SMARTCHAIN

SMART SOLUTIONS IN SHORT FOOD SUPPLY CHAINS

Deliverable 5.7
Recommendations

Work Package 5

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Executive Summary

The integrated sustainability assessment of selected case studies (CSs) in the SMARTCHAIN project consists of an evaluation of short food supply chains (SFSCs) innovations from environmental, social, and economic perspectives, comparing them with conventional food chain practices and providing insights into the comparative advantages and disadvantages of different types of SFSCs in relation to all these aspects. In the first phase, baseline data were collected from all CS of the project to identify key components of the innovative strategies related to SFSCs. In the second part of the project, an environmental assessment, summarized in D5.5, and a socioeconomic impact assessment were conducted based on the data collected from the selected representative CSs. Based on these, this report has developed and evaluated generic scenarios and examined the sensitivity of key parameters to the results of the environmental assessment. Based on these results, recommendations were then derived for the attention of practitioners, consumers and policy makers.

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1. Main results of sustainability assessment

The objective of the sustainability assessment (D5.5 & D5.6) was to obtain a comprehensive understanding of both the environmental as well as socio-economic impacts and benefits along the different types of supply chains that were identified in the case studies under study. This report is now about deriving recommendations at a higher level. Before developing recommendations that are valid on a more general level, a synthesis of the previous findings is provided for each of the three pillars of sustainability: environmental, social, and economic. The subchapters follow the partitioning of the previous deliverables.

The insights within the subchapters are structured according to the categorization as proposed by the European Commission[1].

Face-to-face: The consumer buys directly from the producer (Farm Shop, Famers Market, Roadside sales, Pick-Your-Own).

Spatial proximity: Overlapping with the first category, but including also local specialist retailers (bakeries, butchers, etc.) and local elements of the hospitality industry (local restaurants, hotels, etc.), the consumer typically buys through an intermediate but still in the region of production.

Spatially extended. The consumer typically buys through an intermediate and the point of sales is located outside the region of production. The place and type of production is communicated to the consumer, typically using certification schemes, which inform about the unique combination of soils, topography, climate, locally embedded skills, and knowledge applied in a distinct area to produce the product.

Among the case studies that were analysed in the last deliverable, there was no example for this last category. Typically, the primary production is fairly well specified, is based on traditional agriculture and usually involves a lot of artisanal work. These products are specifically linked to a region and sought after also in other places in the world. Hence the transport distances are typically much longer than in other SFSCs. The impacts are expected to be similar to examples of local retail, but with a longer transport distance in the logistics stage of the life cycle. The importance of this impact mostly depends on the efficiency of the transport.

This categorization scheme will be used throughout the report, as it is able to encompass all perspectives of the sustainability assessment and therefore enables to provide insights in a comprehensive structure. A more refined subcategorization will be applied, when necessary, within the different pillars.

1.1. Environmental assessment

Face-to-face

Different models of face-to-face short food supply chains (SFSC) were examined based on different models of community supported agriculture (CSA), on farm sales as well as the farmer's markets.

Primary production itself does not necessarily change when a conventional supply chain is converted to this type of SFSC. An exception can be in person contribution of labor by the consumers in a CSA model. The type of primary production is much more dependent on the type of product than on the type of supply chain. The processing and transformation steps were found to be equally efficient than in a large industrial installation. However, due to the very small dataset, this cannot be generalized.

The packaging is not only dependent on the type of supply chain but foremost on the product. A liquid product such as milk or apple juice is much more likely to be sold in a bottle than in a bag, at least in Europe. Whereas fruits and vegetables are typically sold in baskets or bags, bread in bags and eggs in cardboard. However, the

[1] doi:10.2791/88784

material and its lifetime (i.e., how many times the same item is re-used) is perceived as a function of the type of supply chain: short or long. For example, egg cardboard is often re-used multiple times at farmers markets but not in a supermarket. The shop stage and the associated storage are a function of the product (cool, cold, or frozen) and not of the type of supply chain. There is not enough data in our set of case studies to draw a statistically relevant conclusion but in no case the data suggested a difference in environmental efficiency regarding packaging when compared to data of long food supply chains (LFSC).

However, in the face-to-face category the data suggested a difference in terms of food loss. Due to the direct relationship between consumer and producer, a much larger ratio of the total produced goods could be sold as a much smaller subset was considered as non-conform.

The biggest range of differences is seen in the contribution of the consumer transport. In CSA that deliver the food directly to the city, the consumer typically comes by bike, by foot or public transport to the pickup hub. The other extreme is on-farm sales, in the case that the consumer drives by car to buy only a small portion of goods (e.g., 5km for 1 kg of apples). Depending on the variety of offered goods and the location of the farmers' market, the consumer transport's impact can be comparable to the case of the LFSC supermarket.

The logistics that can be part of a CSA and a farmers' market are usually negligible in the context of the overall supply chain, as many products can be transported at the same time, reducing the impact per kg of goods.

It is important to state that across the entire supply chain, the primary production typically makes up the largest contribution to the environmental impact. That is why the reduction of food loss has a high importance.

Spatial proximity

The spatial proximity category corresponds to the cooperative shop or local retailers studied in the project. This type of SFSC consists in gathering various products from a limited area to sell them together in one place of retail. Several types of products have been studied: raw fruits (apples and apricots) and processed fruits (apple juice, pear nectar and dried apples).

The environmental profile of these products, whatever the way of distribution, is very much depending on the type of products.

The primary production step is important in the overall environmental impact whatever the products and the way of distribution. The rawer and more unpackaged the product is, the more this step is a major contributor. Therefore, this steps mainly depends on the product.

The step of processing is totally linked to the type of products. For the raw products, the contribution of this step is null. For the low-processed products as juices this step is a low contributor. However, for the high processed products as dried apples studied in the project, this step can be a high contributor. Indeed, some processing processes are very energy intensive (as drying) and can increase the contribution of this processing step.

The logistic packaging is often an exceptionally low contributor for all types of products and distribution channel. However, the consumer packaging is really product and channel dependant. A specific packaging is needed for each type of products. This packaging can also change depending on the way of distribution. As an example, for apples, in the SFSC, the products are sold in bulk and the consumer only use a kraft bag. In the LFSC, this type of products can be also sold in bulk but are often sold into a plastic packaging to gather several units of fruits into one retail unit. As another example, the juices are sold into a bottle. Often in SFSC, this bottle is a glass bottle because this type of packaging is reusable, but it is also heavy, and its environmental impacts is high. A deposit system can be a solution to reduce the environmental impact of the bottle. In LFSC, this bottle is often a plastic bottle, lighter and so with a lower environmental impact.

The distribution step is also an important contributor and is only depending on the way of distribution. The contribution from logistic transport is very low in the studied cases: most of the times in the SFSC the farm or the plant is located very close to the shop. However, in the LFSC, the products often transit through logistics platforms and travel many kilometres. The impact from consumer transport depends on the number of kilometres and on the weight of the food basket bought by the consumer. In LFSC, the average weight of the food basket is often higher than in SFSC and the number of kilometres is often lower. But the category of spatial proximity presents the big advantage to have a broad range of offers as the same place (as a supermarket) and allow to the consumer to pick all the products with a few numbers of kilometres.

This category appears to be the more efficient, as it presents all the advantages of a SFSC at the primary production, processing, packaging, and logistic distribution steps and presents the advantages of the LFSC as the consumer transport step.

1.2. Socio-Economic assessment: social LCA and qualitative assessment

The socio-economic impact of SFSC has been assessed in two complementary ways to obtain a broad overview which will serve as a basis for the recommendations of the overall sustainability.

On the one hand, a semi-quantitative assessment was carried out using Social Life Cycle Assessment (S-LCA). It is a methodology to assess the potential positive or negative social impacts of products and services through their whole life cycle. S-LCA also offers a standardized and comprehensive assessment framework that merges quantitative and qualitative data and evaluated the impact on 3 stakeholder categories: Workers, Value Chain actors, and Local Community and Society.

On the other hand, a qualitative assessment based on a specific questionnaire was carried out, which aimed to bring to light the subjective perceptions of food producers about the socioeconomic benefits of SFSCs, in their business and their life. This qualitative study mainly highlights individual motivations and advantages for farmers, at micro level, but also allows to draw some conclusions about larger-scale and territorial socioeconomic benefits of SFSCs. It focuses on 3 categories of impact: social integration, empowerment and self-determination, and economic comfort and quality of life. The questionnaire also included a question about the impact of COVID-19 crisis, which gives some insights about how it has affected food producers and SFSCs.

Albeit potential bias arisen from data quality and uncertainty, and the fact that the obtained inventory may not always evidence real situations, overall social impacts assessed on the S-LCA show better results for SFSCs than for LFSC.

Face-to-face

Different models of face-to-face short food supply chains such as a Community Supported Agriculture companies and different models of on farm-sale are studied.

The obtained S-LCA results for the "Workers" stakeholder category concluded that all those case studies had a common result for some of the indicators selected. Their fair salary, workers' rights and health and safety indicators showed a higher risk for SFSCs than their long chain of reference. It should be noted that the indicator safety is less meaningful in this context, as the case numbers cannot be extrapolated due to the small number of actors and are thus only comparable with LSFSCs to a limited extent. It has also been observed, through data collected, that none of the case studies analysed had a regularized trade union, probably due to their company's small size.

This type of chains presented less, or none gender discrimination and better actions regarding social benefits and legal issues than LFSCs. However, and even if in general they all have an appropriate working time, the

results for two of the chains studied did not match the rest of the cases, showing a higher risk for the working time. This may be due to the type of product and the seasonality of the production.

All the results for corruption, one of the two indicators selected for the "Value Chain Actors" stakeholder category, coincide, showing that there is no corruption among the agents of the companies studied. However, a greater difference has been seen in the results regarding the promotion of social responsibility, even within the same case study, since, except for two case studies, no company had neither a Corporate Social Responsibility (CSR) certification nor any membership in an initiative that promotes social responsibility along the supply chain.

The "contribution to economic development", the indicator regarding "Local Community and Society", consists of two sub-indicators which are the "contribution of the sector to economic development" and the "embodied value-added total". This last indicator shows better results for SFSCs, being their business model more profitable, thanks to the removal of the intermediaries between them and the consumer. However, the contribution of the sector to economic development is lower than in the reference chains due to the small number of products they handle.

Spatial proximity

Within spatial proximate category, a home delivery service, a processing company and two cooperative shops are examined. In this case, all the results obtained have varied, in general, more than in the face-to-face type of chains. This might be because of the type of products, the type of company, or even due to isolated and coinciding events.

Regarding the "Workers" stakeholder category, their fair salary and workers' rights indicators indicated a higher risk for SFSCs than conventional chains.

As the "face-to-face" chains, this type showed less, or none gender discrimination and better actions regarding social benefits and legal issues. This could be interpreted as SFSC having a closer and more personal working relationships and being more aware of their employees' wellbeing and conditions.

Results show no risk for corruption. Moreover, regarding the promotion of social responsibility, only for half of the case studies assessed present positive results. On the contrary, the cooperative shop has a high risk, with no Corporate Social Responsibility (CSR) certification nor any membership in an initiative that promotes social responsibility along the supply chain. Again, this might be due to the type of product or the type of company model.

Differences have also been seen regarding the "contribution to the economic development" indicator. Apart from the processing company and one of the cooperative stores, the rest of the cases showed a bigger contribution than their long food chain of reference.

Socio economic qualitative assessment

The qualitative survey has contributed to the understanding of socioeconomic benefits of SFSCs, and of subjective motivations of food producers to commercialize their products in SFSCs. The survey reached food producers from more than 15 different countries. Respondents are mainly family farms and small companies and almost all are (or have been) involved in SFSCs, and a significant part of them (40%) is (or have been) also implicated in conventional big distribution, which allows them to compare both systems and to share their experience about each one of them.

In terms of perceived socioeconomic benefits and motivations, it appears that beyond economic reasons, social integration and empowerment have a great importance in the involvement of these actors in SFSCs. Indeed, the three most important benefits of SFSCs identified by respondents are the direct relationship with

consumers, the control they allow them to keep on their product till the end of the value chain, and the conviviality. In their comments, surveyed people mentioned many times the greater margins obtained through SFSC, and thus the better price for their products. In their opinion, this is mainly due to the absence of intermediaries, and the direct relationship with customers, which allows a better mutual understanding. In terms of business certainty, CSA model is mentioned as it offers a greater security for producers, sharing the risks with consumers, since the entire annual budget is covered by consumers' participation, and the sale of the whole production is guaranteed.

Beyond these economic benefits and recognition, the integration in local economy, community feeling and social recognition are often reiterated, as sources of self-esteem and personal satisfaction. Independence and freedom (in the price determination and organization), as well as the control of the whole value chain, are also important. Many respondents mention the ethics, and the fact that working in SFSC brings more meaningfulness to their activity.

Consistently with the analysis of SFSC benefits, apart from economic and organizational reasons, social motivations seem thus to have quite a significant weight in the decision to start with SFSC. The empowerment of producers, a greater social recognition and respect for their work are key in SFSC "raison d'être". SFSC permit their emancipation from an agri-food industry system they see as unfair. Moreover, a lot of respondents describe ethical motivations, and find in SFSC more coherence with their ethics (mainly related to social and environmental issues) and search for meaning. According to them, SFSC is an opportunity to contribute to social change, and taking part in local, circular, ecological and social economy initiatives, to employ people in exclusion risk.

Besides the direct advantages for producers, benefits for customers and society were also highlighted, such as fairer price for consumer as well, less food waste, less packaging waste, strengthened local economy and connexion with territories, reliable organic quality, freshness, animal welfare, etc.

Surveyed producers also identified advantages of big distribution, which appear to be mainly economic, and related to organizational, logistical and marketing issues. Among the assets of this kind of commercialization channels, they mention the income stability, demand constancy and higher visibility. The larger volumes handled allow an increased branding and marketing power, economies of scale and efficient logistics. Big distribution makes easier the sale of larger quantities, which makes the investment in production safer. It is an opportunity for producers to sell a lot without losing time working on and worrying about sales (consumer attraction, packaging, transports, bureaucracy…). This simplicity allows them to dedicate more time to production and farm tasks, and sometimes to increase sales volume, which in some business models makes possible jobs creation. Moreover, sometimes price negotiation seems possible, and if the supermarket uses the local image in its communication and marketing strategy, it can give to producers a great visibility and enhance the on-farm sales. The quality certifications were also mentioned as a positive point of conventional distribution chains, in terms of transparency issues. Finally, many respondents named the advantages for consumers (mainly price, availability and diversity of goods, convenience), that make big distribution more accessible to public and thus so hard to compete with.

Respondents also mention a lot of disadvantages of big distribution, such as food waste, non-seasonal products (and thus encouragement of unsustainable agriculture), lack of ethics and transparency, greenwashing ("socialwashing"), lower-quality products, impersonality, pressure on producers and unfair price negotiation, "greedy middlemen", etc.

All in all, respondents confirm the most acknowledged breaches of big distribution on the social and economic concerns, but also bring to light that for larger volumes, it is still quite unavoidable. Up to now, SFSC remain mainly about small producers, handling rather small quantities of food. Big distribution runs on beaten paths, while SFSC are still rather a niche market willing to scale up.

The survey also gave insights about the impact of COVID-19 crisis on SFSC businesses. It seems to have been quite contrasted and has varied a lot according to the country and the type of products. Respondents from some countries reported a bigger proportion of positive impact, as it is the case for Switzerland, Belgium or Germany. In some others, a more important part of respondents reported a negative impact, like in Spain, Serbia or France. In the Netherlands, Italy and Greece, the "no impact" answer was more present. Production units handling animal products (meat, milk and dairy products, eggs) reported more positive impact.

Overall, results and conclusions obtained from qualitative and semi-quantitative social assessments provided valuable insights to focus the following steps towards a series of operational and administrative recommendations to be implemented into the of short food supply chains.

2. Insights and Impulses of other WPs

Before we go into the literature and the development of the scenarios in this report, we will first discuss findings from other work packages of the Smartchain project that are relevant in this context. WP 4 found that there are certain consumer preferences for shopping in SFSCs. Customers in this market segment prefer organic, locally produced or traditional products. In addition, certain products are preferably purchased through SFSCs: vegetables, fruits, eggs, honey and bread are the most purchased products. Consumers also want environmentally friendly packaging for these products (WP3). An important aspect is also that consumers prefer to be able to buy a wide range of products at the same place (WP4). Overall, products from SFSCs are perceived by consumers as more environmentally friendly than products from conventional supply chains (WP7). These findings are considered as far as possible in the following chapters, be it in the definition of the scenarios or the derivation of the recommendations. Overall, SFSCs are perceived as more environmentally friendly (WP7).

3. Literature review and comparison to Strength2Food

3.1. Environmental literature

The parameters affecting the environmental impacts of food supply chains

Short food supply chains are supposed to improve the environmental impact of food consumption especially via shorter transport distances of food from the producer to the consumer. However, transportation has only a minor effect on greenhouse gas emissions and other environmental impacts of food chains, while agricultural production is the largest contributor (Chiffoleau & Dourian, 2020). In the case of apples used in France analyzed by Loiseau et al. (2020), the contribution of agricultural production to global warming is only about 20% but is higher for other environmental impact categories. Therefore, it is important to consider the impact of short food supply chains on the farming system (Chiffoleau & Dourian, 2020). Short food supply chain actors are often involved in organic or other farming practices that are considered more sustainable or agroecological, but conventional mid-sized farms are also playing an increasing role in these chains. Chiffoleau & Dourian (2020) found evidence that different short food supply chains have different effects on the environmental impact of the farming system. For example, direct selling can lead to lower use of pesticides, as consumers are more likely to tolerate blemishes in products, whereas this is not the case with local marketing through supermarkets. More research is needed in this field, as well as on the impact of short food supply chains on food and packaging waste (Chiffoleau & Dourian, 2020).

Focusing on the distribution and retail phase, some papers investigated the parameters that contribute most to the environmental impacts of this phase. Loiseau et al. (2020) showed that for short food supply chains the final consumer transport is significant and depends on the distance the consumer must travel to the retailer, the amount of products purchased in one trip, and the means of transport used. The results show that total impacts significantly decrease when a car trip is substituted by a walking trip. Within the Strength2Food project, Majewski et al. (2020) demonstrated that consumers cause 76% of a product's food miles in short food supply chains and 63% in long chains. According to Malak-Rawlikowska et al. (2019), on average of all investigated short chains, consumers caused about 69% of the carbon footprint, and only 40% in long chains.

Diversity of short food supply chains

Malak-Rawlikowska et al. (2019) and Majewski et al. (2020) distinguished nine short food supply chains (Pick-your-own, on-farm sales to consumers, internet sales with courier delivery, direct delivery to consumer, farmers' market, and direct delivery to retail). They highlight three important parameters especially for short food supply chains: the transport distance, the means of transport (larger vehicles that transport large quantities or more items than just food are more efficient than smaller vehicles), and the size of the "food basket" that is purchased. The average transport distance per kg of purchased goods and the consumer share in food miles varied highly between the different chains. They were most unfavorable for pick-your-own with 6.04 km/kg and on-farm sales with 3.75 km/kg. With 0.15 km/kg, food miles were lowest for internet sales with a courier service (Majewski et al., 2020). Internet sales also had the best overall environmental impacts because vehicle use per kilogram of transported goods of a courier service is most efficient and there is only little storage needed. Majewski et al. (2020) concluded that innovative business models for retail such as last-mile delivery, group shopping, or internet sales pose a significant potential for improving the eco-efficiency of supply chains.

Comparison of short and long food supply chains

In their study on apple distribution in France, Loiseau et al. (2020) analyzed different types of short and long food supply chains (direct on-farm sale; direct off-farm sales like CSA, farmers' market or retail outlet; an international supply chain with apples from Chile; a national long supply chain, both with retail in super or hypermarkets; and a medium supply chain with shorter transport distance and retail in outdoor markets or

specialist retailers). The investigated chains also have different storage durations. The results showed similar environmental impacts between national, medium and direct off-farm sale. The medium supply chain had a slight advantage over the other supply chains, while on-farm sales had the most unfavorable result due to the less efficient consumer transport.

Malak-Rawlikowska et al. (2019) and Majewski et al. (2020) compared short and long food supply chains for several products (short chains: see above; long chains: on-farm sales to intermediaries, sales to wholesale market, sales to hypermarket). They found that on average, long chains generated fewer food miles and a lower carbon footprint per product unit compared to short chains. Long chains also performed better than the short chains in terms of other environmental impacts. However, there was a variability across supply chains, especially among short chains: While the environmental impacts of pick-your-own and on-farm sales to customers were about three times higher than those of the long chains, the short chain "direct delivery to retail" performed very similarly to the long chain, and "internet sales" was the most favorable of all investigated chains.

Loiseau et al. (2020) studied the conditions under which short supply chains perform better than long ones. Per kilogram purchased apple, on-farm sales can perform better than national long supply chains when the consumer transport distance is less than 15 km with a 21% share of apples in the total food basket purchased, or when the transport distance is less than 5 km for a share of 76% of apples in the food basket. Likewise, when the amount of apples purchased increases to more than 12 kg at 22.7 km transport distance and a 21% share of apples in the food basket.

Apart from these findings, it must be noted, that, at least at the moment, short food supply chains are not a complete replacement for long food supply chains. The two food chain types coexist, both on the side of farms and on the side of consumers who produce or consume products from both chains (Majewski et al., 2020). Research need exists regarding the role of short food supply chains in the transition towards other farming techniques and food behaviors (Chiffoleau & Dourian, 2020).

3.2. Socio-Economic literature

As it is stated by Chiffoleau and Dourian (2020) in their literature review, "SFSCs respond to an increasing desire of urban consumers to access secure, high-quality and sustainable food [Goodman, 2003], and to producers' need to capture a larger portion of the added value [Kneafsey, 2013]. SFSCs also align with political efforts geared towards the localisation or relocalisation of food and agricultural systems [Sonnino, 2016]" (Chiffoleau and Dourian, 2020). According to the same authors, and in line with Strength2food findings and with our results in SMARTCHAIN WP5, "literature tends to generally agree on the social benefits of SFSCs, their economic and environmental impacts typically elicit more heterogeneous outcomes, while their health/nutrition and governance dimensions remain under-explored" (Chiffoleau and Dourian, 2020). Still, with Strength2food project, Malak-Rawlikowska et *al.* (2019) found significant differences according to the types of food supply chain, whether short or long (Malak-Rawlikowska et *al.*, 2019).

Socioeconomic sustainability: clarification of a multidimensional concept

Socioeconomic sustainability is composed of several levels and dimensions. Both may be considered at micro level (i.e. business or farm level) and macro level (i.e. territorial or sectorial level) (Cournut, 2019), considering indicators such as viability, productivity, stability and resilience, for the economic aspects, and working conditions, subjective satisfaction, fairness, food security and sovereignty, social justice, health/nutrition, governance and community integration and vitality, *inter alia,* for the social ones.

Beyond geographical and organizational criteria (limited number of km and intermediaries), social proximity is usually considered as an inherent part of SFSC. In their introductive literature review, Malak-Rawlikowska et *al.* (2019) highlight that this social dimension is already included in SFSC definition proposed in the European

Rural Development Regulation 1305/2013 and define "social proximity" as the definition criterium that "emphasizes some form of 'relationship' between consumer and producer of food based on mutual trust and closeness of the transfer of information" (Malak-Rawlikowska et *al.*, 2019).

Economic sustainability

In strength2food sustainability assessments, Malak-Rawlikowska et *al.* (2019) mainly consider price-related indicators to measure economic impact of SFSCs. On another hand, Chiffoleau and Dourian (2020) characterize SFSCs performance in terms of increased farmers' income, job creation, workload and contribution to local economies.

In our qualitative assessments, we got the subjective perception of respondents about 5 indicators to reflect the individual economic benefits of SFSCs: higher prices, more robust and resilient business model, better quality of life, better salary, and better working conditions. At macro level, they were asked to evaluate SFSCs contribution in the strengthening of local and circular economy.

In the quantitative assessment, the economic indicators that were contemplated were the sector average wage, contribution of the sector to economic development and embodied value-added total, and due to the sector we are working with, the seasonality and the cost-benefit, they were, in general, the ones with worst results.

According to Malak-Rawlikowska et *al.* (2019), "across all types of short chains, sales through SFSCs resulted in better prices achieved by producers", since "they allow a large proportion of margin to be captured". In this regards, the farmers' market and pick-your-own modalities appear to be the economically most profitable for producers. This conclusion, based on quantitative assessment, was confirmed by the qualitative evaluation carried out with business managers, which seem much more satisfied with the prices obtained in SFSCs than in longer ones, in all countries and types of product taken into consideration in the study.

However, Chiffoleau and Dourian's literature review nuances these results putting them into perspective with other researches in France and Quebec, revealing that "some farms operating in SFSCs gain a higher income per asset and per hour than farms operating exclusively in long chains—after at least five to seven years following their foundation—but those results are very heterogeneous among farms using SFSCs, and can even be negative". The positive effect of SFSCs on farms' economy seems to be conditioned to other farm-level factors such as their participation in collective farmers' initiative for producing, selling and transporting food, and the combination of SFSCs with organic farming practices. Moreover, this French research mentioned by Chiffoleau and Dourian (2020) also highlights that SFSCs economic performance also depends on chain-related and territorial factors, such as the degree of local competition, profit margin allotted to the intermediary, availability and proximity of equipment and processing facilities (slaughter houses, processing plants, etc.), and their adaptation to handle small and sometimes seasonal productions.

Apart from the positive impact on producers' income, literature reviews also show that "SFSCs reduce economic uncertainties in contrast to the market volatility typical of long chains [Boutry and Ferru, 2016], and ensure a regular cash flow that favours the greening of agricultural practices [Millet-Amrani, 2020]. Nevertheless, the determination of a "fair" price in SFSCs remains a fundamental issue, both in direct sale schemes and in chains involving intermediaries [Prévost, 2012]".

From a territory perspective, "the economic dimension is also captured by the quantity of jobs created/maintained by SFSCs" (Chiffoleau and Dourian, 2020). According to a French survey, at farm level, "SFSCs represent more jobs per hectare than those in long chains (0,75 Full Time Equivalent/ha vs. 0,26) [Barry, 2012]" (Chiffoleau and Dourian, 2020), but job quality and employment at chain level remain unexplored. More general SFSCs contribution to local economies are still little documented.

According to González De Molina and López-García (2021), SFSCs also contribute to rural development, "[retaining] more food chain links in the rural environment, generating more work and compensating for job losses in the long chains and value processes involved (Gomiero 2017; Martinez et *al.* 2010) (…) In this sense, ALAS effectively counter the abandonment of family farms and rural depopulation, an expanding phenomenon worldwide".

Social sustainability

On an individual level, Strength2food assessments base SFSC social sustainability on 4 indicators: 2 quantitative ones (Labour to production ratio and Gender equality), and 2 qualitative ones (Bargaining power and Chain evaluation in terms of attractiveness and satisfaction), based on self-evaluations of business managers.

They find out that the general satisfaction towards one kind of food supply chain or another is generally higher in the case of SFSCs (Malak-Rawlikowska et *al.*, 2019). As far as the bargaining position in the chain is concerned, it is "visibly perceived as higher in the case of short chains", and it seems to be especially the case "in all SFSC channels where the farmer has a direct contact with the consumer". They also find out that "Internet sales scored the worst, despite the fact, that this is the rapidly growing distribution channel". "Of the long chains 'sales to intermediaries' were assessed as the worst. Most likely this is because of the feeling that producers are 'exploited' by intermediaries" (Malak-Rawlikowska et *al.*, 2019).

Malak-Rawlikowska et *al.* (2019) also highlight that SFSCs are generally more demanding in terms of labour resources, generating additional employment, mainly due to the amount of produce per delivery, but also to the direct responsibility of producer for sales to the final consumer. They also observed a greater engagement of women in sales through SFSCs. However, job quality remains quite an underexplored dimension (Chiffoleau and Dourian, 2020). In a more general way, "work organisation in SFSCs remains an important issue, also from an environmental perspective (…), while the use of digital technologies opens new, time-saving opportunities, yet requires skills [Drejerska et *al.*, 2019] (Chiffoleau and Dourian, 2020) .

Chiffoleau and Dourian (2020) consider social sustainability in a broader sense, including social cohesion, community belonging, social innovation, food security and sovereignty, accessibility, and nutritional/health aspects.

Our qualitative assessments of SFSCs social sustainability took into account several dimensions of social integration in the community and empowerment and self-determination, such as the direct relationship with the consumers, the control producer keeps on his/her product till the end of the value chain, and the conviviality, which are the most important benefits producers see in SFSCs, but also solidarity, self-esteem, social recognition, bargaining power, fair trading practices and job interest.

In the case of the quantitative assessment, gender discrimination, workers' rights, health and safety, social benefits and legal issues, working time, corruption, fair competition and promoting social responsibility were selected as social indicators. Were taken into account aspects such as the wage gap between men and women, the right of association and bargaining, the rate of accidents and the safety measures to avoid them and all the issues affecting the social responsibility which could be translate as the lack of violations of laws, anti-competitive behaviours and corruption.

All in all, the social integration aspects were those that were rated as the most important in the qualitative assessment and yield better results in the quantitative one.

The results of our qualitative survey are also consistent with what Chiffoleau and Dourian (2020) found in the literature, since they say that "the emergence or renewal of SFSCs is considerably tied to social motivations [Deverre and Lamine, 2010; Giampietri et *al.*, 2016]. In contrast with the anonymous character of long supply

chains, SFSCs "re-embed" the economy in personal relations of respect and trust between producers and consumers [Hinrichs, 2000; Sage, 2003]. They also contribute to redevelop relations based on technical dialogue and cooperation between farmers [Chiffoleau, 2009], and include newcomers with no previous agricultural experience, who contribute, by sharing new ideas, to renewing the agricultural sector [Dufour and Lanciano, 2012; Dupré et *al.*, 2017]". Indeed, we found out that the empowerment of producers, a greater social recognition and respect for their work seem therefore to be key in SFSCs "raison d'être".

However, from the consumers' perspective, affordability and accessibility of SFSCs is still an issue, since they usually remain a niche for upper middle-class consumer groups. For Chiffoleau et *al.* (2020), "the social dimension is more largely captured by a wide range of multi-actor collective actions and territory-based social innovations [Chiffoleau and Loconto, 2018] (…) Such actions thus stress the need for instilling food justice or solidarity among low-budget consumers who often remain excluded from these chains [Allen, 2010; Darrot and Noël, 2018]" (Chiffoleau and Dourian, 2020).

This issue is also highlighted by González De Molina and López-García (2021), as they state that "the AFNs [Alternative Food Networks] have also been criticized for establishing, especially in the global North, strong bias in the access to food consumption, both in terms of economic access(…); and other biases intersect with these initial ones such as those of class, gender or race (Goodman, Dupuis, and Goodman 2012; Tornaghi and Dehaene 2019)".

In a wider sense, social sustainability also covers health and nutrition issues, which have been "key drivers of SFSCs' emergence or renewal" (Chiffoleau and Dourian, 2020), since "local food consumers are increasingly seeking fresh, nutritious and safe food [Lappo et *al.*, 2015]. These questions both the agricultural practices (…) and the food processing techniques used in SFSCs". Ancient varieties and landraces, and traditional/artisanal "mild technologies" and processing methods (stone milling, slow fermentation, suppression of additives, etc.), for example, are more likely to be cultivated and implemented in SFSCs. They have acknowledged higher nutritional value, and are also contributing to the preservation of cultural heritage and biodiversity. However, Chiffoleau and Dourian (2020) also highlight that "these on-going processes could also provoke new sanitary risks, as these chains may imply non-professionals (e.g., consumers contributing to food transportation logistics, consumer cooperatives)".

Complementarity with conventional big distribution channels

Within Strength2food, Malak-Rawlikowska et *al.* (2019) also highlight that "individual producers participate simultaneously in several short and long chains, creating a mix of supply chains", while 40% of our sample for the qualitative survey were implicated both in short and long chains. The combination of both types of commercialization systems seems to be a quite common strategy for producers, and "this leads to the conclusion that different supply chains may coexists on the market, providing options that may benefit producers, but also create the possibility of choosing from a complex market offer that satisfies different consumers' expectations and (societal) needs". They find advantages of (some types of) conventional long chains, and complementarity with short ones in producers' business and commercialization model, in some aspects. Sales to hypermarkets, for example, were surprisingly quite well rated in terms of bargaining power: "This is against a certain stereotype, but (…) there were several producers who during the survey emphasized the hypermarket chains are nowadays trustful business partners, offering the possibility of purchasing large quantities of produce at reasonable prices". The same happened in our SMARTCHAIN assessments, since the collaboration and price negotiation with supermarket were qualified of fruitful by several respondents.

In a general way, some evaluation criteria qualitatively assessed by Malak-Rawlikowska et *al.* (2019) are favoured by SFSCs, while others are better rated for longer distribution chains. SFSCs appear more satisfactory in terms of prices and regularity and assurance of payments, while long chains allow to sell larger quantities and offer the possibility of long-term contracts. In our assessments, it appeared a clear correlation between the annual turnover and the involvement in conventional food supply chains. Unsurprisingly, the bigger-sized

production units are more kindly to be implicated in the conventional system, which is consistent with their advantages highlighted by Strength2food researchers. Apart from the efficient logistics, income stability and demand constancy, big distribution also provides a higher visibility, and its increased branding and marketing power is an important advantage for producers, which can bring positive feedback and enhance their on-farm sales.

SFSCs and long chains mix is also interesting from a territorial perspective, as they contribute, in a complementary way, to the resilience of food systems (Chiffoleau and Dourian, 2020). As highlighted by González De Molina and Lopez-Garcia (2021), "many empirical studies highlight the existence of "hybrid" food networks in which the various actors in the production chain enter and leave "alternative" distribution networks based on economic imperatives and the territory's structural conditions – whether material or symbolic – in which they are inserted (Ilbery and Maye 2005; Bloom & Hinrichs 2011; Goodman, Dupuis, and Goodman 2012; Darnhofer 2014; López-García et al. 2018a).

4. Development of scenarios for recommendations

In order to be able to analyse the trade offs between the three pillars of sustainability, somewhat of an overlap of the analysis had to be found. Sticking to the categorization as proposed by the European Commission , the most relevant SFSCs have been categorized into the three main categories:

Face-to-face: Community Suppoerted Agriculture (CSA), On farm sale, Farmers' Market

Spatial proximity: Cooperative shops, Processing company, Home Delivery

Spatially extended: no examples in this project

The socio-economic analysis focuses mainly on the three main categories because they provide a distinction in function of the main characteristic of a supply chain: the number of intermediaries in combination with the physical distance. However, the environmental assessment needs to differentiate further because there is a large heterogeneity within any one of these three categories which lead to a wide range of results for the environmental assessment. For the trade off analysis, the environmental results will be aggregated as much as possible into the three categories, such that a comparison with the socio-economic part is made available.

4.1. Environmental scenarios

In the previous deliverable, the impact of the consumer's transport has shown to be a most relevant contributor. Another variable strongly attached to it is the size of the food basket. Both of these parameters are examined in more detail in the sensitivity analysis. For each of the case studies that were looked at, the reference scenario is compared to a number of scenarios.

The consumer's transport is analysed in terms of km driven (+- 70% in 10% increments compare to the reference scenario) and also type of vehicle (reference scenario, average EURO norms petrol, electric car). This stage of the supply chain depend a lot on the choice made by the consumer and has proven to be a tremendous lever for the environmental impact of the overall supply chain. That is why not only the distance is examined but also a small investigation is undertaken with regards to the type of car and the conditions under which its impact could be reduced or mitigated. Another parameter under study is the size of the food basket which is partly linked to the impact of the consumer's transport.

Because the data collection for primary data is qualified as containing a high uncertainty, wide ranges for the sensitivity analysis were taken. Also, the selection of case studies is low in numbers and therefore cannot be regarded as a representative sample.

The data for the reference scenario is taken from the data collection, the scenarios for the sensitivity analysis are constructed. The additional data for the electric car (inventory data) is from a recent study (Sacchi et al. 2020).

Two categories of SFSC are studied: face to face category (with on-farm sales and farmers market) and spatial proximity (with a cooperative shop). The different scenarios are compared to two types of LFSC (hypermarket): one located in an urban area and another located in a rural area.

4.2. Socio-Economic scenarios

As it is mentioned in the previous section, it is not possible to be so specific in relation to the scenarios for the socio-economic analysis, mainly because of the type of data. While from an environmental point of view it is possible to works on numbers that are modifiable to present different scenarios and see how the selected indicators affect the results, from a socio-economic point of view is not.

That is the reason why this section is going to be used to clarify which has been the categorization for the different scenarios and the next section to give the combined results of the case studies that belong to each scenario, to obtain a general image that helps to propose future recommendations.

Thus, considering the data-related limitations and both the characteristics of the case studies and the characteristics of the different types of scenarios, the "spatial proximity" scenario was broken down into two more specific types and the "spatially extended" scenario was dismissed (Table 1):

Table 1. Categorization of the case studies selected according to the JRC Scientific and Policy Reports of the European Commission.

CHARACTERISTICS	SCENARIO
On-Fam sale	FACE-TO-FACE
Community Supported Agriculture	
Home Delivery	PROXIMATE PRODUCER
Processing company	
1 Cooperative shop	PROXIMATE SHOP
2 Cooperative shop	

Apart from that, the qualitative assessment relies on the 261 responses we received from the questionnaire, and thus on a different basis than the LCAs, based on a selection of project's case studies. The identification questions, contained in the questionnaire, allowed us to compare respondents' perceptions about socioeconomic benefits of SFSCs and their motivation to get involved in this kind of alternative commercialization channels, according to several profiles. The type of product handled (animal-based or not), the type of chain (direct contact with client versus less direct modalities; individual versus collective; CSA), the type of organization (family farm, cooperative and non-profit organization) and the type of stakeholder (primary production, processor, or both) are the most relevant variable to create the scenarios, since they significantly influence the perceptions of practitioners about SFSCs advantages.

5. Assessment of the scenarios (socio-economic and environmental perspective)

5.1. Environmental scenarios

In this chapter, the results for the environmental scenario analysis are presented. These results are not for the overall supply chain, but only comparing the last stage: consumer transport. The impact of the consumer transport is a function of multiple variables such as the total distance, the type of vehicle or the size of the food basket as the impact is calculated by kg of product. Different types of short food supply chains are presented with three types of vehicles: petrol, electric car (Swiss mix), electric car (German mix). They are compared to a LFSC in a rural area and an urban area. For each one, a reference situation has also been defined based on Rizet et al. 2008 (categories hypermarket). These data are presented in the Table 2. Regarding the LFSC in a rural area, the consumer buys around 23kg and the consumer distance is 9,3km (18,6km/2). In a LFSC in an urban area, the consumer travels 4,4 km (8,8km/2) to buy 21,9kg of products.

Reference situations (Rizet *et al.*, 2008)

Table 2 : Reference situations for each scenario

		Distance (km) (return trip)	Size of the food basket (kg)	Average distance km/kg
Short Food Supply Chain	**Face to face: On-farm sales**	20	7.4	2.7
	Face to face: farmers market	7	8.8	0.8
	Spatial proximity: Cooperative shop	14.6	24.6	0.6
Long Food Supply Chain	**Urban area**	8.8	21.9	0.4
	Rural area	18.6	23	0.8

Across all scenarios, the LFSC are held constant at their reference values. For all SFSCs, the three types of vehicles are examined: petrol, electric car (Swiss mix), electric car (German mix). The two national electricity mixes were selected as examples from European countries. The aim was to show the range between a relatively low-emission and a relatively high-emission electricity mix, as well as the effects on the results. Typically, the electric car powered by the Swiss grid mix emits the least while the vehicles run by petrol and the German electricity mix are rather close, with the latter having a slightly better environmental performance.

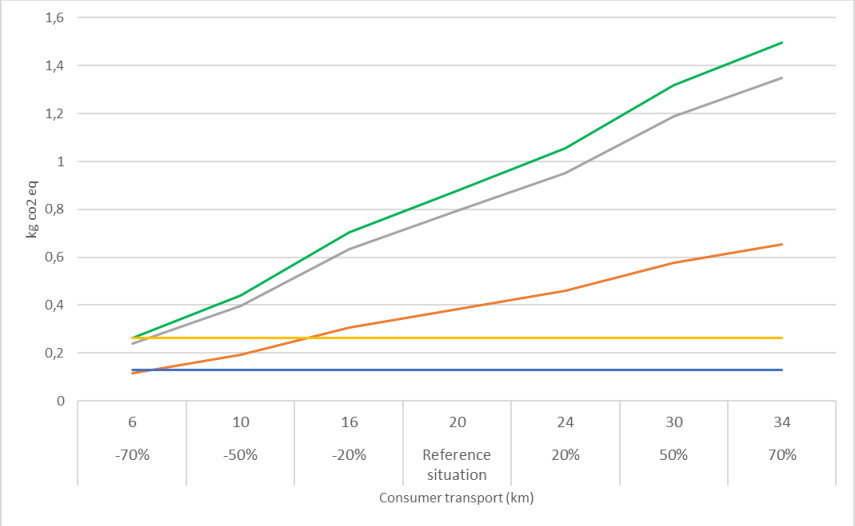
Regarding only the reference situations of each SFSC (which correspond to the average distance and size of the food basket for each one without any variation) :

- The on-farm sale seems to be less efficient from an environmental point of view than both LFSCs (urban and rural areas)
- Farmers' markets are less efficient than LFSCs in an urban area, except in cases where consumers use an electric car with a low-emission electricity mix. In a rural area, the LFSCs scenario with an electric car with a low-emission electricity mix perfoms best. All other scenarios show a comparable environmental performance.
- The cooperative shops perform less than the LFSC in an urban area, excepted with an electric car with a low-emission electricity mix. In a rural area, whatever the distance and the type of car, the SFSC is performing better than the LFSC.

The following sections describe the variation of the parameters "km driven" and "weight of food basket" for the respective basic scenarios. For the LFSCs, no variation has been applied : they are represented as constants in the following graphs. The results are presented in the following graphs for the climate change indicator (kg CO2 eq). The table of results for the climate change are presented in the Annex 1. The results for 7 other environmental indicators and only for the case of the petrol car are presented in the Annex 2.

Table 3: Overview on environmental scenario assessment

On farm sales – food basket = 7.4kg

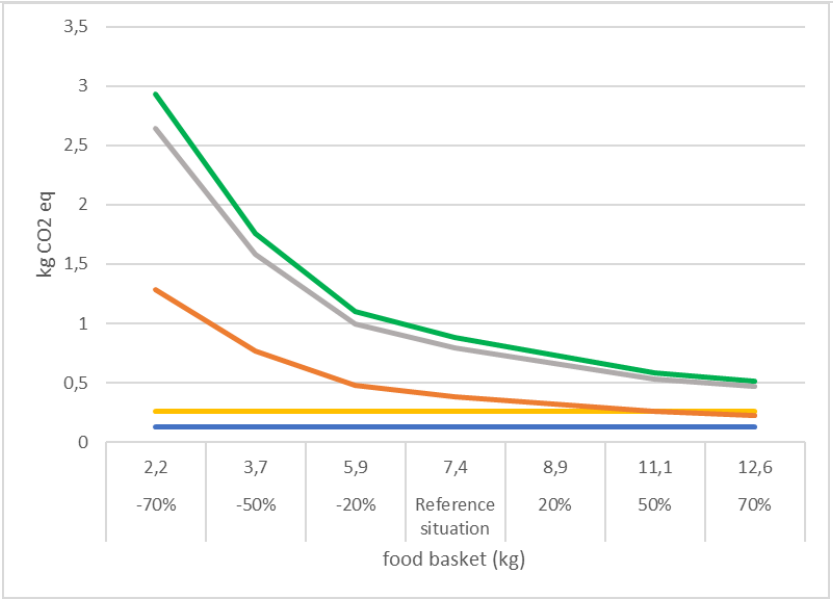


Point of intersection	Rural area (km)	Urban area (km)
Petrol car	6	3
Electric car – low emission	14	7
Electric car – German mix	7	3

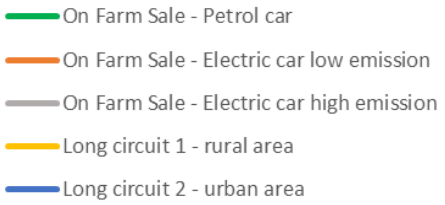
On farm sales I: The size of the food basket is fixed at 7,4kg while the length of the consumer's transport and the type of vehicle vary. Generally, the rural and the urban LFSC have a lower impact than the SFSC as soon as the farm is more than 3.5km (7km/2) away from the consumer's home. The exception to this rule is, in a rural area, the on-farm sale with the consumer using an electric vehicle powered by a low-emission electricity mix and the farm being less than 7km (14km/2) away from the consumer's home.

On farm sales – consumer transport = 20km

Point of intersection	Rural area (kg)	Urban area (kg)
Petrol car	25	50
Electric car – low emission	11	22

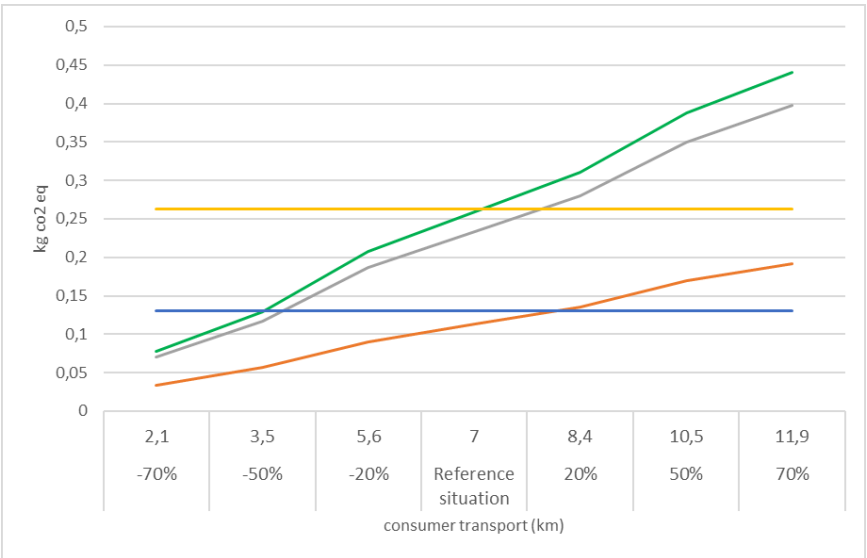


Electric car – high emission	**22**	**45**

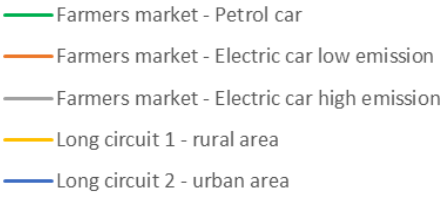


On farm sales II: The length of the consumer transport is fixed at 20km (home to farm distance = 10km) while the size of the food basket is varied for the SFSCs. The best performing SFSC (electric car with low-emission grid mix) is emitting less than the rural LFSC at the food basket size of 11 kg, to outperform the urban area LFSC a food basket of 22 kg is needed.

Farmers' market – food basket = 8.8kg

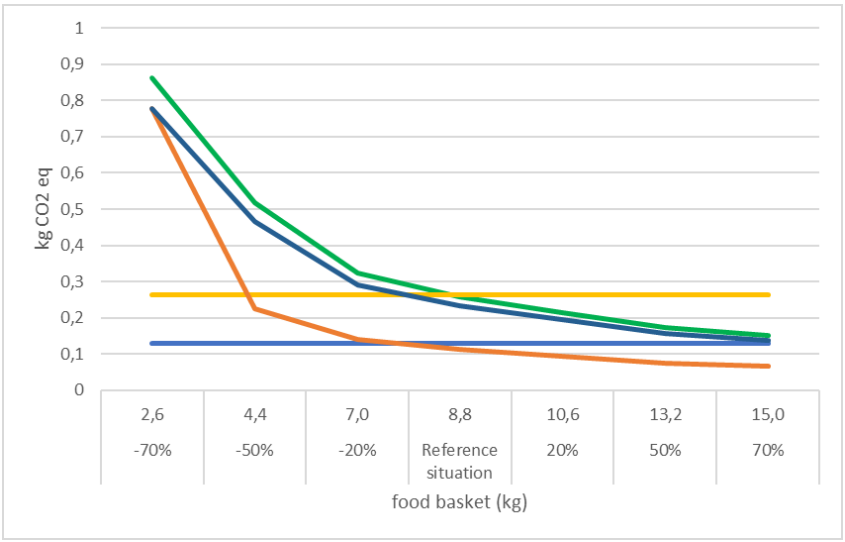


Point of intersection	Rural area (km)	Urban area (km)
Petrol car	**7**	**4**
Electric car – low emission	**16**	**8**
Electric car – high emission	**8**	**4**

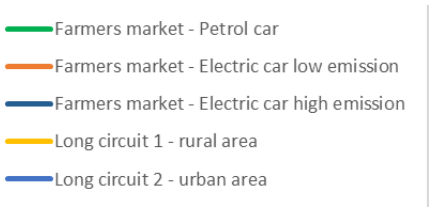


Famers' market I: The size of the food basket is held constant at 8.8kg while the distance of the consumer transport is varied. The curves are very similar to the same scenario of the on-farm sales SFSCs but slightly shifted (with respect to the y-axis) because of the different core assumption (size of food basket). The points of intersection are hence shifted as well, with the best performing SFSC (electric car – Swiss mix) outperforming the least emitting LFSC (urban area) at 8km (16km/2) of home to market distance.

Farmers' market – consumer transport = 7km



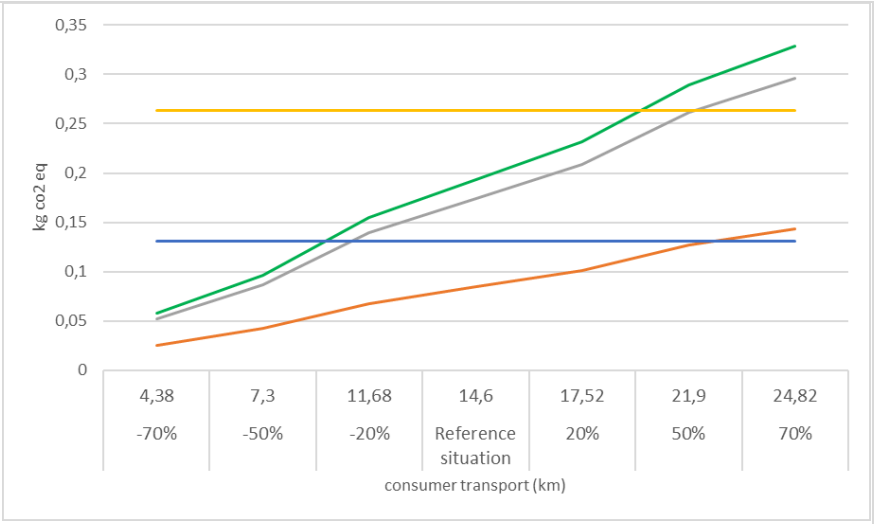
Point of intersection	Rural area (kg)	Urban area (kg)
Petrol car	9	17
Electric car – low emission	4	8
Electric car – high emission	8	16



Farmers' market II: The distance of the consumer's transport is fixed at 7km while the size of the food basket is varied. The best SFSC (electric car – Swiss mix) is outperforming the rural LFSC at 4kg of food basket and the urban LFSC at 8 kg. If the food basket is 17kg or higher, all SFSC options perform better than any of the two LFSCs.

Cooperative shop – food basket = 24.6kg

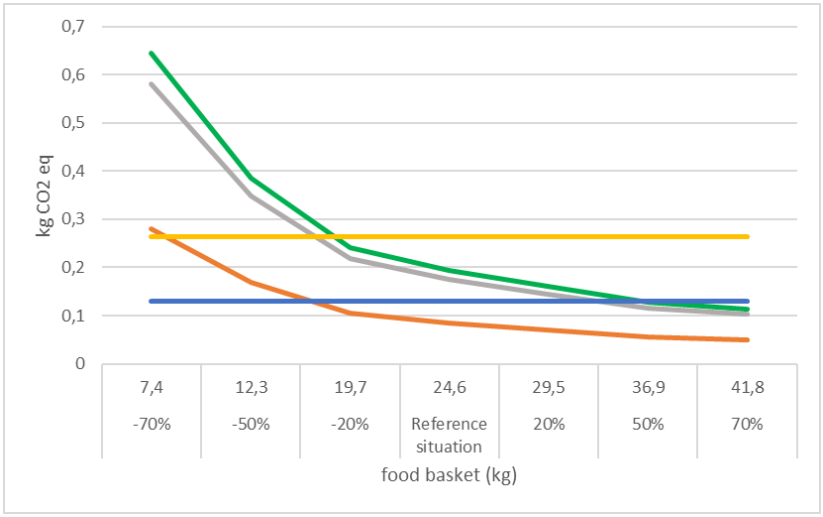
Point of intersection	Rural area (km)	Urban area (km)
Petrol car	20	10
Electric car – low emission	46	23



Electric car – high emission	**22**	**11**

Cooperative shop I: The food basket is fixed at 24.6kg while the distance is variable. All SFSCs perform better up to 5km (10km/2) of distance between home and cooperative shop. The best SFSC (electric car – Swiss mix) performs better than the best LFSC (urban area) up to a distance of 11.5km.

Cooperative shop – consumer transport = 14,6km



Point of intersection	Rural area (kg)	Urban area (kg)
Petrol car	**18**	**36**
Electric car – low emission	**8**	**16**
Electric car – high emission	**16**	**33**

Cooperative shop II: The transport distance of the consumer is fixed at 14.6km, so the home to shop distance is at 7.3km. At 8kg of food basket size, the SFSC with the electric car outperforms the rural LFSC and at 16kg it emits less than the urban LFSC.

It becomes obvious that the curves resemble each other very much. All scenarios with a fixed food basket have a similar shape and all scenarios with a fixed distance have a similar shape. The interception of the y-axis is dependent on these core assumptions. The results are therefore easily generalized: If a consumer wants to lower their impact, a large food basket should be bought at a short distance from home that is covered by an efficient car, such as an electric car that is powered with a low impact mix. From an environmental point of view, SFSCs that provide the opportunity to acquire a large food basket that can be complemented – if necessary – with products from different producers and are accessible by public transport are to be favored.

5.2. Socio-Economic scenarios

The combined results for each one of the selected scenarios are represented in the following tables. As could be observed in Table 4, "face-to-face" short food supply chains, comparing to its chain of reference, show no or almost no risk in terms of gender discrimination, health and safety, and issues related to the right of workers to associate, strike and bargain, the regulation of their contracts and the presence of corruption or anti-competitive behaviour. However, they do show a noticeable risk regarding the sector average wage and weekly hours, their participation in trade unions and social responsibility related memberships, and their contribution to economic development.

Table 4. Results obtained for face-to-face scenario's socio-economic assessment, comparing to its long chain of reference.

	FACE-TO-FACE	REFERENCE
WORKERS		
Gender Discrimination		
Gender wage gap	no risk	medium-high risk
Fair Salary		
Sector average wage, per month	high risk	very low-medium risk
Workers' rights		
Right of Association	no risk	no risk
Right of Collective bargaining	no risk	no risk
Right to Strike	no risk	no risk
Trade union density	very high risk	high-very high risk
Health and Safety		
Presence of sufficient safety measures	very low risk	low risk
Rate of fatal accidents at workplace	very low risk	very low risk
Rate of non-fatal accidents at workplace	very low risk	very low risk
Social Benefits, Legal Issues		

Evidence of violations of laws and employment regulations	very low risk	medium risk
Working Time		
Weekly hours of work per employee	low-high risk	medium-high risk
VALUE CHAIN ACTORS		
Corruption		
Active involvement of enterprises in corruption and bribery	very low risk	low-medium risk
Fair Competition		
Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation	no risk	low risk
Promoting Social Responsibility		
Membership in an initiative that promotes social responsibility along the supply chain	very high risk	high risk
LOCAL COMMUNITY AND SOCIETY		
Contribution to economic development		
Contribution of the sector to economic development	no-medium opportunity	no-medium opportunity
Embodied value-added total	high risk	medium-very high risk

Table 5 presents "proximate producer" scenario's results, which indicate that as well as the "face-to-face" scenario, there is no risk in terms of gender discrimination, health and safety, and issues related to the right of workers, the regulation of their contracts and the presence of corruption or anti-competitive behaviour. However, and unlike the previous scenario, this "proximate producer" shows a significantly lower risk in terms of sector average wage and weekly hours. Their partaking in trade unions and social responsibility related memberships and their contribution to economic development are risky aspects in this type of supply chains too.

Table 5. Results obtained for proximate producer scenario's socio-economic assessment, comparing to its long chain of reference.

	PROXIMATE PRODUCER	**REFERENCE**
WORKERS		
Gender Discrimination		
Gender wage gap	no risk	high risk
Fair Salary		
Sector average wage, per month	medium risk	very low-low risk
Workers' rights		
Right of Association	no risk	no risk
Right of Collective bargaining	no risk	no risk
Right to Strike	no risk	no risk
Trade union density	very high risk	very high risk
Health and Safety		
Presence of sufficient safety measures	very low risk	no data
Rate of fatal accidents at workplace	very low risk	very low risk
Rate of non-fatal accidents at workplace	low risk	low risk

Social Benefits, Legal Issues		
Evidence of violations of laws and employment regulations	very low risk	medium-high risk
Working Time		
Weekly hours of work per employee	low-medium risk	medium risk
VALUE CHAIN ACTORS		
Corruption		
Active involvement of enterprises in corruption and bribery	very low risk	low-medium risk
Fair Competition		
Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation	no risk	low risk
Promoting Social Responsibility		
Membership in an initiative that promotes social responsibility along the supply chain	very low-very high risk	very high risk
LOCAL COMMUNITY AND SOCIETY		
Contribution to economic development		
Contribution of the sector to economic development	low-medium opportunity	medium opportunity
Embodied value-added total	very high risk	high-very high risk

The "proximate shop" scenario (Table 6) is almost identical to the "proximate producer" scenario. Again, gender discrimination, health and safety, and issues related to the right of workers, their contracts, corruption, or anti-competitive behaviour remain issues with no risk involved, and unlike the "face-to-face" scenario, this type of chains also shows a significantly lower risk in terms of sector average wage and weekly hours. However, partaking in trade unions and memberships and their contribution to economic development are risky aspects that should be considered for future recommendations.

Table 6. Results obtained for proximate shop scenario's socio-economic assessment, comparing to its long chain of reference.

	PROXIMATE SHOP	**REFERENCE**
WORKERS		
Gender Discrimination		
Gender wage gap	no risk	medium risk
Fair Salary		
Sector average wage, per month	low-high risk	very low-medium risk
Workers' rights		
Right of Association	no risk	no risk
Right of Collective bargaining	no risk	no risk
Right to Strike	no risk	no risk
Trade union density	very high risk	very high risk
Health and Safety		
Presence of sufficient safety measures	very low risk	very low-low risk
Rate of fatal accidents at workplace	very low risk	very low risk
Rate of non-fatal accidents at workplace	very low risk	very low risk

Social Benefits, Legal Issues		
Evidence of violations of laws and employment regulations	very low risk	very low-medium risk
Working Time		
Weekly hours of work per employee	low risk	medium-high risk
VALUE CHAIN ACTORS		
Corruption		
Active involvement of enterprises in corruption and bribery	very low risk	low-medium risk
Fair Competition		
Presence of anti-competitive behaviour or violation of anti-trust and monopoly legislation	no risk	low risk
Promoting Social Responsibility		
Membership in an initiative that promotes social responsibility along the supply chain	very high risk	high risk
LOCAL COMMUNITY AND SOCIETY		
Contribution to economic development		
Contribution of the sector to economic development	low-medium opportunity	no-medium opportunity
Embodied value-added total	low-very high risk	medium-very high risk

Besides, the analysis of the qualitative questionnaire reveals that responding food producers highly value the direct relationship with their consumers, since they rate it as the most important advantage of SFSCs. Furthermore, it appears that SFSC models allowing a personal contact between producer and consumer foster all the benefits of SFSCs, especially the positive effect on producers' self-esteem, solidarity feeling and business model resilience and robustness.

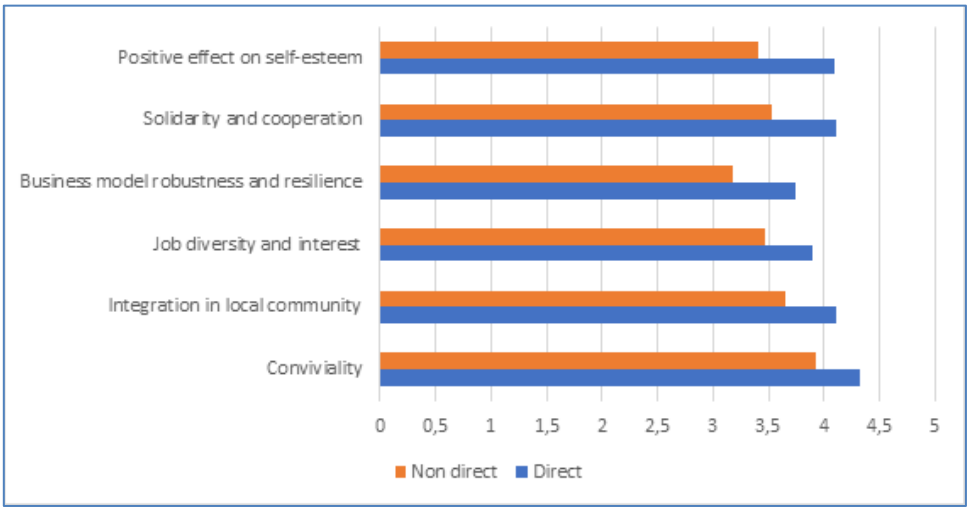


Figure 1: Perceptions of direct model's advantages

In terms of motivations, direct sellers logically give much more importance to the direct relationship with consumers, but are also more driven by the will to keep the control on their product till the end of the value chain, and by their unsatisfaction towards big distribution system.

Collective models, where several production units join to commercialize their products together, mainly enhance producers' bargaining power, as well as the resilience and robustness of their business models. Community integration is also more valued than in individual schemes. However, practitioners involved in this kind of collaboration see as less important the advantages linked to prices and salary, self-esteem and quality of life. People engaged in collective SFSCs are also more motivated by the involvement in their local community and economy.

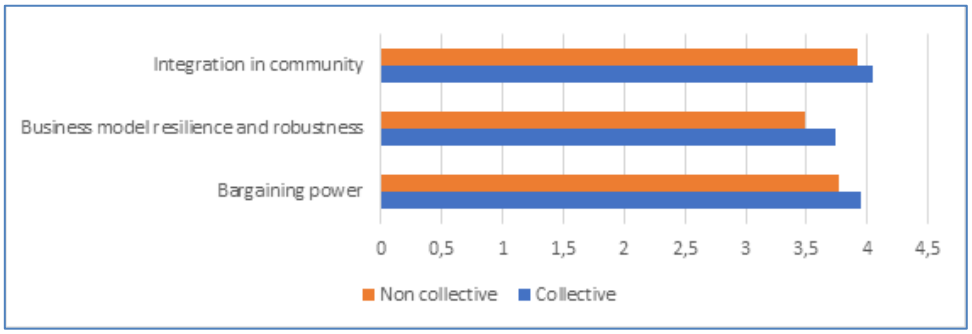


Figure 2: Perceptions of collective models' advantages

The CSA model has its own specificities, beyond individual-collective and direct-undirect dichotomies. Respondents taking part in this kind of SFSC see the increased bargaining power and the better prices and salary as less important, but value more the solidarity feeling and the integration in their community. The better quality of life and working conditions are also identified as a more important benefit in CSA than in other chains.

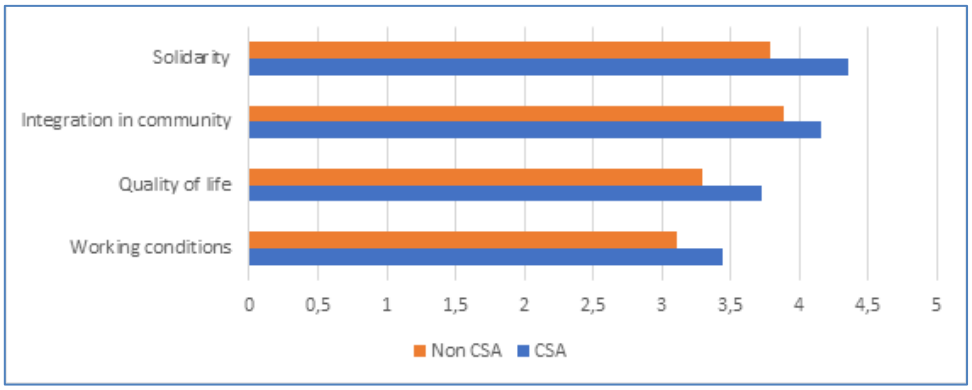


Figure 3: Perceptions of CSA's advantages

In terms of reasons to get involved in SFSCs, CSA members seem to be driven by social (community building and direct relationship with consumers) rather than economic motivations (better prices and bargaining power).

On another hand, we observed significative differences in the perceptions of producers handling animal-based products. Unless the economic advantages and empowerment brought by SFSCs appear to be particularly more relevant for them, they perceive almost all the SFSCs' advantages as more important, except the working conditions and quality of life. The better prices and the dissatisfaction towards big distribution system seem to be more important motivations than for producers of other kind of products.

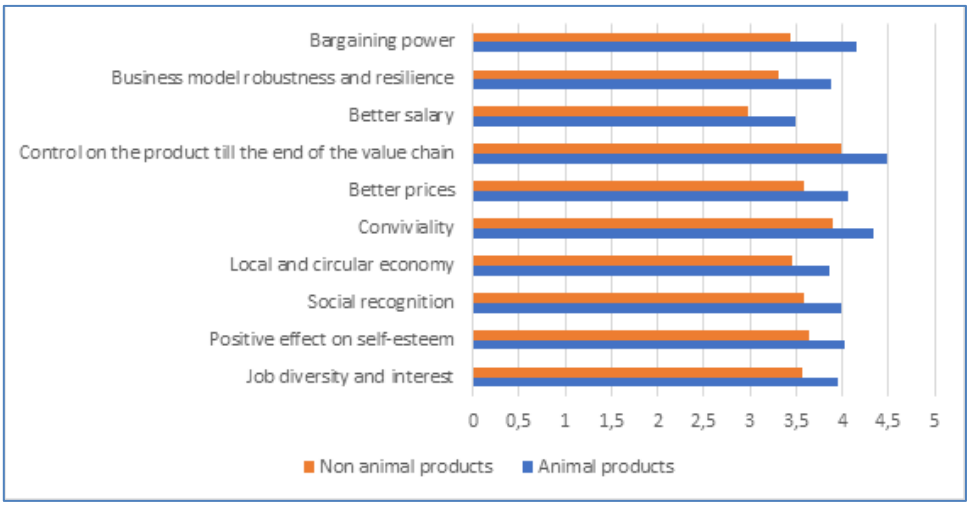


Figure 4: Perceptions of animal-based food producers

The producers handling animal-based product see also more advantages in SFSCs when they are involved in direct and/or collective models, especially in terms of positive effect on self-esteem and business model robustness/resilience (in direct models), and fairer trading practices and quality of life (in collective models), and less in the CSA. However, vegetal producers find more advantages when they are involved in CSA (especially in terms of solidarity feeling, quality of life and self-esteem) and direct sales (especially in terms of business model robustness, solidarity feeling and self-esteem), and less when they are in collective models. One hypothesis to be deepened might be that CSA models suit better the needs of vegetal production units, while collective formulas may be more relevant for producers of animal-based food.

The type of organization respondents belongs to gives interesting insights as well. Producers running a family farm give relatively more importance to the better prices, bargaining power, and job diversity and interest. However, the integration in community, solidarity feeling and local economy are seen as less important advantages of SFSCs. On the contrary, cooperatives give less importance to bargaining power, prices and job diversity/interest, and more to solidarity, fair trading practices and quality of life. In the same line, non-profit organizations' members also value more quality of life, solidarity and community integration, and see higher prices and product control as less important advantages.

It is interesting to note that family farms that commercialize (at least part of) their products through some kind of direct sale model value much higher most of the SFSCs advantages, especially the business model's robustness and resilience, job interest and diversity, and the positive effect on self-esteem. Integration in local community and, to a lesser extent, the increased bargaining power and better prices are also better rated by family farms practising direct sales.

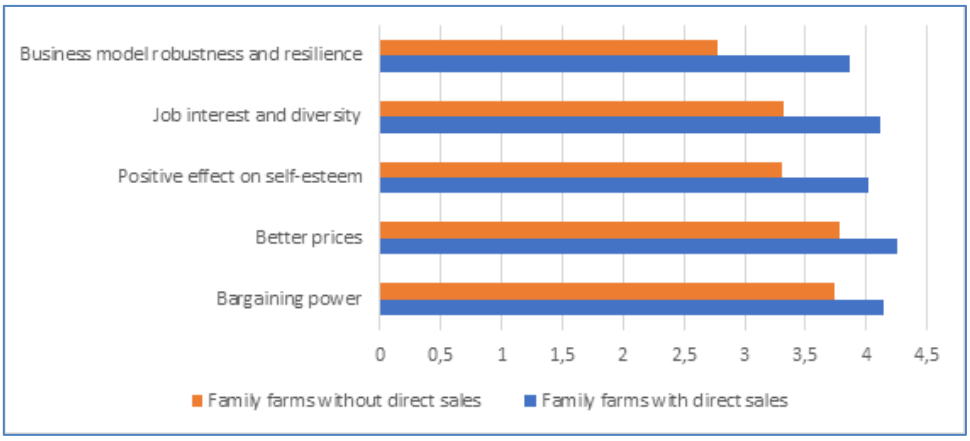


Figure 5: Perceptions of family farms with direct sales

Differences were also found with producers that also process their products, for whom SFSCs seem to have more advantages, especially in terms of bargaining power, working conditions and quality of life. On the contrary, the advantage of price seems more interesting for primary producers. Producers-processors give more importance to the resilience and robustness of their business model and to the diversification and interest of their job, in their motivation to get involved in SFSCs, while primary producers value more the better prices and the implication in local economy.

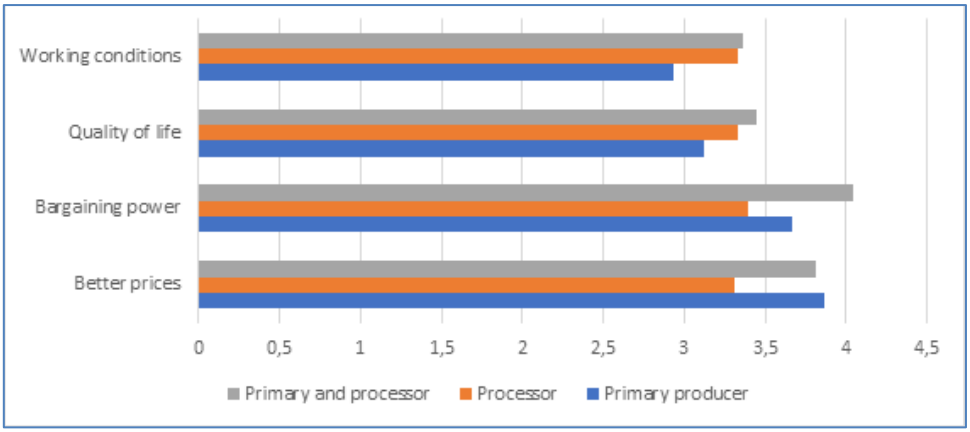


Figure 6: Perceptions of primary producers and processors

Finally, it is worth to note that significant differences have been found according to the country of respondents. The main advantage for Spanish producers, for example, is the increased bargaining power they have in SFSCs, the relationship with consumer and the control they keep on the product being in 2nd and 3rd position. Greek producers give also relatively more importance to the higher prices and salary they get for their products through SFSCs (2nd and 3rd position), and less to the direct relationship with consumers (5th position). Solidarity feeling seem to have more relative importance for Italian respondents (3rd position), while the positive effect on self-esteem is said to be relatively more relevant in Switzerland. SFSCs advantages globally got the lowest scores in Greece, and the highest in Hungary.

5.3. Trade Off Analysis

In the chapters above it became obvious that there are trade offs between the different pillars of sustainability. While some type of supply chain might be performing really well socially and economically due to a close relationship between the consumer and the producer, as well as good profit for the producer, it might have a high environmental impact due to a long transport distance by the consumer.

In order to become more aware of these trade offs, they are illustrated in table 6.

Table 7: Overview on trade-offs between different type of supply chains in the three pillars of sustainability

Face to face		**Environmental Assessment**	**Social Assessment**	**Economic Assessment**
Farm Shop Farmers Market Roadside Sales	**+**	- potentially less food loss - individual consumer transport (big food basket, short distance) - easily reusable packaging - short distance for logistic transport	- direct relationship - more consumer awareness - closer treatment with both the client and between workers - knowledge sharing - gender equality - worker's right to associate, bargain and strike - no corruption and fair competition	- full controll over payment scheme
Pick your own	**-**	- individual consumer transport (long distance and small food basket) - inefficient logistics	- absence of a worker's representative - occasional work overload - no membership in an initiative that promotes social responsibility along the supply chain	- uncertain sell-off - influence of temporary jobs on salary - low contribution to economic development - underdeveloped marketing
Spatial proximity		**Environmental Assessment**	**Social Assessment**	**Economic Assessment**
Local retail Cooperative shop	**+**	- potentially less food loss - consumer transport (short distance and big food basket) - easily reusable packaging and often bulk products - short distance for logistic transport	- gender equality - workers' right to associate, bargain and strike - no corruption and fair competition - appropriate working time	- partial to full control over payment scheme
	-	- inefficient logistics	- absence of a worker's representative - no membership in an initiative that promotes social responsibility along the supply chain	- potentially uncertain sell-off - low contribution to economic development - underdeveloped marketing
Spatial proximity		**Environmental Assessment**	**Social Assessment**	**Economic Assessment**
AOC		no data collected	no data collected	no data collected
LFSC		**Environmental Assessment**	**Social Assessment**	**Economic Assessment**
Supermarkets	**+**	- efficient logistics - consumer transport	- workers' right ot associate, bargain and	- certain sell-off - fair salaries

			strike - fair competition	
	-	- food loss - food waste - hard-to-reuse packaging	- no control over the supply chain - reduced power - no gender equality - occasional work overload - higher risk of corruption - no membership in an initiative that promotes social responsibility along the supply chain	- little to no control over profit - low contribution to economic development

6. Recommendations

6.1. Environmental Recommendations

The heterogeneity among SFSCs does not allow for an analysis of a generalized and averaged SFSC. It is the individual SFSC that has to be compared to the average LFSC, which in contrast does exist. In this project, a wide range of SFSCs has been under study. The different chains can be sorted according to the product that is sold, according to the distribution channel that is used (On farm sale, Community Supported Agriculture, Farmers' Market, Home Delivery, …) or according to the type of producer-consumer relationship there is: Face-to-Face, Spatial proximity, Spatially distant. An analysis across all these different types of supply chains has yielded a few parameters that seem to be of particular importance when aiming at a low environmental footprint. For some SFSCs, the environmental footprint was higher than the average LFSC and for others it was lower (see Deliverable 5.5). Consequently, instead of comparing SFSC to LFSC, the conditions were explored that need to be fulfilled by the SFSCs to be of low impact (see Sensitivity Analysis). Here, the environmental recommendations are presented based on the results of the sensitivity analysis and complemented by insights of the literature review.

6.1.1 Recommendations for Consumer

- Consumer transport is a main driver of environmental impacts in SFScs and thus also a powerful lever for reducing environmental impacts. The consumer can contribute to this by
    - choosing an environmentally friendly means of transport, such as bike, public transport or electric vehicles charged with a low-emission electricity mix
    - reducing the distance travelled per unit of product. There are two ways to influence this. On the one hand, the transport distance can be minimised by choosing nearby selling points. On the other hand, the food basket per purchase can be increased by choosing selling points that allow to buy a range of products If consumers would have to travel to different selling points to buy meat, dairy or vegetables from different suppliers, the environmental impact would be higher.

- Packaging: The main purpose of packaging is to preserve shelf-live. Usually, packaging makes up a small portion of the overall environmental footprint in the case of agricultural primary products. In order to create an even more sustainable packaging scheme, the container chosen by the consumer should be easy to reuse with little water and electricity use for cleaning as well as a long lifetime. It is important that the standards regarding food safety are adhered to.

6.1.2 Recommendations for Practitioners

- Consumer transport: As a practitioner, you can help do decrease the consumer's transport distance respectively increase the size of the food basket by complimenting your offer with goods from other producers.

- Logistics: SFSCs are often less efficient than conventional SC in terms of logistics. Choose an environmentally friendly vehicle and optimize the loading to prevent inefficient transport ways.

- CSA: Make or keep the pick-up points easily accessible, plan the route such that it's the most efficient/shortest route and consider alternative vehicles such as e-vans, cargo-e-bikes etc.

- Farmers' Market: Organize in a market committee and ensure complimentary offers from primary producers with good agricultural practices. Ensure regularity such that clients can rely on the opportunity.

- Cooperative Shop: Ensure complimentary offers (comprehensive food basket), inform clients about changes in the goods for sale, collect client wishes and choose an easily accessible location for the shop.

- On farm sales: Possibly compliment your offer with goods from your neighboring producer, avoid unnecessary or inefficient transports to do so.

- Home delivery: Encourage bulk buys, plan an efficient and short route or consider parcel delivery.

6.1.3 Recommendations for Public Authorities/Policy Recommendations

- Foster the development and continuation of traditional farmers' markets and cooperative shops, where primary producer can sell their goods in an easily accessible public area – ideally with complementary shops nearby

- Provide platforms for primary producers to connect and build networks of primary producers that complement each other's offer

Despite all the measures that can be taken to lower the environmental footprint of the value chain, one of the most important stages with regards to the contribution to the environmental impact remains the agricultural phase in most of the cases under research in this study. To truly create a sustainable food system, the actions taken on the field should be guaranteed the most attention. No recommendations are given to the production stage of the life cycle as this is outside of the scope of the project.

6.2. Socio-Economic Recommendations

The socio-economic recommendations are presented based on the results of the scenarios assessment and complemented by insights of the literature review. They are presented depending on the agent of change: practitioners and policy makers.

6.2.1. Practitioners' Recommendation

- Apart from conviviality and solidarity, the association with other producers (horizontal and/or vertical cooperation with SFSC and/or LFSC) enhances social and economic benefits of SFSCs:
    - In terms of business model, it allows to share knowledge, investments, and resources (to run a virtual or physical shop, for instance), to optimize logistics (collective deliveries) and to get more visibility. The association with producers of similar products may be an opportunity to share processing and specific logistics facilities.
    - Diversify the offer and provide consumers a larger variety of products.
    - Stabilize annual tasks' schedules for avoiding work overload and temporary work.

- To increase the resilience of a company, the accessibility of products should be increased. Online sales, new local-food markets or social events, as well as good sources of communication and marketing, could attract more audience, increasing the product demand and ensuring the success in new markets.

- Consumer trust could be increased by, for example, implementing social or educational campaigns focused on demonstrating the transparency and traceability of the products.

- To foster the marketing potential of this direct relationship with consumers, synergies can be found with other activities such as tourism, cultural and pedagogical activities, which have positive feedback on the sales.

- The value proposition (namely high-quality, fresh and naturalness, sustainability and authenticity) is a key success factor of SFSCs economic performance and competitiveness (WP2). And as it was found in WP4, SFSCs clients show a "greater willingness to pay more for organic and pesticide-free products for health reasons".

- To increase business resilience and performance, a combination of different chains, including more conventional ones, is a key issue. In any case, it seems that SFSCs fulfil more adequately the needs of producers that handle small quantities, taking the gamble of quality/exclusivity rather than quantity.

- Contractual models, requiring a greater engagement of consumers, such as CSA, provide higher business certainty and quality of life to producers.

- Enable the consumers to make complaints through a suggestion box anda costumer care sections, among others. This will also help raising the consumers' satisfaction.

- Encourage local authorities to provide the necessary assistance for producers to keep on developing their actions.

6.2.2. Policy Recommendations

- Foster local reindustrialization (slaughterhouses, mills, shared processing plants, etc.), and their adaptation to handle small and seasonal productions. The lack of adapted and proximate processing infrastructures is an important hindering factor in SFSCs development (T9.4).

- Include in public procurement rules social criteria favoring providers that are socially sustainable, in the sense that they contribute to the local economy, to the viability of small farmers, to rural areas revitalization etc.

- Implement and harmonize the flexibilization and adaptation measures of the hygiene package rules, which are already foreseen by the European legislator, but poorly and unequally implemented at national level. Define the conditions and modalities under which exclusion, derogation and adaptation may be implemented, for some types of businesses/processes/quantities, to keep them proportionate to the risk posed by particular food operations, methods of production or establishments, recognising the different levels and scales for SFSC, direct selling and production. This will avoid costly and irrelevant controls and measures to small structures and help them to keep viable.

- Provide tailored and up-to-date information and training to small farmers/processors about HACCP standards requirements.

- Implement favoring tax system for small producers selling through SFSCs, according to social criteria (e.g. low income), for their contribution to local economy, etc.

- Coordinating and harmonizing policy measures with increased access, awareness, and empowerment of consumers to choose healthy and sustainable and quality food, promoting the

transition from food consumption to responsible eating behavior, characterized by care, awareness, and responsibility.

- Invest more in SFSC related research for their development and identifying improvements. The results of our environmental and socioeconomic assessments call for more coordination of the food production and supply in SFSCs. From a social perspective, the modalities of this cooperation (vertical and horizontal) should be further investigated, focussing on the conditions under which cooperatives effectively act as a support to producers' empowerment. In a general way, more data is also needed, harmonized data at EU level, according to common criteria and indicators, to know more about the contribution of SFSC in EU economy (in terms of GDP, employment, etc.), their relative importance in producers' business model, but also more qualitative aspect (satisfaction of producers, …).

7. Synthesis

It can be concluded that there are some key elements that characterize sustainable short food supply chains. A sustainable short food supply chain needs to allow i) a diversification of distribution channels and points of sale, ii) a collaborative approach of different producers to create a critical mass in number and mass of products and share knowledge and experience, iii) to have a close and direct contact with the consumers both from a geographical and social perspective. In addition, both producers and customers can minimise the environmental impact of logistics by choosing environmentally friendly means of transport and using their transport capacity as efficiently as possible.

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9. Appendices

Annex 1 : Environmental impacts for each scenario for the climate change indicator

On farm sale

		Climate change (kg CO2 eq) Food basket = 7,4 kg				
Consumer transport (km)		**On Farm Sale - Petrol car**	**On Farm Sale - Electric car low emission**	**On Farm Sale - Electric car high emission**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	6	2,6E-01	1,2E-01	2,4E-01	/	/
-50%	10	4,4E-01	1,9E-01	4,0E-01	/	/
-20%	16	7,0E-01	3,1E-01	6,3E-01	/	/
Reference	**20**	**8,8E-01**	**3,8E-01**	**7,9E-01**	**2,6E-01**	**1,3E-01**
+20%	24	1,1E+00	4,6E-01	9,5E-01	/	/
+50%	30	1,3E+00	5,8E-01	1,2E+00	/	/
+70%	34	1,5E+00	6,5E-01	1,3E+00	/	/

		Climate change (kg CO2 eq) Consumer transport = 20km				
Food basket (kg)		**On Farm Sale - Petrol car**	**On Farm Sale - Electric car low emission**	**On Farm Sale - Electric car high emission**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	2,2	2,9E+00	1,3E+00	2,6E+00	/	/
-50%	3,7	1,8E+00	7,7E-01	1,6E+00	/	/
-20%	5,9	1,1E+00	4,8E-01	9,9E-01	/	/
Reference	**7,4**	**8,8E-01**	**3,8E-01**	**7,9E-01**	**2,6E-01**	**1,3E-01**
+20%	8,9	7,3E-01	3,2E-01	6,6E-01	/	/
+50%	11,1	5,9E-01	2,6E-01	5,3E-01	/	/
+70%	12,6	5,2E-01	2,3E-01	4,7E-01	/	/

Farmer's market

		Climate change (kg CO2 eq) Food basket = 8,8 kg				
Consumer transport (km)		**Farmers market - Petrol car**	**Farmers market - Electric car low emission**	**Farmers market - Electric car high emission**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	2,1	7,8E-02	3,4E-02	7,0E-02	/	/
-50%	3,5	1,3E-01	5,7E-02	1,2E-01	/	/
-20%	5,6	2,1E-01	9,0E-02	1,9E-01	/	/
Reference	7	**2,6E-01**	**1,1E-01**	**2,3E-01**	**2,6E-01**	**1,3E-01**
+20%	8,4	3,1E-01	1,4E-01	2,8E-01	/	/
+50%	10,5	3,9E-01	1,7E-01	3,5E-01	/	/
+70%	11,9	4,4E-01	1,9E-01	4,0E-01	/	/

		Climate change (kg CO2 eq) Consumer transport = 7km				
Food basket (kg)		Farmers market - Petrol car	Farmers market - Electric car low emission	Farmers market - Electric car high emission	Long circuit - rural area	Long circuit - urban area
-70%	2,6	8,6E-01	7,8E-01	7,8E-01	/	/
-50%	4,4	5,2E-01	2,3E-01	4,7E-01	/	/
-20%	7,0	3,2E-01	1,4E-01	2,9E-01	/	/
Reference	**8,8**	**2,6E-01**	**1,1E-01**	**2,3E-01**	**2,6E-01**	**1,3E-01**
+20%	10,6	2,2E-01	9,4E-02	1,9E-01	/	/
+50%	13,2	1,7E-01	7,5E-02	1,6E-01	/	/
+70%	15,0	1,5E-01	6,7E-02	1,4E-01	/	/

Cooperative shop

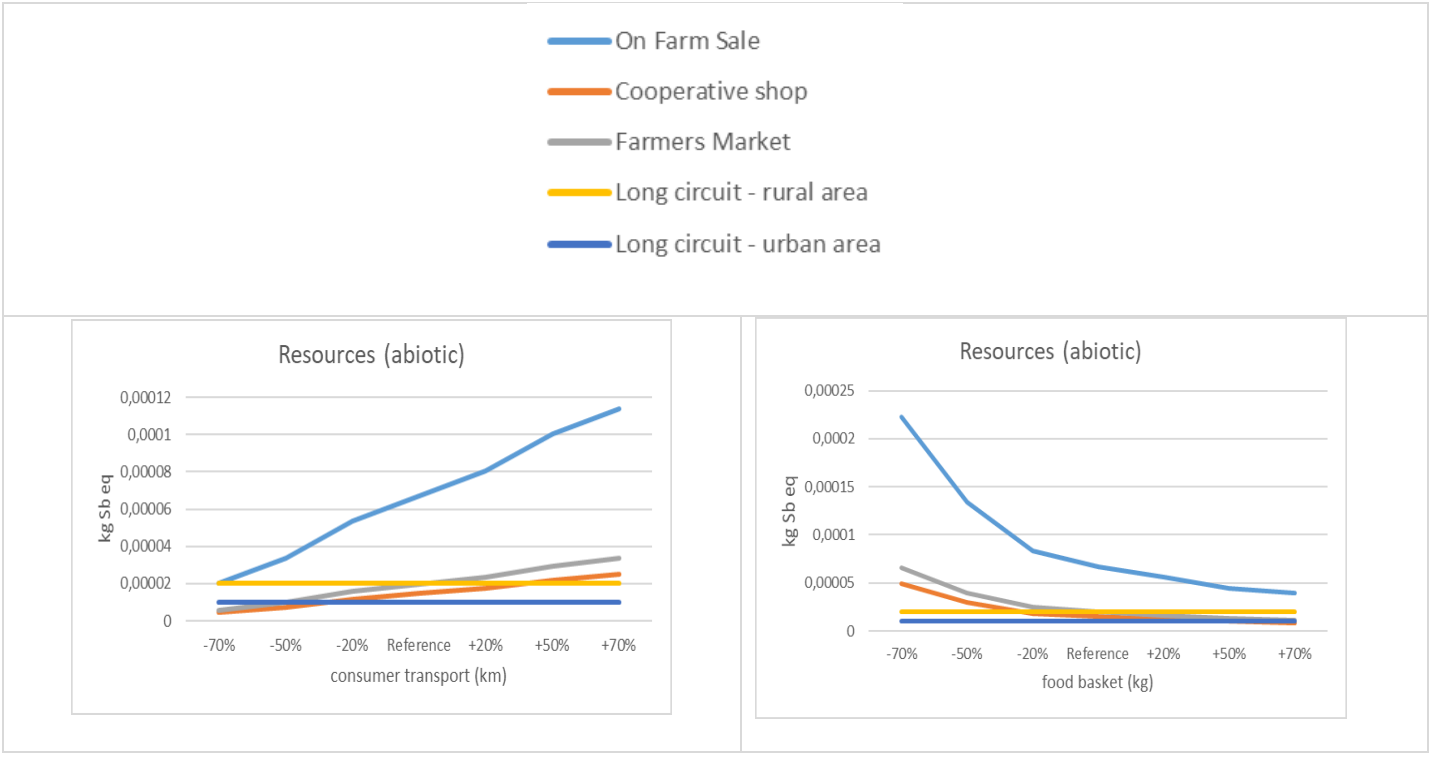
		Climate change (kg CO2 eq) Food basket = 24,6 kg				
Consumer transport (km)		Cooperative shop - Petrol car	Cooperative shop - Electric car low emission	Cooperative shop - Electric car high emission	Long circuit - rural area	Long circuit - urban area
-70%	4,4	5,8E-02	2,5E-02	5,2E-02	/	/
-50%	7,3	9,7E-02	4,2E-02	8,7E-02	/	/
-20%	11,7	1,5E-01	6,7E-02	1,4E-01	/	/
Reference	14,6	**1,9E-01**	**8,4E-02**	**1,7E-01**	**2,6E-01**	**1,3E-01**
+20%	17,5	2,3E-01	1,0E-01	2,1E-01	/	/
+50%	21,9	2,9E-01	1,3E-01	2,6E-01	/	/
+70%	24,8	3,3E-01	1,4E-01	3,0E-01	/	/

		Climate change (kg CO2 eq) Consumer transport = 14,6km				
Food basket (kg)		Cooperative shop - Petrol car	Cooperative shop - Electric car low emission	Cooperative shop - Electric car high emission	Long circuit - rural area	Long circuit - urban area
-70%	7,4	6,4E-01	2,8E-01	5,8E-01	/	/
-50%	12,3	3,9E-01	1,7E-01	3,5E-01	/	/
-20%	19,7	2,4E-01	1,1E-01	2,2E-01	/	/
Reference	**24,6**	**1,9E-01**	**8,4E-02**	**1,7E-01**	**2,6E-01**	**1,3E-01**
+20%	29,5	1,6E-01	7,0E-02	1,5E-01	/	/
+50%	36,9	1,3E-01	5,6E-02	1,2E-01	/	/
+70%	41,8	1,1E-01	5,0E-02	1,0E-01	/	/

Annex 2 : Environmental impacts of each scenario for other environmental indicators

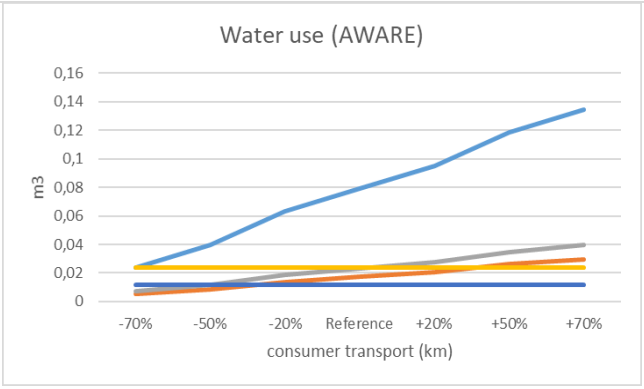
Reminder of the reference situation of each scenario

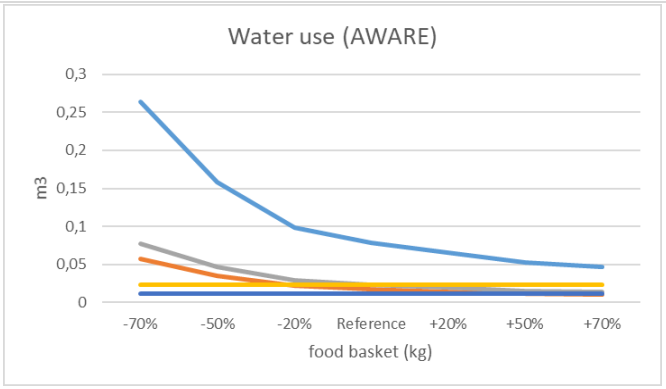
		Distance (km) (return trip)	Size of the food basket (kg)	Average distance km/kg
Short Food Supply Chain	**Face to face: On-farm sales**	20	7.4	2.7
	Face to face: farmers market	7	8.8	0.8
	Spatial proximity: Cooperative shop	14.6	24.6	0.6
Long Food Supply Chain	**Urban area**	8.8	21.9	0.4
	Rural area	18.6	23	0.8



	Resources (abiotic) (kg Sb eq)				
Consumer transport (km)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	2,0E-05	4,4E-06	5,9E-06	/	/
-50%	3,3E-05	7,4E-06	9,9E-06	/	/
-20%	5,4E-05	1,2E-05	1,6E-05	/	/
Reference	**6,7E-05**	**1,5E-05**	**2,0E-05**	**2,0E-05**	**1,0E-05**
+20%	8,0E-05	1,8E-05	2,4E-05	/	/
+50%	1,0E-04	2,2E-05	3,0E-05	/	/
+70%	1,1E-04	2,5E-05	3,3E-05	/	/

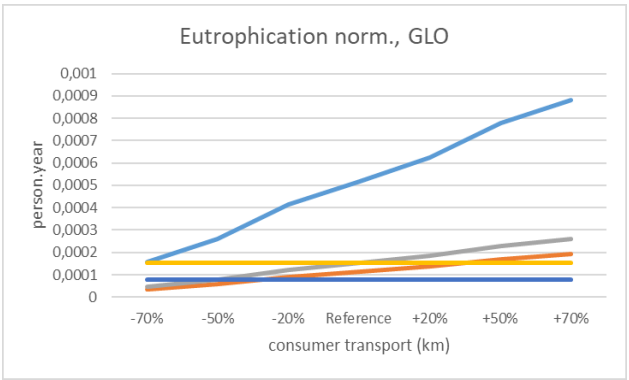
	Resources (abiotic) (kg Sb eq)				
Food basket (kg)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	2,2E-04	4,9E-05	6,6E-05	/	/
-50%	1,3E-04	2,9E-05	3,9E-05	/	/
-20%	8,4E-05	1,8E-05	2,5E-05	/	/
Reference	**6,7E-05**	**1,5E-05**	**2,0E-05**	**2,0E-05**	**1,0E-05**
+20%	5,6E-05	1,2E-05	1,6E-05	/	/
+50%	4,5E-05	9,8E-06	1,3E-05	/	/
+70%	3,9E-05	8,6E-06	1,2E-05	/	/

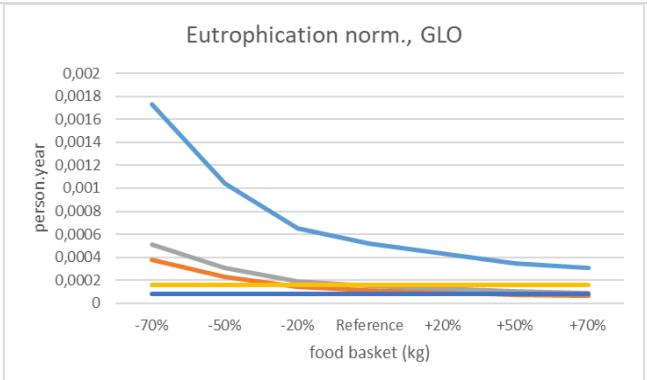




	Water use (AWARE) (m3)				
Consumer transport (km)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	2,4E-02	5,2E-03	7,0E-03	/	/
-50%	4,0E-02	8,7E-03	1,2E-02	/	/
-20%	6,3E-02	1,4E-02	1,9E-02	/	/
Reference	**7,9E-02**	**1,7E-02**	**2,3E-02**	**2,4E-02**	**1,2E-02**
+20%	9,5E-02	2,1E-02	2,8E-02	/	/
+50%	1,2E-01	2,6E-02	3,5E-02	/	/
+70%	1,3E-01	3,0E-02	4,0E-02	/	/

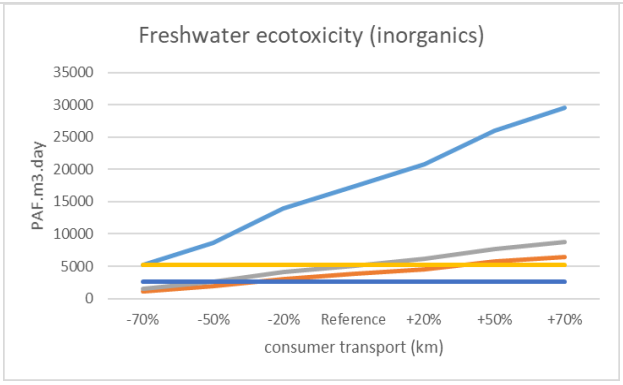
	Water use (AWARE) (m3)				
Food basket (kg)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	2,6E-01	5,8E-02	7,8E-02	/	/
-50%	1,6E-01	3,5E-02	4,7E-02	/	/
-20%	9,9E-02	2,2E-02	2,9E-02	/	/
Reference	**7,9E-02**	**1,7E-02**	**2,3E-02**	**2,4E-02**	**1,2E-02**
+20%	6,6E-02	1,4E-02	1,9E-02	/	/
+50%	5,3E-02	1,2E-02	1,6E-02	/	/
+70%	4,6E-02	1,0E-02	1,4E-02	/	/

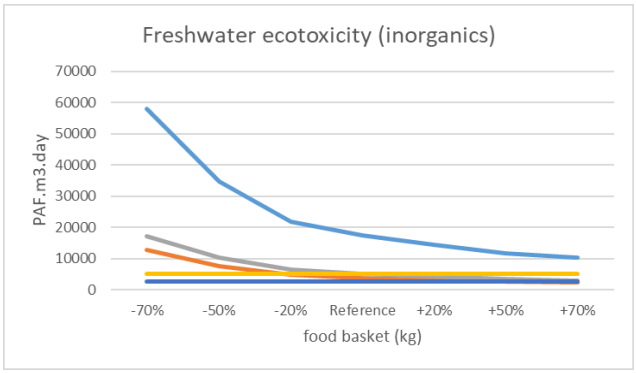




	Eutrophication norm., GLO (person.year)				
Consumer transport (km)	**On Farm Sale**	**Cooperative shop**	**Farmers Market**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	1,6E-04	3,4E-05	4,6E-05	/	/
-50%	2,6E-04	5,7E-05	7,6E-05	/	/
-20%	4,2E-04	9,1E-05	1,2E-04	/	/
Reference	**5,2E-04**	**1,1E-04**	**1,5E-04**	**1,6E-04**	**7,7E-05**
+20%	6,2E-04	1,4E-04	1,8E-04	/	/
+50%	7,8E-04	1,7E-04	2,3E-04	/	/
+70%	8,8E-04	1,9E-04	2,6E-04	/	/

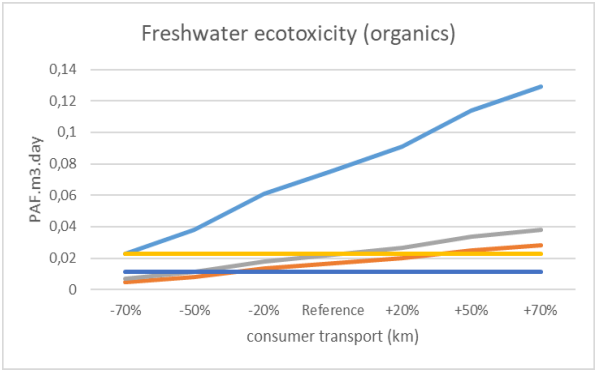
	Eutrophication norm., GLO (person.year)				
Food basket (kg)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	1,7E-03	3,8E-04	5,1E-04	/	/
-50%	1,0E-03	2,3E-04	3,1E-04	/	/
-20%	6,5E-04	1,4E-04	1,9E-04	/	/
Reference	**5,2E-04**	**1,1E-04**	**1,5E-04**	**1,6E-04**	**7,7E-05**
+20%	4,3E-04	9,5E-05	1,3E-04	/	/
+50%	3,5E-04	7,6E-05	1,0E-04	/	/
+70%	3,1E-04	6,7E-05	9,0E-05	/	/

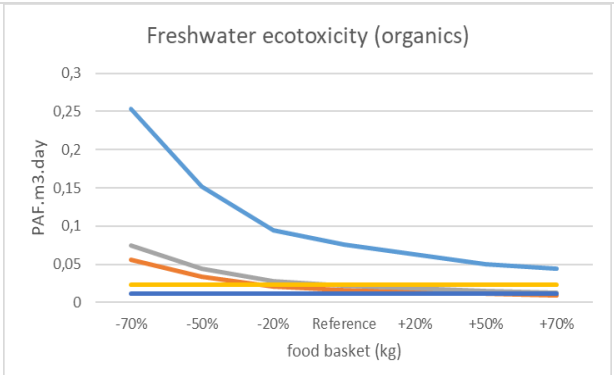




	Freshwater ecotoxicity (inorganics) (PAF.m3.day)				
Consumer transport (km)	**On Farm Sale**	**Cooperative shop**	**Farmers Market**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	5,2E+03	1,1E+03	1,5E+03	/	/
-50%	8,7E+03	1,9E+03	2,6E+03	/	/
-20%	1,4E+04	3,1E+03	4,1E+03	/	/
Reference	**1,7E+04**	**3,8E+03**	**5,1E+03**	**5,2E+03**	**2,6E+03**
+20%	2,1E+04	4,6E+03	6,1E+03	/	/
+50%	2,6E+04	5,7E+03	7,7E+03	/	/
+70%	3,0E+04	6,5E+03	8,7E+03	/	/

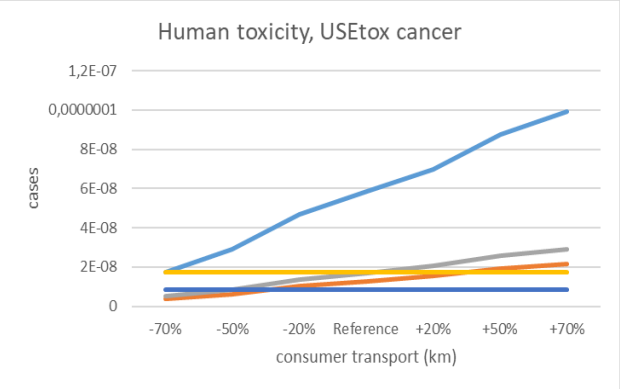
	Freshwater ecotoxicity (inorganics) (PAF.m3.day)				
Food basket (kg)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	5,8E+04	1,3E+04	1,7E+04	/	/
-50%	3,5E+04	7,6E+03	1,0E+04	/	/
-20%	2,2E+04	4,8E+03	6,4E+03	/	/
Reference	**1,7E+04**	**3,8E+03**	**5,1E+03**	**5,2E+03**	**2,6E+03**
+20%	1,4E+04	3,2E+03	4,3E+03	/	/
+50%	1,2E+04	2,5E+03	3,4E+03	/	/
+70%	1,0E+04	2,2E+03	3,0E+03	/	/

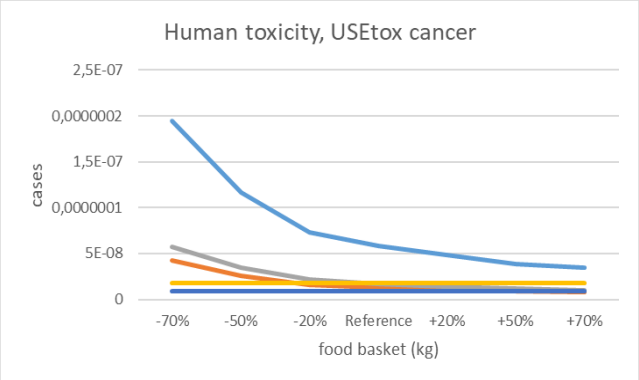




	Freshwater ecotoxicity (organics) (PAF.m3.day)				
Consumer transport (km)	**On Farm Sale**	**Cooperative shop**	**Farmers Market**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	2,3E-02	5,0E-03	6,7E-03	/	/
-50%	3,8E-02	8,3E-03	1,1E-02	/	/
-20%	6,1E-02	1,3E-02	1,8E-02	/	/
Reference	**7,6E-02**	**1,7E-02**	**2,2E-02**	**2,3E-02**	**1,1E-02**
+20%	9,1E-02	2,0E-02	2,7E-02	/	/
+50%	1,1E-01	2,5E-02	3,4E-02	/	/
+70%	1,3E-01	2,8E-02	3,8E-02	/	/

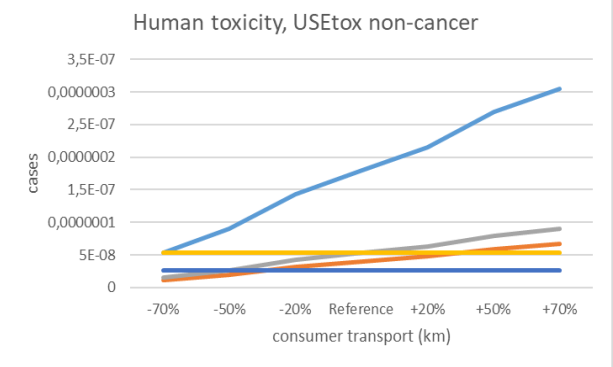
	Freshwater ecotoxicity (organics) (PAF.m3.day)				
Food basket (kg)	**On Farm Sale**	**Cooperative shop**	**Farmers Market**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	2,5E-01	5,6E-02	7,4E-02	/	/
-50%	1,5E-01	3,3E-02	4,5E-02	/	/
-20%	9,5E-02	2,1E-02	2,8E-02	/	/
Reference	**7,6E-02**	**1,7E-02**	**2,2E-02**	**2,3E-02**	**1,1E-02**
+20%	6,3E-02	1,4E-02	1,9E-02	/	/
+50%	5,1E-02	1,1E-02	1,5E-02	/	/
+70%	4,5E-02	9,8E-03	1,3E-02	/	/

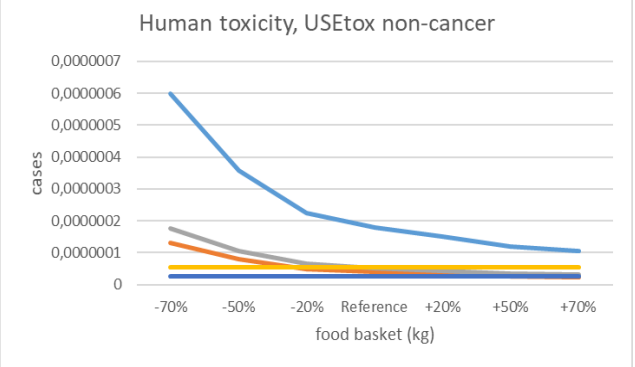




	Human toxicity, USEtox cancer (cases)				
Consumer transport (km)	**On Farm Sale**	**Cooperative shop**	**Farmers Market**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	1,7E-08	3,8E-09	5,1E-09	/	/
-50%	2,9E-08	6,4E-09	8,6E-09	/	/
-20%	4,7E-08	1,0E-08	1,4E-08	/	/
Reference	**5,8E-08**	**1,3E-08**	**1,7E-08**	**1,7E-08**	**8,7E-09**
+20%	7,0E-08	1,5E-08	2,1E-08	/	/
+50%	8,7E-08	1,9E-08	2,6E-08	/	/
+70%	9,9E-08	2,2E-08	2,9E-08	/	/

	Human toxicity, USEtox cancer (cases)				
Food basket (kg)	**On Farm Sale**	**Cooperative shop**	**Farmers Market**	**Long circuit - rural area**	**Long circuit - urban area**
-70%	1,9E-07	4,3E-08	5,7E-08	/	/
-50%	1,2E-07	2,6E-08	3,4E-08	/	/
-20%	7,3E-08	1,6E-08	2,1E-08	/	/
Reference	**5,8E-08**	**1,3E-08**	**1,7E-08**	**1,7E-08**	**8,7E-09**
+20%	4,9E-08	1,1E-08	1,4E-08	/	/
+50%	3,9E-08	8,5E-09	1,1E-08	/	/
+70%	3,4E-08	7,5E-09	1,0E-08	/	/





	Human toxicity, USEtox non-cancer (cases)				
Consumer transport (km)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	5,4E-08	1,2E-08	1,6E-08	/	/
-50%	9,0E-08	2,0E-08	2,6E-08	/	/
-20%	1,4E-07	3,2E-08	4,2E-08	/	/
Reference	**1,8E-07**	**3,9E-08**	**5,3E-08**	**5,4E-08**	**2,7E-08**
+20%	2,2E-07	4,7E-08	6,3E-08	/	/
+50%	2,7E-07	5,9E-08	7,9E-08	/	/
+70%	3,0E-07	6,7E-08	9,0E-08	/	/

	Human toxicity, USEtox non-cancer (cases)				
Food basket (kg)	On Farm Sale	Cooperative shop	Farmers Market	Long circuit - rural area	Long circuit - urban area
-70%	6,0E-07	1,3E-07	1,8E-07	/	/
-50%	3,6E-07	7,9E-08	1,1E-07	/	/
-20%	2,2E-07	4,9E-08	6,6E-08	/	/
Reference	**1,8E-07**	**3,9E-08**	**5,3E-08**	**5,4E-08**	**2,7E-08**
+20%	1,5E-07	3,3E-08	4,4E-08	/	/
+50%	1,2E-07	2,6E-08	3,5E-08	/	/
+70%	1,1E-07	2,3E-08	3,1E-08	/	/