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Measuring Short Food Supply Chain Sustainability: A Selection of Attributes and Indicators through a Qualitative Approach

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Abstract: Short food supply chains (SFSCs) are one of the most direct approaches to more directly connecting consumers with producers. The scaling-up of SFSCs is often challenged by critical issues which can be overcome with identification of the most sustainable, replicable schemes. This paper presents the results of a participatory analysis conducted within the agroBRIDGES H2020 project, with the aim of defining a list of economic, social, and environmental attributes and indicators to assess the sustainability of SFSCs and set up a decision-making tool to support producers in self-assessing their sustainability level and choosing the most appropriate business model (BM) from those identified within the project. The proposed framework was based on a literature review and validated using co-creation exercises (Delphi rounds and focus groups) with relevant European stakeholders. A final set of 47 indicators was identified, and their potential for use in assessing the sustainability level of various BMs was also validated. Early results highlighted three main issues: indicator calculation feasibility, business model categorization, and the simplicity of the framework for sustainability self-assessment. Some recommendations are made, including the importance of using a participatory process in building an evaluation framework on SFSC sustainability and the necessity of its adaptation to territorial contexts and needs.

Keywords: short supply chains; producers; sustainability; participatory methods; co-creation exercise; farmers

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1. Introduction

Short food supply chains (SFSCs) can be understood as supply chains with a minimized number of intermediaries. Although they have been proven to bring economic, social, and environmental benefits, they represent a niche phenomenon in the agri-food market [1–5]. The so-called "gold standard" for SFSCs would be direct contact between the producer and the consumer in terms of maximizing revenue and income for farmers and producers [6,7].

SFSCs are also considered in the Farm to Fork strategy as a useful way of improving the resilience of regional and local food systems, considering their production, processing, and selling processes, as an alternative to conventional longer chains [6,8].

The literature presents and catalogues many different types of SFSCs; these are classified according to different criteria, including the geographical distance between the production and sales points and the chain's organizational aspects [5,9–11].

Nowadays, the spread of SFSCs is enhanced by many factors, including an interest in and awareness of the consumption of local and secure products, as well as a willingness to establish direct contact with the producers or a level of trust regarding the origin and traceability of a product [7,9,12,13]. Despite this growing trend, some barriers limiting the scaling-up of SFSCs still exist, including a lack of information (e.g., unclear labels or

difficulties in communicating the added value of products), weak cooperation between producers, a generational gap, and infrastructural deficiencies (e.g., critically minimal Internet connection in rural areas, and logistics and distribution issues). Several studies, such as that of Hyland et al., conducted in 2021 [14] within the framework of the H2020 agroBRIDGES project, highlight that major consumer motivations to purchase within short chains include product quality in terms of taste and freshness, food safety issues, support for the local economy, and trust in SFSC producers.

This study is also part of the same H2020 research project, which is largely based on the development of an agri-food multi-actor framework and a set of practical support tools (called the agroBRIDGES toolbox) which can be used to connect producers with consumers in new SFSC business and marketing models (BMs), a term which is further defined later in this work. Among the different tools available, a key role is played by the development of a producer decision-support tool (DST) to facilitate the identification of the most sustainable business model to be adopted by each producer. The tool is based on a multi-criteria decision analysis (MCDA) that compares BMs. In MCDA approaches, it is assumed that the relative attractiveness of the sales channels depends on a set of indicators [15]. The indicators are intended to measure the economic, environmental, and social sustainability of the sales channels.

The purpose of this study is to show how a participatory process succeeded in the identification of a set of attributes and indicators that constitute the basis of the DST, supporting farmers in self-measuring their production sustainability.

To achieve this goal, suitable indicators to compare the business models within an SFSC were identified through a two-stage qualitative analysis. After a first stage of in-depth analysis of the literature, experts and stakeholders from different European countries were included in two Delphi rounds and two focus groups (FGs) to discuss a primary list of indicators and choose those considered more suitable from the point of view of producers. A final set of 47 indicators, listed as 14 attributes corresponding to 3 sustainability dimensions, was created.

Although, in the literature, studies investigating the sustainability of supply chains are often focused on consumer benefits or preferences and the analysis of market demand [16–19], the novelty of this study lies in its consideration of the production side and the position of farmers in the supply and value chains. Moreover, the sustainability assessment was conducted using the direct engagement of producer and sector representatives, who were involved in participatory exercises.

This paper is divided into six sections: an introduction, presenting the general context of the research and objectives; a literature review on SFSC classification approaches; a methodology section illustrating the indicator definition process following the agroBRIDGES participatory approach, with a focus on how a qualitative approach has been effective during the definition process and considering the inclusiveness and interactions occurring in the focus groups and Delphi rounds; results and discussion sections on the concrete use of such evidences; and a conclusions section regarding the limits of the research and future steps.

2. Literature Review

Traditionally, SFSCs allowed producers to have a strong position in the food chain, but their role decreased with Europe's industrialization and the rise of long-distance transportation, urbanization, and technological advances [20]. Mass distribution rose spectacularly in the 1960s with the import of the American model of supermarkets to Western Europe, unbalancing the producer's position in the agri-food supply chain and decreasing their income. During the 1990s, many small farms disappeared, and local open-air markets were often dominated by retailers who procured from wholesalers and large chain suppliers. Nowadays, renewed consumer interest in direct purchasing, in relation to the demand for more secure products, has boosted the resurgence of SFSCs and of new and

innovative business models [5,7,21]. In 2015, 15% of farmers sold half of their products via short chains [22].

On the policy side, several EU member states have developed legal frameworks and incentives to support short agri-food chains. At the EU level, support for short supply chain initiatives is provided by rural development policies. Within the "CAP towards 2020" proposals, the European Commission (EC) has also proposed that SFSCs may be subject to themed sub-programs within the oncoming Common Agricultural Policy (CAP) strategic plans. This is what occurred with the Farm to Fork strategy, in which the promotion of SFSCs had a central role.

SFSCs are attracting more and more attention in research on food systems, partly as a result of their growing popularity among consumers, producers, and policy makers. Longitudinal interdisciplinary assessments of different types of SFSCs could also be useful for identifying levers and barriers to sustainable production and consumption, as well as for assessing their role in improving the agro-industrial scheme based on intensive production and long chains [23]. Their potential input in the transition towards a more sustainable food system [24] offers many research insights.

Concerning SFSCs, different approaches are used to classify their models, including innovation, the interpretation of local concept, proximity, organizational issues, and trust (Figure 1).

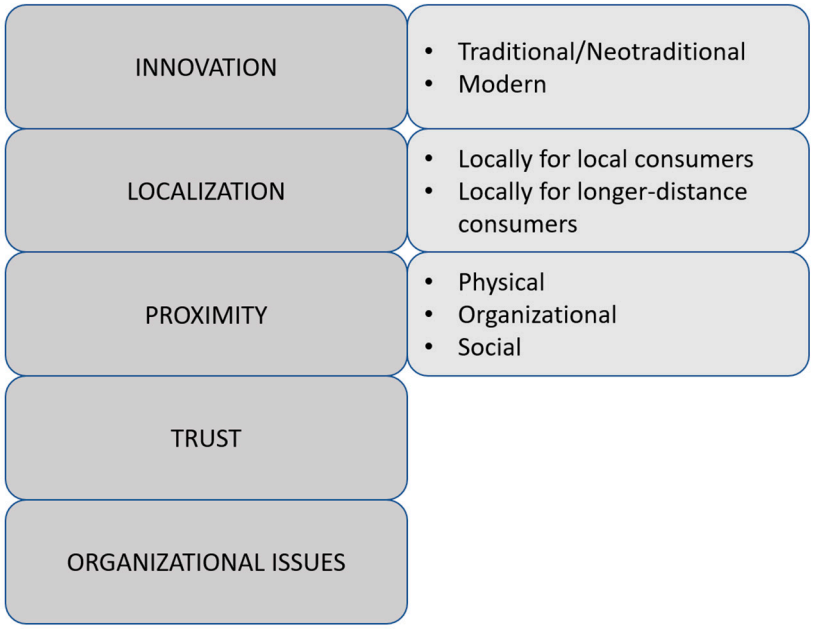

Figure 1. Approaches to classifying SFSC models.

One vision of SFSCs is based on the concept of innovation, dividing SFSCs into two overarching clusters: traditional or neo-traditional [6] and modern [25]. Within the SmartChain project, Sebök et al. (2022) [26] identified technological and non-technological innovations that can be applied in short food chains to increase their attractiveness for consumers and to improve the ability of SFSCs to deliver products and services reliably and consistently. The largest number of innovations identified concerns the issue of "logistics, product accessibility and short food chain channels", followed by food preservation and other processing technologies (i.e., preservation of freshness; nutritional value; packaging).

Some authors have focused on the context-based understanding of the concept of local food, distinguishing between "locally produced food for local consumers" and "locally produced food for longer-distance consumers" [27]. These terminological clarifications stress the complexity of SFSCs, their link with food, their local context, and the role of knowledge-based relations between local actors [27]. Thomé et al. (2021) [28] grouped

chain models by convergence of interests and the need to add value criteria and described the conceptual coexistence framework of the food supply chains and SFSCs, this being at odds with the current bias of the literature.

Otherwise, according to Malak-Rawlikowska et al. (2019) [5], SFSCs can be categorized in terms of proximity between producers and consumers from three points of view: physical, organizational, and social. Contrary to what common sense might suggest, the application of physical proximity could lead to an unclear assessment of environmental impact [7]. For example, frequent deliveries of small quantities of products, even with very few displacements, may lead to negative impacts on environmental sustainability [29,30]. Majewski et al. (2020) [10] highlighted how SFSC models are characterized by the highest level of emissions, as they entail the use of personal cars (i.e., pick-your-own and on-farm sales). Eco-efficiency indicators display wide variability across the different types of SFSCs because the distribution process depends on numerous factors, including not only geographical proximity, but also supply chain infrastructure and logistics. On the other hand, organizational and social proximity generate social benefits [12], increasing consumer confidence in producers and bringing economic benefits to the local economy [4,31] while allowing producers to strengthen their position [5,7]. Different types of SFSCs also have different outcomes: for instance, farmers' markets may create stronger producer–consumer interactions, while direct sales are generally more efficient in terms of demand stability and economic return for producers [32].

Petropoulou et al. (2022) [33] highlight trust as the single most important determinant of success in SFSCs: "Without trust, any collective endeavor is doomed to fail. At the same time, trust is both an input and an outcome in SFSCs, where trust leads to more trust and vice versa". In general, organizational issues, i.e., the way initiatives are organized using traditional or new methods, seem to be an important factor in how the social, economic, and environmental sustainability of an SFSC is perceived, even in spite of geographical differences [12].

3. Materials and Methods

The focus of this study was to identify a group of attributes and indicators to assess the overall sustainability of SFSCs for the three main dimensions considered in the literature (economy, environment, social issues) [5,9,10,34]. The logical framework underlying the study is as follows:

Dimensions of sustainability → identification of attributes → selection of feasible indicators.

Within this framework, the three sustainability dimensions are composed of a set of identified attributes, each of them described by a selected set of different indicators. As suggested by Pyke et al. (2002) [35], we use the term attribute to describe a component of an SFSC that cannot be directly measured, and so a set of observable and measurable indicators can be used as a proxy. In this framework, the study aimed to determine a set of attributes and indicators to assess different SFSC business models through a multicriteria dashboard, as well as the development of the DST.

The research path was based on a two-stage qualitative analysis: (i) a literature review with the aim of proposing an initial list of issues and variables to be considered; (ii) a process of discussion and validation of the results of the first stage through a participatory process based on two Delphi rounds and two focus groups. The result of the second stage was the identification of a final list of feasible attributes and indicators by the so-called SFSC business models (BMs), as categorized in previous phases of agroBRIDGES [11]. The proposed categorization of SFCS BMs was firstly based on different types of relationships between producers and consumers, as shown in Table 1.

Table 1. agroBRIDGES Business Models.

agroBRIDGES Business Model Category	SFSC Business Model Type
Face-to-Face Trade	On-farm sales—Farm shops On-farm sales—Pick your own On-farm sales—Farm-based hospitality
Local Food Trade	Off-farm sales—Sales to retailers who source from local farmers and who make farmer identities clear Off-farm sales—Commercial Sector—Farmers' markets and other markets Off-farm Sales—Farm shops Off-farm sales—Sales directly to consumer co-operatives
Online Food Trade	Farm-direct deliveries—Internet sales Off-farm sales—Internet sales
Improved Logistics	Farm-direct deliveries—Delivery schemes Farm-direct deliveries—Specialty retailers
Other models	CSA

Source: Adaptation from AgroBRIDGES project D2.1.

In stage 1, the analytical framework following the economic, social, and environmental dimensions of sustainability was composed. To this aim, a first set of indicators was compiled, starting with a deep literature review of roughly 80 scientific references and other similar international project results, including SmartChain [26,33,35–39] and Strength2Food [12,40–42], focused on methodical models and instruments to assess SFSC sustainability [7,43]. This initial list included over one hundred indicators. Such a large set of indicators cannot be managed effectively, especially by farmers. Additionally, overlaps between indicators and poor practical feasibility of populating them were observed in many cases. Often, only theoretical hypotheses were proposed, while studies that had concretely measured the dimensions of sustainability were found to be in the minority. Consequently, applying criteria of non-redundancy and practical feasibility, the team selected a second list of indicators from the first list (63), aggregated into different attribute groups by sustainability dimensions, to be proposed operationally in the project and then aggregated.

In stage 2, an online participatory process using qualitative methods was proposed to assess and validate the attributes and indicators from the first stage. This approach—which could be considered a co-creation exercise—was chosen as the most appropriate method of validating the designed set, following RACER criteria (Relevant, Acceptable, Credible, Easy, and Robust). For the further phases of the agroBRIDGES project, a final and validated set of attributes and indicators was used to design the DST. The tool was then tested and validated by producers involved in the project around Europe, who implemented it in their business practices.

The following part of the paragraph outlines the participatory process carried out by the research team during the period of November 2021–January 2022 to formulate the final set of attributes and indicators, detailing the two qualitative methods chosen: Delphi rounds and focus groups.

The Delphi method is a structured methodological communication process that conveys competent opinions on specific questions, using questionnaires to reach shared conclusions that are as clear as possible based on consensus and stability [44–46]. For the purpose of this study, the Delphi technique was applied to explore the consensus of the participants on attributes and indicators chosen for the SFSC sustainability measurement. The activity was structured into two rounds.

For the first round (December 2021), a panel of experts from the European academic sector was invited by e-mail to complete an online questionnaire composed of 10 closed (Likert scale) and open-ended questions based on open-access software (i.e., the Google

module). The purpose of the questionnaire was to analyze the level of agreement and disagreement regarding:

1. The different attributes presented for the measurement of the economic, environmental, and social sustainability of SFSCs;
2. The relationship between each economic, environmental, and social sustainability attribute and the five different business models identified (shown in Table 1) during the previous phases of the project.

In total, 19 experts from Finland, the United Kingdom, Greece, Belgium, Hungary, France and Italy completed the questionnaire; in order to reach a general consensus, the answers were analyzed following a feedback process [44].

The responding experts from the first round were invited to fill out the second-round questionnaire (January 2022). This second DELPHI round was composed of 9 closed-ended questions based on the results of the data collected in the first-round. Attributes that were either judged too negatively or met with a near-unanimous positive consensus were not reintroduced in round two, while attributes that did not meet with a sufficiently polarized and clear judgment were the subject of round two. The questionnaire was divided into different parts relating to the following themes:

1. A re-evaluation of the indicators that did not reach a sufficiently shared assessment in the first round;
2. The degree of expert agreement or disagreement with the attributes provided for the sustainability assessment of the five identified business models.

The focus group technique [47] is a research method that allows for the collection of qualitative data through a group discussion. It enables the gathering of potentially hidden information through the interactions between participants. For this study, two online meetings were organized. The two focus groups were set during the period of December 2021–January 2022.

The first FG involved members of the agroBRIDGES Stakeholder Reference Group (composed of one representative per each state participant as well as other stakeholders from the Experts Advisory Board and from the EU agri-food community), while the second involved experts from sister European projects on SFSCs (COACH, FOODRUS, and COCOREADO). The FGs aimed to present a list of indicators and select the most suitable and feasible ones to design an assessment model according to RACER criteria (Relevant, Acceptable, Credible, Easy, and Robust). The two events were conducted online and moderated by CREA researchers. The application Mentimeter (www.mentimeter.com) was used by the coordinators and experts to share comments, ideas, and opinions on-screen for each group of indicators presented and discussed, allowing for smoother and easier interactions among participants.

The discussions were based on analyzing the feasibility of the following attributes for measuring the SFSC sustainability in its three dimensions (economic, environmental, and social) and of their associated indicators (detailed indicators are shown in Tables 2–4):

- Attributes of the economic dimension: price, value chain, local producer sustainability, on-farm impact, bargaining power, regional economic impact;
- Attributes of the environmental dimension: food miles, energy consumption, type of process/production/packaging, food loss and waste;
- Attributes of the social dimension: labor/employment, human capital, social capital, food and nutrition, governance.

Table 2. Initial results of economic attributes and indicators.

Attribute	Indicator	DELPHI	FG 1	FG 2	Final Assessment
Price	Price different from farmgate (EUR)	A			A
	Premium price (%)	A			A
	Selling price is cheaper (%)	R			R
Value distribution	Chain value added (EUR)	A	+		A
	Chain value added (%)	A	+		A
	Reduction in production costs (%)	A	+	-	A
	Reduction in supply cost (%)	A	+	-	A
	Generated value is more equally distributed	A	+		A
Farm economic results	Turnover	A			A
	Financial support	A			A
	GVA	A	-	-	R
	Production costs	A			A
	Distribution costs	A			A
	Access to credit	A			A
Regional economic impact	Number of employees	A		-	A
	Number of producers involved	A		-	A
	Geographic scale including hectares farmed	V		-	R
	Sells to local customers	V		-	A
	Local supply	A		-	A
Bargaining power	Relationship with customers	A	+	+	A
	Relationship with suppliers	V	+	+	A
	Quantity of product sold	R	+	+	R
	Bargaining power self-assessment	A	+	+	A

Source: authors' own elaboration. Note: Columns 4 and 5 in the table refer to focus group evidence. The sign "+" indicates a positive and the sign "-" a negative judgment. Column 6 combines the results of the DELPHI and focus groups to build the final assessment: A = accepted; R = rejected; V = revised.

Table 3. Initial results of environmental attributes and indicators.

Attributes	Indicators	DELPHI	Focus Group 1	Focus Group 2	Final Assessment
Food Miles	Total food miles	R	-	-	R
	Carbon footprint related to food miles	A	-		A
	Reduced food miles—km/kg production	A	+		A
	Reduced food miles—km/kg distribution	A	+	+	A
	Use of fuel	A			A
Energy Consumption	% of clean energy from renewable sources	R			R
	Reduced % of energy consumption	A			A
	Increased energy efficiency measures	A			A

Table 3. *Cont.*

Attributes	Indicators	DELPHI	Focus Group 1	Focus Group 2	Final Assessment
Type of production process	% of organic products	A	+		A
	% of local/traditional products	A		+	A
	Certification	R	+	-	R
	Less packaging is used	R			R
	Increased ecofriendly packaging	A			A
Food loss and waste	Reduced kg of food loss and waste	A			A
	Increased circular economy initiatives	A			A

Source: authors' own elaboration. Note: Columns 4 and 5 in the table refer to focus group evidence, in particular: the sign "+" indicates a positive and the sign "-" a negative judgement. Column 6 combines the results of the DELPHI and focus groups to build the final assessment: A = accepted; R = rejected.

Table 4. Initial results of social attributes and indicators.

Attributes	Indicators	DELPHI	Focus Group 1	Focus Group 2	Final Assessment
Labor/Employment	Labor to production ratio (hours)	A			A
	Labor to production ratio (AWU)	R			R
	Presence of corporate welfare	V			A
	Increased resilience of employment	A			A
	Inclusion of disadvantaged people (%)	A			A
	Reduced wage difference (%)	V			R
Human Capital	Generational change	A			A
	Educational attainment	A			A
	Gender equality (%)	A		+	A
	No unequal treatment for same roles	A			A
	Smaller gender gap (%)	A			A
Social Capital	Influence by SFSC	A			A
	New local networks (formal orinformal)	A	+		A
	Customer and producer participation	A			A
	Stakeholder involvement	A	+		A
	Increased customer trust	A			A
Food and Nutrition	Increased access to food via SFSC	A			A
	Standards for food safety	A			A
	Certification	V			R
	Increased customer awareness	A		+	A
Governance	Coopetition index	A			A
	SFSC actor proactive involvement	A	+		A
	Typology of governance is moreinformal	R			R
	Collective investments	V		-	R
	Type and number of actors	R			R

Source: authors' own elaboration. Note: Columns 4 and 5 in the table refer to focus group evidence, in particular: the sign "+" indicates a positive and the sign "-" a negative judgement. Column 6 combines the results of the DELPHI and focus groups to build the final assessment: A = accepted; R = rejected; V= revised.

An analysis of the content and topics was used to study the results of this activity.

Finally, from the subsequent comparison of the results between the Delphi rounds and the focus groups, a final assessment of the feasibility and consistency of the attributes

and indicators was composed. The evaluation of inclusion or exclusion was subsequently complemented by an analysis of the attributes and indicators for each business model, as identified by the agroBRIDGES project. Each of them could be useful for the assessment of a specific SFCS model, although it could be indifferent to another, or could represent a positive factor for one BM and a negative for another one. In addition, for each attribute, one lead indicator was identified as a milestone in the assessment, whereas a certain degree of freedom was possible in the collection and systemization process for the other indicators.

4. Results

The two qualitative methods were successfully used to discuss the results of the literature review from the first stage, and the final proposal of a list of attributes and indicators useful for assessing the sustainability of SFSCs was created. The outcomes, presented in the figures below, show a high level of agreement among the opinions on the proposed attributes and indicators, with only some minor exceptions.

The following Tables 2–4 represent the validation process from Delphi and focus groups for the three dimensions of sustainability. For each sustainability dimension, the first column lists the attributes, the second the indicators, and the next three columns report the assessments from the Delphi and focus groups. It must be remembered that these steps are linked; an issue that did not achieve a sufficiently clear evaluation in one step is not considered in the subsequent ones. The last column shows the final evaluation of possible use, indicating which attributes and indicators were feasible and which were not.

The use of a two-stage research method required an interpretative and mediating analysis to make the information consistent. In some cases, there was also a reversal of the results obtained, thus shaping the final assessment and the relative inclusion or exclusion of indicators in the final set. The gross value added indicator in Table 2 serves as an example. Although it advanced through the Delphi phase, it was deemed useful for operational practicality to discard the indicator due to the objections received during the two focus groups, as indicated by the "-" sign in the respective cells. The final assessment is, therefore, the result of the overall reading of the information obtained from the two phases of discussion involving experts.

Table 2 relates to the measurement of the economic sustainability of SFSCs through the following proposed attributes: price, value distribution, farm economic results, regional economic impact, and bargaining power.

We observed a high degree of agreement, although fewer disagreements and neutral values were registered for the attributes price, bargaining power, and regional economic impact, which were re-evaluated in the second Delphi round. More specifically, a critical reflection on the feasibility of the regional economic impact attribute emerged, as well as the need to clarify the definition of bargaining power. Additional comments concerned the reduction in indicators related to costs in order to avoid overlapping and redundancy. Some other suggestions aimed at simplifying the collection of indicators, especially at the level of on-farm impact (e.g., turnover could be an easier indicator for the farmers' self-assessment than gross added value).

Table 3 concerns the measurement of the environmental sustainability of SFSCs described by the proposed attributes: food miles, energy consumption, type of production process, and food loss and waste. There was quite a high level of agreement among the respondents. However, the presence of some neutral opinions about food loss and waste, a mixture of disagreements and neutral opinions about type of production process (particularly concerning the certification indicator), and, finally, a disagreement regarding the attribute food miles must be underlined. The attribute food miles proved controversial, as it could be interpreted from very different points of view. Additionally, the certification indicator was a topic of lengthy discussion due to ambiguity in its assessment, definition, identification, and use.

Table 4 concerns SFSC social sustainability: labor/employment, human capital, social capital, food and nutrition, and food system governance. Despite the commonly

acknowledged difficulties in the actual measurement of this dimension overall, the experts underlined the usefulness of assessing the impacts of short supply chains by means of the attributes. They also suggested a simplification of the attributes proposed using simpler and more direct indicators that can be better understood by producers. The need to define the importance of SFSCs for human health emerged during the focus group sessions, while at the same time, the difficulty of finding suitable measurement indicators was discussed. The need to think "beyond the gates of the farm" was also highlighted, including aspects such as measuring the ability to build networks and to involve stakeholders in local/regional networks. In terms of employment, the issues of labor quality and seasonality were discussed, with the aim of including them in the evaluation set. Finally, the governance attribute needed to be simplified.

Overall, from the initial list of 63 indicators (23 economic, 15 environmental, and 25 social) from the literature review (stage 1) which were assessed by the Delphi and focus groups, 47 were confirmed, aggregated, and ranked into 14 attributes in three sustainability dimensions, and 14 lead indicators were identified as milestones. Table 5 shows the final set of attributes and indicators. For the economic dimension, the lead indicators identified are price difference from farmgate, equity in the generated value chain, turnover, number of producers involved, and bargaining power self-assessment. For the environmental dimension, these indicators were reduced food miles, reduced energy consumption, access to agri-environmental scheme support, and reduced food loss and waste. Finally, for the social dimension, the lead indicators were higher resilience of employment, educational attainment, stakeholder involvement, increased customer awareness, and coopetition index.

Table 5. Final set of SFSC sustainability attributes and indicators.

	Selected Attribute	Selected Lead Indicator	Other Selected Indicators
ECO	PRICE	Price difference from farmgate	Premium price
	VALUE DISTRIBUTION	Equity in the value chain generated	Chain value added
			Reduction in production costs
			Reduction in supply cost
	FARM ECONOMIC RESULTS	Turnover	Financial support
			Production costs
			Distribution costs
			Access to credit
	REGIONAL ECONOMIC IMPACT	Number of producers involved	Number of employees
			Sells to local customers
			Local supply
	BARGAINING POWER	Bargaining power self-assessment	Relationship with customers
			Relationship with suppliers
ENV	FOOD MILES	Reduced food miles (production and distribution)	Carbon footprint related to food miles
			Use of fuel
	ENERGY CONSUMPTION	Reduced energy consumption	Increased energy efficiency measures
	TYPE OF PRODUCTION PROCESS	Access to agri-environmental scheme support	% of organic products
			% of local/traditional products
			Increased eco-friendly packaging
	FOOD LOSS AND WASTE	Reduced food loss and waste	Reduced food loss and waste
			Increased circular economy initiatives

Table 5. *Cont.*

	Selected Attribute	Selected Lead Indicator	Other Selected Indicators
	LABOR/EMPLOYMENT	Higher resilience of employment	Labor to production ratio
			Presence of corporate welfare
			Inclusion of disadvantaged people
	HUMAN CAPITAL	Educational attainment	Generational change
			Gender equality
			No unequal treatment for the same roles
SOC	SOCIAL CAPITAL	Stakeholder involvement	Influence of SFSC
			New local networks
			Customer and producer participation
	FOOD AND NUTRITION	Increased customer awareness	Increased access to food via SFSC
			Standards for food safety
	GOVERNANCE	Coopetition index	SFSC actor proactive involvement
			Presence of corporate welfare

Source: authors' own elaboration.

Furthermore, through this participatory process, the feasibility of the identified attributes was also assessed in order to measure the sustainability of the five BMs identified within agroBRIDGES: community-supported agriculture (CSA), face-to-face, local food, online food, and improved logistics.

The overall process enabled the initial screening and final selection of the most suitable attributes for measuring the sustainability of each proposed BM. As can be seen in Table 6, the findings were summarized in a so-called performance matrix to connect and compare each BM to the most appropriate attributes. The connection is indicated with an "x". Instead, an empty cell is used where a specific attribute is irrelevant to a specific BM.

Table 6. Business models' performance matrices.

Attributes	CSA	FACE-TO-FACE	LOCAL FOOD	ONLINE FOOD	IMPROVED LOGISTICS
Price	x	x	x	x	x
Value Distribution	x	x	x	x	x
Farm Economic Results	x	x	x	x	x
Regional Economic Impact	x		x		x
Bargaining power	x	x	x		x
Food Miles	x		x		
Energy Consumption	x	x	x	x	x
Type of Production Process	x	x	x	x	x
Food loss and waste	x	x	x	x	x
Labor/Employment	x	x	x	x	x
Human Capital	x	x	x	x	x
Social Capital	x	x	x		x
Food and Nutrition		x			x
Governance	x		x	x	x

By observing the table, it can be seen that 3 out of 5 models are described by almost all of the identified attributes (13 out of 14).

Going through the individual models in detail, it can be assumed that the lack of certain attributes is due to the fact that the indicators of which they are composed measure factors that are not applicable to the SFSC model in question.

For example, the "food and nutrition" attribute is missing in the CSA, local food, and online food models because it is composed of several indicators that are not useful for measuring the sustainability of these typologies, including the consumer's full awareness regarding the product they buy and the consumer's perception regarding a farm's commitment to promoting short supply chains.

Similarly, for the local food and online food models, the attribute "regional economic impact" is missing because it is composed of indicators not relevant to the measurement of such models, such as the number of producers involved in representing the size structure of an SFSC on their territory or the number of employees.

5. Discussion

The issue of farm sustainability is at the heart of the forthcoming CAP, not only in economic and environmental terms, but, above all, within the boundaries of social analysis in relation to the newly introduced social cross-compliance. However, even though the CAP 2023-27 objectives require an important reorientation of the subsidy scheme, the reform proposal does not provide the instruments needed to address them [48].

It is, therefore, rational to analyze producers' views on the sustainability of short supply chains, often considered sustainable by definition, without using solid supporting indicators. At the same time, it is also important to empower farmers to engage with other actors to determine whether the identified criteria are understandable and useful. Agricultural knowledge and innovation system interventions to promote and share knowledge and innovation (AKIS) could be crucial for this purpose.

The two-stage path of this study was used for the identification of attributes and indicators that can be easily used by farmers to evaluate which business model matches their needs. For this reason, lead indicators have been identified to aid farmers in the collection of data needed for measurement.

In this light, it is important to consider environmental, economic, and social benefits in relation to the specific type of SFSCs to assess the potential sustainability of the different SFSC business models, taking into consideration the different actors involved in SFSCs themselves (farmers, consumers, processors, etc.), and not in a general rational context.

The co-creation approach used herein was particularly suitable for validating the list of attributes and indicators, because it was based on the direct involvement of experts with different levels of competence and experience arising from their participation in other sister projects on SFSCs. They were asked to assess the feasibility of the chosen attributes and indicators.

The early results highlight at least three elements for discussion that are relevant in theoretical and operational terms: feasibility, categorization (business models), and simplicity.

The main constraint remains the feasibility of obtaining basic information, and, therefore, the definitive possibility of collecting data for calculating the indicators. These are the basic building blocks for the assessment of the various attributes and, thus, allow for an assessment of the three main dimensions.

Despite a copious amount of literature on the topic, only very few references offer indications for an actual evaluation of SFCSs in operational terms [5,10,32]. Very often, only theoretical reflections are reported. Moreover, real attempts to quantify these dimensions are rare. Where quantifications have been possible, information gaps are observed in a spatial or temporal sense, which in turn invalidate the models. In this sense, the quality of data must also be evaluated in terms of robustness. A trade-off between cost/difficulty of collection and feasibility can be predicted. In many cases, the literature refers to self-assessment procedures to ensure the feasibility of collection, leading, however, to a reduction in the reliability of the information.

Basically, this research path made it possible to highlight that the initial set of attributes and indicators from the literature was adequate and feasible. Through the results of the Delphi and focus groups, there a high level of consensus was reached regarding the selections made. This is undoubtedly the most important result.

However, the results also revealed several critical points which were addressed and overcome. The first was the need to provide clear and agreed-upon definitions. For example, the bargaining power indicator proved to be difficult to handle for some participants and was debated at length during the discussions in the focus groups. A second consideration concerned the positive or negative connotation that an indicator should have. As an example, the meaning of the food miles indicator seemed to be clear and shared in the literature, but it was highly debated and reinterpreted in the FGs. Moreover, the meanings of some indicators and their collection modalities were discussed. Due to the multiplicity of existing types of certifications, the certification indicator was also discussed at length. To address it, it was considered appropriate to refer to specific adopted rural development measures.

Finally, participants agreed with the use of self-declaration for the ease of calculation and the level of reliability of the information, as was often proposed in the literature [9,34].

The second element of discussion concerns the identification of the most appropriate and explanatory attributes and indicators for the different BMs, which was based on the results of the participatory exercises and examined through the performance matrix. This highlights how this approach allows for categorization due to the flexibility of the grid based on attributes and indicators. The consensus on the proposed models resulting from the literature review in an earlier step of the project was the first interesting thing to be noted. Equally remarkable is that consistent assessments of the explanatory capacity of the selected indicators for each SFSC model were gathered. As was already noted from the results of the first Delphi Round, the polarization between adherent and non-adherent opinions on the indicators for each model was very clear. In fact, only a limited number of them required a second evaluation round. The overall rating of feasibility in relation to the SFCS models was also homogeneous.

The analysis conducted taking into account the different models of SFSC highlights some important differences concerning the practices adopted by farmers, and helps to overcome an excessively abstract vision of these distribution methods. Indeed, we often talk about short-chain models as if there were a single modality for reducing the number of intermediaries, yet the different practices considered herein affect sustainability dimensions and influence both prices and growth in different ways.

The evaluation model proposed by the research was positively perceived by the participants. This result is important because it reflects both the adequacy of the proposals and the concrete applicability of the performance matrix to the DST. In this sense, the trade-off between simplicity and explicative capacity seems to be considered adequate, and the course of action consistent and robust. This could be especially interesting for the purpose of reducing the distance between research and practices when considering agricultural sustainability. In fact, while the research generally uses complex models and procedures to measure sustainability and applies them with the aim of generalizing the results and confirming the validity of approaches, farmers need to have simple tools to understand immediately whether the choice to be made is in line with their vision and strategy.

6. Conclusions

The qualitative research approach was found to be suitable for validating the proposed framework of indicators through the direct involvement and inclusion of different representatives of the sector in co-creation activities (focus groups and Delphi rounds). In this sense, the research also takes into account producers' points of view, albeit indirectly, and reflects the main goal of the project, which is to balance the role of agricultural producers as active players for a more sustainable agri-food sector. This study lays an additional brick in the research framework regarding the measurement of short supply chain sustainability and

the methodology of participatory approaches by considering the needs and views of the production sector instead of consumers only. However, it is also necessary to emphasize some limits of the research which could be attributed to methodological issues and the real engagement of farmers in the research pathway.

The novelty of this study is the determination of a process to handle the three main critical factors that the research results highlighted: feasibility, relationship with business models, and simplicity. This objective is even more challenging in this work because it must lead to set operational tools in the field and not only to a proposition of a methodological exercise, as can often be observed in the literature. The use of co-creation based on the literature review and qualitative techniques proved to be appropriate. This mixed and participatory approach provided both insights and operability to the process through the Delphi and focus groups. In relation to the three critical issues highlighted, the study provided concrete solutions: (i) it addressed the critical issues in terms of feasibility, building a common understanding of the indicators; (ii) it ensured the necessary flexibility of the indicator system in relation to the specificities of the different business models; and (iii) it simplified the process of gathering information from producers through self-declaration.

From a methodological point of view, the business models were identified within the countries of the project partners, starting from the most common practices. However, other practices and models could be widespread in Europe, and it would be useful to check whether there are other attributes and indicators identified as valid for them, and/or if there are any others to be used.

In fact, the participatory research involved different experts in SFSC, not all of whom were farmers, with potentially different opinions on appropriate, explanatory, and simple attributes and indicators for specific practices in their contexts. However, another stage of the project will specifically be aimed at verifying the results of this exercise.

These constraints could be addressed and overcome by exploring and analyzing specific geographical contexts, adapting the framework to local or national territorial needs, and collecting more feedback, mainly from farmers. Moreover, this research could add significant elements to other studies dealing with the application of tools that producers can adopt on their own to improve their business choices in terms of sustainability.

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