recipient who are outside the region and who may have no knowledge of that region (e.g. certification labels, restaurants, public food procurement).[6]

Table 1 presents an overview of types of SFSC distinguished in the report by Kneafsey et al. (2013).

[5]Galli F., Brunori G., Short Food Supply Chainsas drivers of sustainable development Evidence Document, European Commission 2013, p. 15.
[6] Renting, H., Marsden, T., Banks, J., Understanding Alternative Food Networks: Exploring the Role of Short Food Supply Chains in Rural Development. Environment and Planning, 2003, 409-411.

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Table 1. Overview of types of SFSC in the EU

Short Food Supply Chains	
Sales in proximity	***On Farm Sales:*** - Farm shops - Farm based hospitality (e.g. table d'hote, B&B) - Roadside sales - Pick-Your-Own
	Off Farm Sales – commercial sector: - Farmers' markets and other markets - Farmer owned retail outlet - Food Festivals / tourism events - Sales directly to consumer co-operatives / buying groups - Sales to retailers who source from local farmers and who make clearthe identity of the farmers.
	Off Farm Sales – catering sector: - Sales to hospitals, schools etc. The catering sector institution in this case is understood as the 'consumer.'
Sales at a distance	***Farm Direct Deliveries:*** - Delivery schemes (e.g. veg box)
	Farm Direct Deliveries: - Delivery schemes - Internet sales - Specialty retailers

Source: Kneafsey M. et al. (authors), Santini F. (ed.), Paloma S. G. (ed.), Short Food Supply Chains and Local Food Systems in the EU. A State of Play of their Socio-Economic Characteristics, JRC. Luxemburg 2013, s. 28.

Sustainability of the SFSC is a hotly debated issue, especially in the context of comparisons with long, conventional chains. According to Sisco, Blythe Chorna and Pruzan-Jorgensen (2010) a sustainable supply chain "*manages environmental, social and economic impacts and works for good governance throughout the life cycle of products and services. The goal of a sustainable supply chain is to create, protect and grow long-term value for all stakeholders involved in the presence of products and services on the market*"[7].

One of the goals for the creation and operation of short supply chains is to shorten the way the food has to travel to the consumer, which reduces so called food miles. The concept of "food miles" is now seen as an unrepresentative measure of the environmental sustainability of food supply systems[8]. However SFSC are also expected to be more

[7] Sisco C., Blythe Chorn B., Pruzan-Jorgensen P.M., Supply Chain Sustainability. A Practical Guide for Continuous Improvement, UN Global Compact Office and Business for Social Responsibility, 2010, p.5.
[8] Edwards-Jones G., Does eating local food reduce the environmental impact of food production and enhance consumer health? Proceedings of the Nutrition Society, 2010, p. 267

environmentally friendly by i.e. minimizing the use of fossil fuels or packaging or less intensive production methods[9].

Social sustainability of SFSCs refers to their contribution to equity or fairness among food chain actors and the viability of local communities. It is much rooted in trust, fair and personal relations, solidarity and shared values between consumers and producers. It is easier to establish fairness in direct relationships between producers and consumers. To conscious consumers it is easier to understand the true cost of food production, making it easier to pay for a product that knows and trusts. This in turn will allows the manufacturer to receive a fair payment for his hard work in making that good[10]. SFSC may also contribute to the revitalize of local communities. The value and importance of the product and its origin gives rise to a sense of pride, social cohesion and belonging to a certain area and community[11]. SFSC's close social closeness means that consumers are often informed about process of production, which is generally expected to be highly balanced in many respects. In addition, it can be assumed that consumers with more knowledge and attention to food can produce less food waste at household level[12].

Economic sustainability of SFSCs covers issues such as the competitiveness and viability of food chains and their actors, the efficient use of resources, contributions to the community in terms of job creation and income. It is noticeable that mostly small and medium-sized enterprises are involved in SFSC. This is because they are often less competitive in conventional chains due to their higher production costs, often due to the lack of economies of scale or different organization of production processes and higher prices. By providing fair market access, SFSC represents a solution that increases the profitability of small and medium sized farms or processing companies. SFSCs are often devised as collective economic initiatives in response to deteriorating market conditions, thereby "shortening" and strengthening links between local businesses and mobilizing local resources[13]. SFSC can contribute to the revival of the local rural economy[14]. They

[9] Galli f., Brunori G. (eds.), Short Food Supply Chains as drivers of sustainable development. Evidence Document.,Laboratorio di studirurali Sismondi 2013, p. 10.
[10] Renting H., Marsden TK., Banks J., Understanding alternative food networks: exploring the role of short food supply chains in rural development. Environment and Planning, 2003, 395.
[11] Peters R. (ed.), Local Food and Short Supply Chains. EU Rural Review. European Network for Rural Development, no.12, 2012, p. 18.
[12]Galli f., Brunori G. (eds.), op. cit., p. 11.
[13]Schermer M., Hirschbichler K., Gleirscher N., Encouraging Collective Farmers Marketing Inititatives (COFAMI).Status-quo analysis, National Report Austria, COFAMI, 2008, p. 12.
[14]Rosset PM., The multiple functions and benefits of small farm agriculture in the context of global trade negotiations. Food First, Institute for Food and Development Policy, Policy Briefs, No.4. 1999, p. 46.

support small and medium-sized farms that are at the root of local rural economies. SFSCs increase or help re-generate community income and create new jobs[15].

3. Methodology of quantitative analyses

There are several types of supply chains that may be distinguished depending on the final destination of the produce (type of client or end consumer), type and number of intermediaries in the chain or type of products (raw materials or processed foods). It was assumed that single farmers may belong to several chains that differ not only in the length (measured with the distance, as well as the number of intermediaries), but also such characteristics as labor input, costs of sales, etc. Basing on these assumptions, as well as literature review and practical experience the following types of chains (long - LFSC and short - SFSC) were taken into consideration in the Farm Survey:

Short food supply chains:

- Pick your own
- On-farm sales to individual consumers
- Direct sales: Internet deliveries
- Direct sales: delivery to consumer
- Direct sales on farmers markets (fairs)
- Sales to retail shops (1 interme-diary)

Long Food Supply chains:

- On-farm sales to intermediaries
- Sales to wholesalers or wholesale market
- Sales to retail chain (2 intermediaries)
- Sales for processing

The set of indicators for quantitative assessments of economic, environmental and social sustainability of supply chains was proposed by authors and discussed with the partners of S2F project. The general description of selected indicators is presented in table 2.

[15] Peters R. (ed.), op. cit., p. 19.

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Table 2. Indicators of economic, environmental and social sustainability of SFSC

ECONOMIC SUSTAINABILITY INDICATORS	
Price difference Farmgate [EUR**]**	Shows the difference between the average farmgate price in the channel in 2016 and the average farmgate prices in the region in 2016 on the retail level (hypermarket chains). $\boldsymbol{Price\ difference\ Farmgate} = Average\ Farmgate\ Price\ in\ the\ channel\ in\ 2016\ \left[\frac{euro}{kg}\right] - Average\ farmgate\ retail\ price\ in\ the\ region\ in\ 2016\ \left[\frac{euro}{kg}\right]$
Price Premium [%]	compares *Price difference Farmgate* to the average farmgate price in region on the level of retail (hypermarket) chains. $\boldsymbol{Price\ premium} = \frac{Price\ difference\ Farmgate\ in\ 2016(euro/kg)}{Average\ farmgate\ retail\ price\ in\ the\ region\ in\ 2016(euro/kg)}$
Chain value added [EUR**]**	= Price difference_Farmgate – Packaging and sales costs €/unit
Labour to production ratio [h/kg]	Reflects the number of hours worked in the preparing for selling, selling and delivery per the kilogram of production sold within particular channel. $\boldsymbol{Labour\ to\ production\ ratio} = \frac{\left(man\ hours\ used\ for\ preparing\ for\ sale\ per\ one\ delivery + man\ hours\ used\ for\ transport\ and\ delivery\right) * Number\ of\ deliveries}{volume\ of\ sales\ in\ the\ channel\ (kg)}$
ENVIRONMENTAL SUSTAINABILITY INDICATORS	
Food Miles Total [km/kg**]**	It reflects how many kilometres travelled both by the products (during the process of transportation from the farm by farmer or intermediaries) and the customers (in the process of purchasing) are accounted for every kilogram of the product. The methods of calculating *food miles product* and *food miles consumer* are different in particular sales channels and take into account among others *coefficients of return way, coefficients of passing by* (direct sales to consumers), *coefficient of the share of the product in total purchases or in transport(*sales to retail shops). $\boldsymbol{FOOD\ MILES\ Total} = Food\ Miles\ Product\ \left[\frac{km}{kg}\right] + Food\ Miles\ Customer\ \left[\frac{km}{kg}\right]$
Carbon Footprint	Represents Carbon emissions related to the transportation stage, in kg equivalent of CO2 per kg of product. It includes not only the distance but also the logistics of the distribution stage when the final product is considered. This indicator includes *fuel consumption (l/kg)* multiplied by *Carbon Footprint (CFP) coefficient*. *Fuel consumption (l/kg)* describes how much fuel in litres has been consumed together by the product and the consumer for every kilogram of product sold in particular sales channel. It includes not only the length of the travelled distance but also the type of transport that fuel consumption depends on. *CFP coefficient* points for the kg of CO2 equivalent per litre of fuel which was emitted during the transportation of the product. The value of this coefficient for particular channels depends on the kind of fuel used for transportation and their percentage share.

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	$\boldsymbol{Carbon\ Footprint} = Fuel\ consumption\ \left(\frac{l}{kg}\right) * CFP\ coefficient\ (CO_2/\mathrm{kg})$
SOCIAL SUSTAINABILITY INDICATORS	
Bargaing power 1 (poor) to 5 (excellent)	Measure based on self-evaluation of farmers bargaining position in the chain. The following dimensions were considered: 1. farmers' position in the channel, the extent to which they can influence"things"; 2. level of trust in relations with other chain participants; 3. relations with other farmers participating in the same type of chain; 4. relations with the customers.
Chain evaluation 1 (poor) to 5 (excellent)	Measure based on self-evaluation of factors which may have a different importance for farmers making their decisions on choosing sales channel. The attractiveness of the channel has been rated in relation to the following factors: 1. Prices achieved in the chain; 2. Possibility of selling large quantities of produce; 3. Level of labour requirements according to the process of preparing for sale and transport; 4. possibility of making long term contracts; 5. regular and assured payments; 6. general level of satisfaction and how they "like" this channel.
Gender equality [%]	represents the % share of hours worked by women in processes of preparation for sale and in transportation of products $\boldsymbol{Gender\ equality} = \frac{hours\ worked\ by\ women}{total\ sales\ related\ labour\ input\ (h)} * 100\ \%$

4. Overview of Case Studies

"Locavorium Shop and its suppliers"

"Locavorium" is a shop located near Montpellier (5 kilometres away) in which only local products are sold. The concept of the shop is based on direct supplies by farmers (the shop is the only intermediary between farmers and consumers) and proximity - the majority of products come from within a radius of 50 km around the shop (the maximum distance allowed is 150 km). The project started in 2014 and the shop opened in November 2015. The investment reached 250 000 € and was financed by bank loans, grants and crowd-funding with the use of the PickandBoost platform.

In the Farm Survey suppliers of the following products have been interviewed:

- fresh products: apples, lettuce, carrots and eggs (free-range)
- 2 processed products: goat cheese („Protected Designation of Origin" – PDO product) and boiled ham.

Table 3. Sales of products tested in Locavorium case through different distribution channels (share in the total value of sales).

Sales of product by channels	Number of farmers	Share of fruits & Vegetables [%]	Share of eggs & processed products [%]
Short channels	**7**	**88,2**	**89,1**
Pick your own	1	1,4	-
On-farm sales to individual consumers	6	6,8	2,3
Direct sales - Internet deliveries	1	1,0	-
Direct sales - delivery to consumer	3	5,2	4,3
Direct sales on farmers markets (fairs)	1	0	0,6
Sales to retail shops (1 intermediary)	6	73,7	81,9
"Long" channels	**5**	**11,8**	**10,9**
On-farm sales to intermediaries*	-	-	-
Sales to wholesalers or wholesale market	5	3,7	10,9
Sales to retail chain (2 intermediaries)**	1	8,1	0,0
Total	**-**	**100,0**	**100,0**

Source: S2F internal report 2017.

Farmers, suppliers to the Locavorium shop, participated in 9 out of 10 chains originally distinguished in the Farm Survey Questionnaire. Farmers from the sample were using mainly Short Food Supply Chains (nearly 90% of the value of sales) and retail shops were the main customers. Five farmers out of 7 participated also in "long" distribution channels (about 11% of the value of sales) selling their products through wholesale market or directly to the retail chain (1 farmer).

"Korycin Cheese producer group"

Korycin is a commune *(gmina)* in the North-Eastern part of Poland, located in the high value nature area, between two large complexes of forests belonging to National Parks. Agriculture is the main industry of the region. Agricultural land which constitutes about 85% of the total area (about 60% in the podlaskie region) belongs to individual, family farmers. Korycin Cheese is a local variety of rennet cheese, maturing, produced from unpasteurized cow milk based on the traditional, old recipe (figure 2 and 3). There is a group of 12 farmers who in 2012 registered the Korycin Cheese as the product of the Protected Geographical Indication (PGI). The average farm size in the group is 29

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hectares, ranging between 11,5 and 70 hectares. In total farmers produce about 125 tonnes of registered PGI cheese annually.

Producers of the Korycin cheese participate in a variety of distribution channels, ranging from on-farm sales, through SFSCs (direct sales, sales on farmers or food markets, own retail outlet) and long chains involving a number of intermediates (wholesale markets, sales to hypermarket chains).

The farm survey was conducted in a form of interviews with 9 farmers, of the total number of 12 Korycin Cheese producers. Farmers from the sample participated in 8 distribution channels, of which 5 may be considered as Short Food Supply Chains (table 3). Each farmer participated in at least 2 SFSCs. Seven farmers were selling regularly or occasionally on farmers and/or food markets. Eight, out of 9 farmers, participated in the "long" channels involving at least 2 intermediaries.

Table 4. Korycin cheese sales through different distribution channels

Sales of product by channels	Number of farmers	Amount [kg]	Share [%]
Short channels	**9**	**30871,5**	**38,3**
On-farm sales to individual consumers	3	5014,0	3,9
Direct sales - Internet deliveries	4	10501,0	8,1
Direct sales - delivery to consumer	1	4380,0	3,4
Direct sales on farmers markets (fairs)	7	10976,5	8,4
Sales to retail shops (1 intermediary)	6	18969,0	14,6
"Long" channels	**8**	**80335,0**	**61,7**
On-farm sales to intermediaries*	2	14700,0	11,3
Sales to wholesalers or wholesale market	4	50335,0	38,7
Sales to retail chain (2 intermediaries)**	2	15300,0	11,8
Total		**130175,5**	**100,0**

Source: S2F internal report 2017.

It is important to emphasize that Korycin Cheese is a specific product processed by a small group of farmers from the small commune located in the remote area of the country. However, the demand for Korycin Cheese concentrates mainly in large urban centers in different parts of Poland. This explains a high share of long chains in the cheese sales, because delivering this product to a large number of consumers far beyond the region requires using intermediaries. About 8% of cheese is sold through internet delivered to consumers all over the country, small quantities are even sold abroad.

Another observation that can be made is that for different reasons farmers tend to diversify distribution channels. Only 2 smaller scale farmers don't participate in "long" channels. Most of the farmers sell cheese trough 3 or 4 channels, both short and long.

Organic vegetables' and cereals producers "EKOŁAN"[16]

The study has been conducted in the sample of 14 organic farms that supply with organic grains the pasta company "Bio Babalscy". Cereals cultivated for "Bio Babalscy" are mainly old varieties of wheat[17] which are not grown any longer in conventional production. All surveyed farmers, except one, grow also organic vegetables and fruits which are delivered to different customers (including end consumers) for direct consumption or processing. Vegetables, mainly cucumbers, cabbage and potatoes dominate in the sales structure in terms of volume.

Table 5. Sales of organic grains, vegetables and fruits by EKOŁAN farmers through different distribution channels

Sales of product by channels	Number of farmers	Amount [kg]	Share [%]
Short channels	**14**	**146059,2**	**8,58**
On-farm sales to individual consumers	8	85971,3	5,05
Direct sales on farmers markets (fairs)	3	35551,1	2,09
Sales to retail shops (1 intermediary)	3	24536,8	1,44
"Long" channels	**14**	**1556377**	**91,42**
On-farm sales to intermediaries*	2	31322,5	1,84
Sales to processing – grains	14	343349,7	20,2
Sales to processing – vegetables&fruits	13	1181705,0	69,38
Total		**1702436,2**	**100**

Source: own study.

More than 90% of all sales were classified to "long channels" because a vast majority of crops grown on sampled farms was sold for processing. Thus, from the perspective of the proximity of the farmer and end consumer of processed products the chain is certainly long. It should be emphasized, however, that taking farmers perspective, distribution channel with no intermediaries between farmer and processor of raw materials can be considered short.

[16] All farmers belong to the Association of Organic Producers in Cuiavia and Pomerania "EKOŁAN", which gathers farmers and processors.-

[17] Including such as cultivated in antient times „samopsza" (triticum monococcum, „Le petit épautre" in French or Einkorn in German)

All grains are sold for processing, but different short channels are used by farmers for selling vegetables and fruits.

5. Results

Our survey shows that farmers usually participate in more than one chain, diversifying distribution channels. Most of the farmers from the surveyed sample participated in both, short and long chains.

Significant differences in the value of economic indicators across the chains were found (table 6).

Table 6. Average values of selected indicators for Short and Long Food Supply Chains within three Case studies

Chains \ indicators		Price Premium [%]	Chain Added Value [€]	FOOD MILES km/unit TOTAL	CARBON FOOTPRINT [kg CO_2/kg]	Labour to production ratio	Gender equality [%]	Bargaining power	Chain evaluation
Korycin Cheese farmers									
Short chains	**Mean**	**30**	**0,78**	**4,43**	**1,12**	**0,12**	**86**	**3,58**	**3,81**
	Standard Deviation	*(21)*	*(1,33)*	*(5,88)*	*(1,25)*	*(0,21)*	*(25)*	*(0,65)*	*(0,42)*
Long chains	**Mean**	**16**	**0,50**	**2,47**	**0,86**	**0,06**	**47**	**3,13**	**3,38**
	Standard Deviation	*(10)*	*(0,47)*	*(2,19)*	*(1,38)*	*(0,09)*	*(26)*	*(0,98)*	*(0,71)*
Locavorium shop									
Short chains	**Mean**	**27**	**0,00**	**0,59**	**0,15**	**0,03**	**25**	**3,14**	**3,58**
	Standard Deviation	*(37)*	*(3,02)*	*(4,07)*	*(0,87)*	*(0,39)*	*(20)*	*(0,69)*	*(0,24)*
Long chains	**Mean**	**-57**	**-0,47**	**0,60**	**0,15**	**0,02**	**24**	**2,5**	**3,00**
	Standard Deviation	*(46)*	*(1,05)*	*(0,77)*	*(0,12)*	*(0,12)*	*(20)*	*(0,32)*	*(0,00)*
Ekołan Organic producers									
Short chains	**Mean**	**60**	**0,14**	**0,37**	**0,08**	**0,03**	**23**	**4,29**	**3,90**
	Standard Deviation	*(3)*	*(0,04)*	*(0,11)*	*(0,11)*	*(0,01)*	*(12)*	*(0,26)*	*(0,29)*
Long chains	**Mean**	**49**	**0,14**	**0,05**	**0,03**	**0,00**	**25**	**4,71**	**4,32**
	Standard Deviation	*(0)*	*(0,02)*	*(0,01)*	*(0,01)*	*(0,00)*	*(25)*	*(0,04)*	*(0,15)*

Source: own study.

In each of the case studies, as well as in all farms, sales through short chains resulted with better prices, as the average values of "price premium" and "chain value added" indicated. Despite that, almost all farmers were selling their produce also through chains defined as

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long, not only in terms of a number of intermediaries, but also in terms of physical distance between farmers and end consumers. The point is that SFSCs, largely locality oriented are not sufficient for selling all production from bigger farms. This is because the demand for food goes with the consumers, who through many decades were moving so far to large urban agglomerations. It is not possible to meet this demand by single, relatively small scale farmers without involving an intermediary.

Findings in the presented case studies suggest that SFSC give participating farmers greater bargaining power and autonomy but with several constraints that limit upscaling. The farmers usually evaluate better self-perceived position in the channel, the extent to which they can influence "things", the level of trust in relations with chain actors and relations with the customers.

There is an exception of EKOLAN farmers, whose evaluation of their bargaining power and the chain are noticeably higher for the long channel (sales to Bio Babalscy for processing). This is because of almost unique relationship between farmers and the processor. The owner of the Biobabalscy company is a pioneer of ecological farming in the region and a trustworthy buyer of grains, who offers good prices for his suppliers and provides all support and advice they may require. Besides, as it was mentioned before, this specific case with no intermediaries between farmer and processor of raw materials can be considered as short.

Environmental indicators measured in the pilot study are against the common belief that short supply chains are more environmentally friendly. Only in the Locavorium case average values of "food miles" and CarbonFootprint indicators were similar. It can be observed, however, that in most cases these indicators are much lower for long supply channels. This is because much larger quantities of products are transported in longer channels. Although distances are usually high, amounts transported (most often in other products) become a decisive factor causing that environmental impacts of long supply chains are lower.

In the case of Short Food Supply Chains high values of environmental indicators result from two main causes:

- relatively small quantities of produce transported to local retail shops, farmers market or directly to consumers;
- relatively high distances travelled by consumers (usually by car) for on-farm purchases or to farmers markets.

Selected indicators calculated as weighted averages for all distribution channels used by Korycin Cheese farmers are presented in Annex 1.

Preliminary conclusions

Our preliminary results confirm that farmers usually participate in more than one chain, diversifying distribution channels, with some farmers participating both in short and long channels.

Large differences in economic indicators were found across the chains. SFSCs are economically more beneficial for farmers, while it seems that „long supply" channels generate less negative environmental impacts per unit of production measured by carbon footprint. Findings suggest that participating farmers perceive that SFSC as giving them greater bargaining power.

The results from only three pilot case studies are presented in the paper. From the complete study which will cover eight EU countries we expect to contribute to a better understanding of the SFSCs complexity and to verify the following, key hypotheses:

- SFSCs provide better financial results, are more socially acceptable, but „long" chains are more environmentally sustainable;
- Indicators for the same channels may significantly vary between farms depending on distances and quantities delivered;
- Relations between indicators for fresh and processed products are similar (different)?

Although initial results are indicative, they need to be verified on a larger sample of farms and supply chains.

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Annex 1.

Selected indicators for supply chains used by Korycin Cheese farmers (average values weighted by the volume of sales in the channel)

Sales of product by channels	Amounts of cheese sold through the channel (kg)	Economic			Environmental	Social			
		Price difference _Farm Gate	Price Premium	Chain Added Value	FOOD MILES km/unit TOTAL	Labour to produc-tion ratio	Bargai-ning power	Gender equality	Chain importance
Short channels									
On-farm sales to individual consumers	5014	1,23 *(0,83)**	0,23 *(0,16)*	0,3 *(0,98)*	6,24 *(0,84)*	0,28 *(0,20)*	3,68 *(0,42)*	0,88 *(0,21)*	3,54 *(0,50)*
Direct sales - Internet deliveries	10501	1,99 *(0,85)*	0,38 *(0,16)*	1,03 *(1,27)*	0,25 *(0,06)*	0,07 *(0,06)*	3,46 *(0,45)*	0,93 *(0,07)*	3,41 *(0,26)*
Direct sales - delivery to consumer	4380	2,19	0,42	0,7	0,6	0,04	3,75	0,82	4,20
Direct sales on farmers markets (fairs)	10976	2,32 *(0,90)*	0,44 *(0,17)*	0,94 *(0,70)*	4,60 *(3,34)*	0,19 *(0,21)*	3,3 *(0,68)*	0,65 *(0,27)*	3,69 *(0,53)*
Sales to retail shops (1 intermediary)	18969	0,84 *(0,63)*	0,16 *(0,12)*	0,28 *(1,47)*	4,48 *(2,70)*	0,11 *(0,12)*	3,12 *(0,87)*	0,45 *(0,29)*	3,18 *(0,83)*
Long channels									
On-farm sales to intermediaries	14700	-0,27 *(0,12)*	-0,05 *(0,02)*	-0,86 *(0,46)*	7,62 *(3,03)*	0,05 *(0,01)*	3,89 *(0,13)*	0,99 *(0,01)*	4,03 *(0,20)*
Sales to wholesalers or wholesale market	50335	0,80 *(0,25)*	0,15 *(0,05)*	0,54 *(0,32)*	2,88 *(1,88)*	0,03 *(0,05)*	3,60 *(0,34)*	0,48 *(0,25)*	3,66 *(0,51)*
Sales to retail chain (2 inter-mediaries)**	15300	0,14 *(0,47)*	0,03 *(0,09)*	0,05 *(0,32)*	2,23 *(2,00)*	0,04 *(0,00)*	2,30 *(0,70)*	0,49 *(0,12)*	2,44 *(0,40)*

Source: own study.

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