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Participation in S-LCA: A Methodological Proposal Applied to Belgian Alternative Food Chains (Part 1)

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Abstract: In social life cycle assessment (S-LCA), the use of a participatory approach to define and select assessment criteria and indicators (C&Is) is recommended given the specificity of social issues, but it has been, for now, rarely implemented and presents methodological challenges. Within a participatory action research project gathering academic researchers and field actors, we tested the applicability of configuring a C&Is list for S-LCA, together with chain actors of three alternative food distribution systems active in Belgium. The purpose of this article is to present the results of this work and to examine the methodological limits, requirements, and contributions of such an approach. The participatory approach is an appropriate method to build a list of C&Is standing out from other studies, with the identification of ambitious and innovative C&Is relating to value-chain actors (VCAs) stakeholder category, on chain governance and transaction modalities. In our case, it required an adaptation work of C&Is to the S-LCA requirements and the use of a specific theoretical approach to articulate C&Is within a coherent framework. Finally, this kind of work seems useful to give ground to the S-LCA Guidelines' list of subcategories, which was built through a rather top-down expert-based approach.

Keywords: Social LCA; indicator selection; participative approach; stakeholder consultation; alternative food networks

1. Introduction

Social life cycle assessment (S-LCA) is currently developed as a complementary tool to environmental life cycle assessment (E-LCA), with the objective to assess the social sustainability of products and services along their life cycle. Consumption and production activities indeed generate impacts on actors within the products' chains (e.g., value-chain actors and their employees, consumers) as well as outside of these chains (e.g., local communities, public authorities).

With growing pressure from consumers and communities as well as public authorities and markets, companies are more and more required to account for their performances in terms of social sustainability, i.e., identify, assess, and improve the impacts linked to their activities [1]. This call for improved and more holistic, systemic, multi-dimensional assessments is supported by the international community; Sustainable Development Goals include the promotion of decent work (goal 8) as well as of responsible consumption and production (goal 12) [2]. In this societal and policy context S-LCA should help value-chain actors reduce their impacts on the one hand, and should ideally enable consumers to make informed choices. Beyond the theoretical objective of assessing the multidimensionality of impacts, the operational issue of what should be assessed and measured with an S-LCA tool remains a crucial, yet strongly discussed issue in the field [3]. The present paper aims to contribute to this rapidly evolving practice of S-LCA.

Several methodological frameworks to conduct S-LCA exist (e.g., Guidelines for S-LCA of products [4]), proposing different lists of assessment criteria (or what is called "impact categories" or "subcategories" in the UNEP/SETAC (United Nations Environment Programme/Society of Environmental Toxicology and Chemistry) Guidelines for S-LCA) and indicators (C&Is) [3]. Even when applying existing frameworks such as the UNEP/SETAC Guidelines for S-LCA, practitioners tend to adapt such lists of C&Is to the specific geographical or sociopolitical context and/or to the industry under assessment [5]. As a consequence, the object of assessment tends actually to differ between S-LCA studies. In this context of heterogeneity by practice, the UNEP/SETAC Guidelines for S-LCA and the Handbook for Product Social Impact Assessment—which are two of the main frameworks developed to conduct S-LCA—are (being) updated. The revision of the latter has been recently completed, while the revision process of the former is currently in process [6,7], and awaits its first operationalization. Thus, the present paper aims to contribute to these formal, institutional, international exercises by opening the discussion (and practice) to a blind spot.

Indeed behind the question of what is assessed lie actually the questions of what the developed criteria and indicators (C&Is) really reflect as impacts, and how that selection of C&Is is really made, and whose understanding and prioritization of impacts gains access to the C&Is. Quite often, the basis of these selections and adaptations of C&Is simply are international treaties and policy documents, voluntary standards, or adjacent assessment tools; and their contextualized translations into C&Is are simply operated by the respective authors of the assessments. Occasionally, when the selection is not done entirely by the conductors of the assessment themselves, the process of selection and adaptation includes the consultation of the private sector, or of experts [3,5]. While there are obvious calls to extend these consultations to other actors [8] (cf. Section 2), currently, S-LCA remains rarely configured via the consultation of stakeholders. Thus, applying a participatory approach in S-LCA processes remains a methodological challenge with potential benefits for an ongoing international discussion. The present paper is related to an attempt to test participatory S-LCA in particular with respect to its applicability and relevance within a participatory-action research project named COSY-Food.

The COSY-Food project aimed to assess the sustainability of local food products traded under three different, alternative distribution systems (alternative food networks or systems; AFNs) in Belgium. AFNs include various "alternative" forms of food production and distribution such as community-supported agriculture, consumer food co-operatives, or farmers' markets. Their alternativeness relates to their promise to mitigate the heap of negative sustainability impacts of the mainstream, agro-industrial food system [9]. This project was developed in a co-creational modus, meaning that knowledge was generated collaboratively "by academics working alongside stakeholders from other sectors" [10]. As a co-creational or participatory action research project, COSY-Food involved three academic researchers and three field partners, or co-researchers, which are the facilitators/retailers from the three AFNs. Our set included an organic shop, a web-shop for local products (organizing a weekly farmers' market), and a network of community-supported agriculture (CSA), in which a group of consumers subscribe to a harvest of a certain farm and receive in return a weekly box of farm goods.

Simplified, the first stage of the project co-created a definition of what is a sustainable food system in the Belgian/Brussels context, which was then translated into a list of assessment C&Is. The second stage applied these C&Is specifically to the assessment of two food products traded under the three alternative distribution systems, eventually leading into a comparison with the mainstream food system whenever possible (in parallel, another set of C&Is was configured—based on the same sustainability definition—as a basis for a second tool designed to assess distribution systems and their supply chains and to be implemented by the AFNs themselves). The present paper discusses the first stage of the project, i.e., the configuration of the assessment tool by defining C&Is (referred to as the first part of the article), while the present special issue contains also a further paper on the second stage (i.e., the assessment itself and the application of the assessment tool, referred to as the second part of the article [11]).

This paper exposes a methodological proposal to the participatory definition of assessment C&Is in the general context of S-LCA, with the means of a participatory-action-research project. The paper examines the potential contributions, limits, and requirements of this proposal and strives to formulate recommendations that could feed the ongoing revision process of the UNEP/SETAC Guidelines [6]. Indeed, considering the latter was rather built through a top-down approach, involving stakeholders and experts at a regional or international level (i.e., trade and professional associations, consumer associations, etc.), the integration of results from a rigorously straight bottom-up approach, as is the present one, could be seen as very complementary.

First, we present a short state-of-the-art on the use of participatory approaches in S-LCA (Section 2). Next, we develop on the process of building a list of C&Is for S-LCA through a participatory process involving food-chain actors (Section 3), and its result (Section 4). Indeed, such a participatory process has been rarely implemented in S-LCA, while it has been recommended by several authors. The story of our exercise will help us discuss the contributions (mainly for the stakeholders involved), requirements, and limits of such a process (Section 5.2). While it would be counter-intuitive to appraise the quality of the list of obtained C&Is in absolute terms, we will discuss the C&Is by comparing the set to other comparable studies in the food sector using other C&Is selection methods. This will drive us discussing more broadly what should be assessed in S-LCA (with the revision of the UNEP/SETAC Guidelines in mind) (Section 5.1). While the paper aims for careful generalization in the specific context of S-LCA, the configured list of C&Is is clearly meant to be applicable to the assessment exercise depicted in the second part of this article; applying it to any context and to other assessment applications would betray its intended contextualization by participation.

2. The Use of Participatory Approaches in Configuring S-LCA C&Is: State-Of-The-Art, Added-Value, and Limits

The consultation of stakeholders (or participatory approach) as a way to select C&Is has been highlighted as relevant and needed, given the specificity and contextuality of social and socioeconomic issues under assessment by S-LCA. Literature speculates that social indicators would need to gain public acceptance to be valid [12], and participatory approaches would enhance the legitimacy of the results [8]. Additionally, as social C&Is should be context-dependent, a consultation of stakeholders would improve their adaptation to the context [13,14] in [8]. As highlighted by Mathe (2014) [8], considering the plurality of stakeholder interests and of local knowledges, participation enables the selection of "impact categories that make sense for stakeholders in different contexts", simplifies the process of indicator identification and promotes dialogue, partnerships, learning, and empowerment at the level of the stakeholders involved [14,15] in Mathe (2014) [8]. Finally, participation would enhance the quality, appropriation, and usability of the tool in itself [8,16].

Participatory approaches to select assessment C&Is have been implemented to some extent in other non-LCA related assessment fields [17–21], but rather rarely in S-LCA, where "the choice of the impacts is generally determined in a normative fashion using standards established in international conventions [. . .] or national laws" [8]. Yet, several S-LCA authors recommend or propose stakeholder consultation/participation as a way to identify assessment criteria from scratch, either solely by participatory approaches [8,22,23], or in combination with other processes (e.g., literature review) [24]. In a previous review [5], we found that if stakeholder consultation is used, it is generally merely to select or validate assessment C&Is *from an existing framework* (such as the Guidelines for S-LCA [25–29]), rather than to select C&Is *from scratch*. For instance, we identified one particular study in the fields of S-LCA and life cycle sustainability assessment (LCSA, which considers other sustainability aspects, beyond social and socioeconomic ones, see Valdivia et al. (2011) for more details [30]), with a detailed published list of C&Is stemming from a participatory process involving various stakeholders [31].

While promoting the approach, Mathe (2014) warns about its implications and requirements. A participatory approach requires "a multidisciplinary approach and the integration of new knowledge and skills for S-LCA practitioners" [8] (p. 1507). It also requires more time and resources, and the

availability of participants throughout the process. Finally, using such a participatory approach would prevent, by design, the comparability of results over different contexts.

In the following section, we present the materials and methods used for this exercise.

3. Materials and Methods: Configuring Criteria and Indicators with a Participatory Approach

3.1. Process and Principles for Building the List of C&Is with a Participatory and Co-Creational Approach

This section describes how the selection of C&Is was conducted (i.e., what process was used and, how, and which stakeholders were involved). The process of configuring the list was an iterative one, switching between in-house academic desk research, the co-creational interactions with co-researchers (i.e., AFN retailers/facilitators), and the consultation moments with food value-chain actors (VCAs) and final consumers. Thus, operationally, the process spun over two levels/modes of participation: i) The level of co-creation which took place during the whole project duration between co-researchers from academia and the field, and ii) the level of consultation which was often one-time but involved a much wider range of stakeholders.

Main steps of the procedure were the following:

- Step 1: Academic researchers review the criteria used in comparable selected sustainability assessment tools (including S-LCA) and standards (list 1), and identify pertinent C&Is candidates.
- Step 2: In parallel, the 3 co-researchers from the field identify assessment criteria on the basis of their distinct practices and sustainability objectives (lists 2–4) and are asked to classify those according to the 3-pillars approach to sustainability (this classification was challenged by co-researchers and was consequently given up, see further discussion on this issue in Sections 3.2 and 5.2).
- Step 3: Academic researchers merge and organize these 4 lists into a principles, criteria, and indicators frame (P,C&Is), and co-researchers validate it. Chain actors of the three AFNs are consulted and asked to provide feedback on the consolidated list. Academic researchers and co-researchers integrate any comments to configure an improved list of principles and assessment criteria (P&C general list, cf. Table A1).
- Step 4: From this P&C list, academic researchers build a secondary list specifically framed to S-LCA. Finally, a set of corresponding indicators and performance reference points are identified, with the support of co-researchers and literature; and questionnaires are elaborated for data collection (C&Is list for S-LCA, cf. Table 1).

During the consultation process, participants were asked to define what a sustainable food system is. For participants to express their preferences in a structured way, we used the support of the principles, criteria, and indicators framework. Principles correspond to relatively generic objectives that are to be reached by AFNs, e.g., economic viability. Criteria are linked to one principle and correspond to the conditions for principles to be met. One or more indicators measure each criterion.

Table 1. The list of criteria and indicators (C&Is) for S-LCA.

	Assessment Criteria	Indicators
Chain governance and relations between VCA	Chain/VCAs governance	
	C1. Chain length	Number of intermediaries between the producer and the final user
	C2. Control of organizations	Actual ownership of VCAs
	C3. Participation of other VCAs in decision making	Actual and potential ownership of VCAs by other VCAs
	C4. Competition management	Buying obligations of intermediaries towards certain suppliers
	C5. Market power of organizations	Size of the organization and industry market concentration
	Transaction modalities between VCAs	
	C6. Commitment between VCAs	Contract between the buyer and the supplier
	C7. Stability of trading relationship	Fluctuations of ordered volume over time
	C8. Price fairness	Pricing mechanism (price maker, basis) Or: Cost price (incl. income)/sale price
	C9. Equity/fairness between VCAs	Distribution of added value between VCAs
	C10. Unfair trade practices	Payment term
VCAs	C11. Quality of social ties between VCAs	Trust in the trading relationship
		Recognition between VCAs
		Understanding of each other's reality/difficulties
	Profitability and autonomy of VCAs	
	C12. Profitability of each VCA	Sole proprietorship: income/living wage; companies: profit ≥ 0
		For farms: use of other gainful activity to complement income

Table 1. *Cont.*

	Assessment Criteria	Indicators
	C13. Efficiency of processes along the chain	Costs of each process along the chain per functional unit
	C14. Reliance on external source of income and funding	Share of subsidies in takings/incomes
		Share of repayment of a loan in costs/expenses
	C15. Level of diversification (products, outlets)	Share of turnover/revenue brought in by the main product
		Share of turnover/revenue that comes from the main client/outlet
Workers	Employment conditions	
	C16. Social benefits/social security	Provision of good quality contracts to workers (other than partners)
		Use of "low-cost" worked hours (subsidized contracts, "false" self-employed person, non-paid familial labor, or non-declared)
	C17. Stability of work contracts	Use of unstable contracts/arrangements
	C18. Fair wage	Wage/living wage
	Working conditions	
	C19. Working time	Excessive work hours per week
		Possibility to have weekly days off
		Possibility to take annual leave
	C20. Safety of work conditions	Use/handling of harmful biological or chemical agents
	C21. Work hardness	Feeling of workers on psychological and physical work hardness
		Concerns of workers on potential future occupational health problems
	Worker wellbeing	
	C22. Participation to decision making	Existence of processes to make workers participate in decisions
	C23. Work satisfaction	Feeling of workers on general satisfaction, autonomy, learning, relations with supervisor and colleagues, work recognition, work–life balance, and pay

Table 1. *Cont.*

	Assessment Criteria	Indicators	
Final consumers	C24. Product's accessibility	Satisfaction of consumers regarding product affordability	
		Representation of young, low educated, and low income people among final consumers	
	C25. Consumer education	Feeling of consumers regarding the evolution of their awareness on sustainability issues, since they buy the product through the channel	
	Product's quality and transparency		
	C26. Food safety	Chemical residues level in the product	Or: Trust of consumers on product's safety
	C27. Nutritional quality	Level of nutrients in the product	
	C28. Taste	Satisfaction of consumers on taste quality	
	C29. Product's transparency	Satisfaction of consumers regarding the information provided on the product and on production methods	
Broader societal issues	C30. Animal welfare	Sufficient human care	
		Access to outdoors	
		Limited use of drugs	
		Respect of natural life cycle of animals	
		Painless end-of-life	
	C31. Labor intensiveness of processes	Quantity of working hours/functional unit	
	Territorial development		
	C32. Promotion of exchanges between local VCAs	% of working hours occurring in the same region as consumption	
	C33. Promotion of local labor	Use of temporary non-resident workers	
	Solidarity and reduction of inequalities		
	C34. Contribution to public expenses	% of price to tax payment and social contributions	

Table 1. *Cont.*

	Assessment Criteria	Indicators
	C35. Reflection of all costs in price	True price (including social (and environmental) costs)/sale price
	Food sovereignty and heritage	
	C36. Contribution to local food needs	% of output for food purpose
		% of output for local markets
	C37. Conservation of heritage and know-hows, incl. agricultural	Indicator not found
	C38. Support to peasant and small-scale production methods and to autonomous farms	Indicator not found

Note: VCA stands for value chain actors.

Regarding the stakeholders involved in the consultation process, Mathe (2014) advises to include three categories of stakeholders in the participatory process: value chain stakeholders, users of the systems, and institutional stakeholders [8]. These three stakeholders all satisfy the following three criteria: They "are affected differently (impact criteria) by [the product life cycle] whether in terms of exchange (e.g., value chain stakeholders), taxation (e.g., public services), or level of well-being (e.g., users)"; they represent a certain "diversity of social representations (completeness criteria)"; and "representative individuals in each category division (legitimacy criteria)" [8] (p. 1512). Within the COSY-Food project, the choice of the type of stakeholders to be included in the consultation process, done with the co-researchers limited the consultation process to both value-chain actors (including employees/workers) and the food systems' users (i.e., consumers). Operational constraints entailed to exclude institutional stakeholders and public authorities. Looking at Mathe's (2014) [8] criteria to select stakeholders, local communities could have been included since these can be affected by the product through the taxation of the product occurring at various life cycle phases and the resultant public services available for local communities, and their inclusion through elected representatives would have increased the diversity of social representations. However, elected representatives were not selected to participate in the consultation process.

Value-chain actors of the three AFNs were included in the consultation process; on the first line, because they are project partners (i.e., retailers/those facilitating the retail); in a secondary line, some of their wholesalers, processors, primary producers were consulted equally. Systems' users were represented by final consumers of the retailers/retailing systems. The sampling was made according to whether or not value-chain actors were major suppliers to the AFNs, depending on data access (for the final consumers) and—of course—depending on their availability to participate to the workshops. In the end, between 20 and 37 persons per AFN (value-chain actors and final consumers taken together) were consulted through this process. Thus, the sample is representative of stakeholders frontally involved in the three specific AFNs. This choice could limit any subsequent applicability of the tool for products from other food systems (or chains), but is obviously unavoidable in order to capture first-order participants to the 3 AFNs. It is their views on sustainability which is vital to the S-LCA, given that these AFNs explicitly pursue the objective of being sustainable, particularly on social and socioeconomic aspects.

While the principles of the consultations are generally quite straightforward, participatory and co-creational exercises are intriguingly difficult to grasp in detail. Hardly any descriptions exist of what exactly a thorough consultation implies. In the following subsection, we chose to give our process some flesh by detailing out decisions and orientations taken, with the aim to allow others to take inspiration.

3.2. Focus: From the Principles and Criteria List to the Criteria and Indicators for S-LCA

At step 3, the co-creation process resulted in a list of 70 criteria linked to 16 sustainability principles (cf. Table A1). Overall, principles contain several criteria corresponding to sub-elements relating to the same theme (e.g., criteria "work contract stability" under principle "decent working conditions and worker wellbeing"). This principles and criteria (P&C) list covers a wide range of issues directly relevant for the various consulted stakeholders (various value-chain actors, consumers, workers), but integrates also broader societal issues (e.g., territorial development, cultural heritage, food sovereignty, fauna and flora).

3.2.1. Adapting Criteria to the S-LCA Format and Cleaning the List

In order to be used for S-LCA purpose, the P&C list required some adaptation and restructuring. A first adaptation was the removal of environment-related criteria from the list; being covered in environmental LCAs, these environmental criteria were non-pertinent in a S-LCA context. Therefore, we excluded the "environmental pillar" principles from the overall P&C list. This means that for the assessment of social sustainability, we used all P&C identified (through the participatory process) to define overall sustainability, but the environmental P&Cs. The remaining P&C list is considered as a

definition of *social sustainability*. This understanding of social sustainability is indeed rather broad, since it includes, next to social issues, elements that can be considered as belonging to the economic and governance pillars. This approach may have implications for the assessment itself. It originates from the difficulty met the academic- and co-researchers in the process of delimiting what should be in the "social pillar" or not, since most identified issues were considered as "transversal" and potentially causally linked with each other.

Second, the configuration of indicators for each criterion being actually iterative with the refinement of the criterion itself, it appeared that several selected criteria were rather indicators (e.g., number of intermediaries was selected but seemed to be rather an indicator of the chain length than a criteria).

Third, some criteria had to be adapted due to biases implied by the decisions taken on the selection process. On one hand, stakeholders were asked to define what a sustainable food *system* or chain was, rather than what a sustainable food *product* was. This means that criteria have a system-focus rather than a product- or organizational focus, as it would be more generally expected in S-LCA. On the other hand, the co-researchers from the field are retailers (or facilitators in the case of the CSA network) of short chains for two of them. Although other value-chain actors (producers, wholesalers, final consumers) were consulted, retailers/facilitators as co-researchers had more influence in the process. As a consequence, some criteria gained a "retailer-focus" or "short-chain" bias, and had to be made more generic to fit to a larger set of life cycle organization (e.g., both farms and industrial processors).

During the configuration process of the list, the structuration of the list was questioned. In fact, co-researchers felt that a number of criteria were linked to more than one principle, and that the transversal nature of sustainability elements could not be expressed with a typical PC&Is architecture, in which criteria are linked to one principle only and which does not allow to express links between principles or criteria themselves. As a consequence some criteria are doubled in the list (e.g., the criteria number of intermediaries appear under principles "fair trade practices" and "awareness raising and practices improvement"). Specific criteria were abandoned for being too transversal (e.g., the principle/criteria "(human) size of VCAs"), or too ambiguous notably with respect to the cause–effect relationships they were supposed to link (e.g., "commitment between VCAs and stability of income/takings" or criteria "cooperative management and participation of stakeholder to decision making" under principle "fair trading practices" instead of being positioned under principle "solidarity, social ties, and participation").

In order to address this causality issue, the research team conducted a further participatory process in which academic- and co-researchers sought individually to identify "their" causalities according to their knowledge, beliefs, and norms. As an overall result, each criterion was linked to several principles and inversely, each criterion was linked to other criteria. While this web-like, complex-system result confirmed the intuition that criteria should be untied from their initial basic principles, the sheer complexity and the high number of identified causal links would not have allowed to identify one specific sequence of impact pathways or one narrative.

3.2.2. Structuring the List with the Stakeholder Input and Theory

Consequently, the list of P&C was restructured by removing principles and the stakeholder approach from 2009 S-LCA UNEP/SETAC Guidelines [4] was used to classify according to whether criteria regard workers, final consumers, VCAs, and relations between them, or broader societal issues. While this restructuring solved some of the above-raised problems (e.g., unclear relation between principles and their criteria), the issue raised by co-researchers over the unexpressed interlinkages between sustainability elements and assessment criteria remained. This consideration echoed critics raised in the field of S-LCA about the lack of conceptual and theoretical frameworks underlying S-LCA, particularly the so-called type I/reporting S-LCA (in S-LCA, there are two main approaches, one assessing social performances and comparing results to performance reference points—or type I or reporting approach—and one using impact pathways in the analysis to connect so-called inventory

indicators and impact indicators—or type II approach), that gives rise to descriptive only and "heterogeneous list of indicators chosen in an empiric and arbitrary way [. . .] with no way to explain social phenomena, articulation and interactions between assessed dimensions" [1] (p.163). Thus, several researchers argue that theories, including from social sciences, should be more prominently used to configure S-LCA because theory can provide a coherent framework of analysis [1,32,33], especially when identifying impact pathways [34].

To cater for these calls for analytical frames, our assessment grid was linked to the global commodity chains (GCCs) approach. GCCs echoes particularly well the rationale underlying the AFN movement, with its focus on balanced and fairer trading relationships. This specific theoretical approach developed in the 1990s in the field of development studies. It looks at how global chains are organized and structured as well as at authority and power relations between chain actors (i.e., the governance of the chain) [35]. According to the GCCs approach, chain governance is deemed to structure the way that goods and services are produced and traded, and to "determine how financial, material and human resources are allocated and flow within a chain" [36] (p. 10), particularly the way that value is captured and distributed along a value chain [37].

The GCCs approach unveiled the growing and dominant role of global buyers (retailers, branded marketers, industrial processors, and international traders) in value chains. These global buyers emerged in the 1980s from the process of horizontal integration of firms, with a move of merges and acquisitions leading to oligopolistic situations downstream value chains, which concentrated power within few actors. On the other hand, there has been a vertical disintegration of firms, with a large move of outsourcing from main firm (located in Northern countries) to other legally independent entities (more and more located in Southern countries) [38,39]. This move has changed ownership patterns, but also has shifted risk towards upstream suppliers [40], as well as responsibility. Meanwhile, given their high market power, buyers drive other value-chain actors by imposing their requirements in terms of price, quality, delivery time, etc., without necessarily owning them. In this context, chain governance patterns help understand value capture and distribution, and hence remaining inequalities within product chains and countries [37].

By cutting down intermediaries within supply chains or going through alternative actors, CSAs, farmers' markets, and food co-ops shift away from big buyers [9]. Producers and consumers taking part at those chains seek to gain a better control over respectively their outlets and sources of supply, and over transaction modalities. The narrative of the GCCs approach is therefore particularly relevant to articulate and tell the values expressed in the P&C list built with the co-researchers.

The resulting list of C&Is for S-LCA is presented in the results section below (Section 4). After this presentation, we will compare this list with existing S-LCA practice in the food sector in the discussion Section 5.

4. Results: The Obtained List of C&Is for S-LCA

The C&Is of our S-LCA framework (Table 1 below) places chain governance and relations between VCAs, as drivers of other social sustainability aspects. First are presented the criteria relating to chain governance and relations between VCAs, followed by criteria relating to VCAs, workers, final consumers, and finally to broader societal issues.

4.1. Chain/VCAs Governance and Relations between VCAs

The participatory process stresses that food chains should become shorter, more democratic, balanced, and they should be protected against strong competition, in the face of mainstream food chains in which power and control are highly concentrated in few hands [41].

The length of the chain is considered as a key criterion for the sustainability of food chains (C1). It is measured by an indicator, corresponding to the number of intermediaries between the producer of the final product and the final consumers. A short chain is seen as a way to ensure the fairness of exchanges, to develop social ties between primary producers and final consumers and to

raise awareness of consumers regarding sustainability issues. The second selected criterion is the ownership of the capital of life cycle organizations, which is seen as a key element in order to keep control of the direction of the organization (C2). To illustrate this concern, one of the retailers of the project has decided to exclude products from its assortment that come from companies quoted on the stock exchange and to favor family businesses. At the same time, control should be shared between VCAs who should be enabled to participate in the decision-making of other VCAs, especially of intermediaries (processors, wholesalers, retailers) (C3). By contributing to the capital of intermediaries' organization, value-chain actors can contribute to important decision-making, but also benefit from potential dividends. If the organization is not owned in majority by its clients or suppliers from the beginning, their shareholding can be promoted and be made easier, provided that the participation to capital is (relatively) open. While not necessarily jeopardizing competition benefits at a larger scale, a controlled management of the competition by the intermediary is considered as a positive practice since it is a way to avoid the buyer to go for the cheapest suppliers (C4). In order to assess this criterion we have chosen to look at whether the intermediary has a policy regarding the selection of suppliers and whether it is committed to specific suppliers, through its status (e.g., producer co-op) or not.

According to GCCs analysts, ownership of organizations is not the only criteria to look at when talking about control. In fact, a VCA can drive other VCAs without necessarily owning them through the market power they have and exert (C5). This market power relies on the level of consolidation of the market (whether a few or a number of organizations hold market shares) and on the size of the organization itself (in comparison to its competitor).

Additionally, more balanced power relations should allow more balanced trading relationships. Transaction modalities have been considered as an important component of sustainability, including commitment between VCAs, and price setting mechanisms.

Commitment between actors of assessed chains is considered as a sustainable practice to ensure a better predictability for suppliers (C6). Having a better visibility over outlets would make the planning of expenses easier, including labor-related costs. In addition, production can be subject to weather hazards, that makes it unpredictable and adds uncertainty. At the same time, such commitment brings constraints to the buyer, since it does not leave the freedom to source from cheaper suppliers. A formal commitment between value-chain actors takes the shape of contracts or membership to a producer cooperative. However, long-term and stable trading relationships can take place without a formal contract, and we propose to look as well at the extent to which volumes ordered fluctuate overtime (C7).

Secondly, prices should be set by the seller on the basis of cost price (including the cost of a decent income for all workers), and they should not be negotiated or set by the buyer (C8). As indicators, we propose to look at the above-mentioned elements (i.e., the pricing mechanism), or at the coverage of the cost price by the sale price, if data is accessible. In addition to price fairness for each VCA, there should be a fair distribution of gains between them (C9). Fairness between VCAs can be measured by looking at the distribution of added value per labor unit between VCAs. Finally, other trade practices should be fair, including the payment term, which should not exceed 30 days (C10).

4.2. Value-Chain Actors

Good social relationships between value-chain actors have been considered as important by stakeholders (C11), and are measured through the trust in the trading relationship, the recognition of each other's work, and the understanding of each other's difficulties. This choice is quite logical since AFNs and short food chains have been initiated also with the purpose of reconnecting producers and consumers and to exceed pure economic exchanges.

Other major issues raised are the profitability of each VCAs, on which depends the level of income available to partners, including farmers (C12). In Europe, at least on third of farmers has another gainful professional activity besides production to complement their incomes [42], and we consider this element as being a good complementary indicator of farm profitability. The efficiency of processes along the chain is also taken as a sustainability criteria by comparing the cost per functional unit of

each process along the chain (C13). The reliance on subsidies and on loans should be minimized for VCAs to keep their autonomy (14) and VCAs should diversify their outputs and outlets (C15).

4.3. Workers

In regards to workers, VCAs should provide fair employment conditions, including compliant contracts with full social benefits (i.e., employee contracts) and stable contracts. They should avoid the use of daily contracts, non-paid family labor, and non-declared labor (C16 and C17), and workers should be paid with a fair wage (i.e., a wage exceeding the country's living wage (C18)). The working time should not exceed weekly statuary working time and workers should have weekly and yearly days off (C19). Working conditions should be safe, meaning that the handling of harmful inputs should be banned (C20). Work hardness is assessed through the feeling of workers in terms of physical and psychological hardness and their concerns regarding potential future occupational health problems (C21). Finally, workers should participate in the decision making of organizations (C22) and workers should be satisfied with their work (C23). On this latter criteria, workers are asked how they feel about various work-related aspects: autonomy, learning, internal and external rewards, work–life balance, and salary.

4.4. Consumers

According to the sustainability definition, quality (i.e., food safety, nutritional and taste quality), transparency, and affordability of products have been judged as important criteria. Regarding product's accessibility (C24), we propose two indicators: The first one looks at the satisfaction of consumers regarding the affordability of products, and the second one looks at how vulnerable people are represented among the sample of consumers of the product, in comparison to their representation among the population.

Criteria relating to product's quality and transparency are assessed through the satisfaction or trust of consumers regarding these aspects, apart from the nutritional quality for which the level of nutrients in products should be measured (C26–C29).

Finally, the awareness of consumers regarding sustainability issues should be raised, through their participation in product chains. For this criteria, we propose to ask consumers to auto-evaluate whether they feel more educated/informed when they buy products through the respective alternative product chains (C25).

4.5. Broader Societal Issues or Issues Not Related to Any Particular Stakeholders

The last category does not relate to a specific stakeholder but gathers issues that are of general or common interest. In this category, we find criteria concerning territorial development, food sovereignty and conservation of heritage, and animal welfare.

Criteria covering animal welfare include the need for sufficient human care for herds, access to outdoors, limited use of drugs including curative treatment and hormones, respect of natural life cycles of animals, and the need to limit pain at end-of-life (C30).

Product life cycles involving processes with high labor intensiveness are considered as positive since it is a way to provide jobs to people (C31). This criterion can be measured with the quantity of working hours per functional unit. Additionally, collaborations between local VCAs are promoted, meaning that product life cycles with processes taking place at the same place are favored (C32). This criterion can be measured by looking at the percentage of working hours that takes place in the same region as consumption. In the same vein, local labor is promoted and VCAs should avoid hiring non-resident workers since these workers are often hired with contracts of their country of origin and do not benefit from local social benefits, as posted workers are in the European Union (C33). Finally, VCAs should contribute to public expenses by paying regular taxes and social contributions and not engage in tax optimization, nor tax evasion (C34). For this criterion, the indicator corresponds to the percentage of price that goes to tax payment and social contribution, the higher being seen as the better.

Ideally, the sale price should also take into account all the social (and environmental) costs induced by the product life cycle, so that products with a more detrimental effects on the planet and on people should be more expensive, and thus less consumed, following the LCA Eco-social cost concept [43] (C35).

Organization of the product life cycle should promote food sovereignty, meaning that their output should go in priority for food purpose (and not e.g., fuel) and for local markets (C36). Also, product life cycle should valorize local and traditional know-how and small-scale, autonomous, and peasant farms should be supported, but for these criteria, relevant indicators could not be found (C37).

5. Discussion

In this section, we discuss on one hand the results obtained in terms of C&Is configuration (Section 5.2) and on the other hand the process to build the list itself (Section 5.3). The first sub-section describes the materials and methods used for those both exercises.

5.1. Materials and Methods

In order to discuss the list of C&Is obtained to conduct S-LCA, we compare our list of C&Is with 16 S-LCA studies that we selected on the basis of the following criteria: The product is for food purpose or is agricultural (the destination is not specified), the study proposes a list of C&Is that has been obviously applied to a case study, and the list is structured by stakeholder category or is easily comparable (excluding thus studies with no indicators, type II studies (which use, generally, not more than two indicators), and studies on biofuels products). Among the 16 reviewed studies, 14 take the Guidelines for S-LCA as primary reference. As already mentioned, some of these studies consulted stakeholders; however, rather to select or validate C&Is *from an existing framework* (i.e., the Guidelines for S-LCA), than to select C&Is *from scratch* [25–28]. Additionally, when consulted, stakeholders tend to be from mainstream value chains, since performances or potential impacts of conventional sectors are assessed (e.g., Canadian milk industry, sugar industry in South Africa). One study consulted other actors, such as experts [44]. About half of the studies focus on primary production and processing (including input production for some of them), while another half has a broader system boundary and includes consumption. Thus, our study differs from reviewed studies by the way C&Is were selected, by the product chains assessed (local alternative food chains), and by the processes included in the assessment perimeter (primary production to consumption), with all that having implications on the consulted stakeholders (whenever they were consulted). Because our research question focuses on what should be assessed in a sustainability assessment of AFNs, and not on how respective criteria should be assessed, the subsequent comparative analysis focuses on assessment criteria, and not on indicators. Given the importance of studies using the subcategories/criteria of the Guidelines for S-LCA as a basis, and our objective being to feed in the discussion on the revision of the Guidelines, the following discussion uses the list of subcategories/criteria from the Guidelines for S-LCA as a framework to structure the discussion.

More prosaically, in order to discuss the process (Section 5.2) of building the list of C&Is, we collected the individual feedback of the co-researchers on the learning acquired during the process of co-defining a sustainable food system. Further, we analyzed the process and sought to identify the limits and the requirements of such an approach, in order to draw lessons for other applications.

5.2. Discussing the Results; or, a List of Criteria and Indicators for S-LCA

In order to discuss the list of C&Is for S-LCA, we look for convergences and divergences. In other words, we seek to interpret the result of our work, with the support of the state of art. As a basis for the discussion, Table 2 gathers criteria included in our list and the ones used by other S-LCA food studies, structured according to the subcategories proposed by the Guidelines for S-LCA [4].

In terms of stakeholder categories, our list focuses primarily on “VCAs” (including relations between VCAs) and on “worker”, and to a lesser extent on “final consumers”, ”local community”, and

"society". This is a first divergence with the reviewed studies, which focus primarily on the stakeholder categories "worker" and "local community", followed by "final consumers", "VCAs", and "society", as already highlighted [45].

Table 2. Comparison assessment criteria/subcategories used in food and agricultural S-LCA studies.

	Subcategories/Criteria	Studies Using It
Chain/VCAs governance and relations between VCA	From the Guidelines	
	Fair competition	[28,46–48], C1
	Supplier relationships	[46,47,49], C6, C7, C11
	Promoting social responsibility	[28,46,47,49,50]
	Intellectual property rights	[28,47]
	From other studies	
	Fairness/equality of the transaction	[25,28,48,51], C8, C10
	Responsible supplier practices	[28]
	Bargaining power/participation in decisions/	[27], C3
	Ownership	[48] C2, C3
	Chain length	C1
	Competition management	C4
VCAs	From other studies	
	Efficiency of processes along the chain/costs	[44,48], C13
	Contribution of product/process to income	[48]
	Accessibility of the industry for a worker	[48]
	Profitability of each VCA	[44], C12
	Reliance on external source of incomes and funding	[52], C14
	Level of diversification (products, outlets)	C15
	Quality of social ties between VCAs	C11
Workers	From the Guidelines	
	Freedom of association and collective bargaining	[26,28,47,48,51–55]
	Child labor	[28,48,51–55]
	Fair salary	[26–28,46–48,52–55], C18
	Working hours	[25,28,47,48,51–54], C19
	Forced labor	[28,48,52–54]
	Equal opportunities/discrimination	[26–28,44,46–48,52–54,56]
	Health and safety	[25,26,28,44,46–48,50–55], C20
	Social benefits/security	[28,46–48,51–55], C16
	From other studies	
	Compliance with labor laws/contracts/illegal workers	[1–4]
	Seasonal and migrant workers	[47]
	Stability of work contracts/employment insecurity	[25,28,44], C17
	Work hardness/working conditions	[27,51], C21
	Participation to decision marking	[27], C22
	Professional accomplishment/ growth/development	[28,46,49]
	Age/education of employees	[25,49,56]
	Work satisfaction	[27], C23

Table 2. *Cont.*

	Subcategories/Criteria	Studies Using It
Final consumers	From the Guidelines	
	Health and safety	[47,48,50,52,54,55], C26, C27
	Feedback mechanism	[47,52,54,55]
	Consumer privacy	[46,54,55]
	Transparency	[46–48,52,54,55], C29
	End-of-life responsibility	[46,47,54,55]
	From other studies	
	Consumer education	[54,56], C25
	Taste/satisfaction with product	C28
	Affordability and accessibility	C24
Local community	From the Guidelines	
	Access to material resources	[44,46,52,53,55]
	Access to immaterial resources	[44,46,52,53,55]
	Delocalization and migration	[28,46,47,52,55]
	Cultural heritage	[52,55], C37
	Safe and healthy living conditions	[28,46,52,53,55]
	Respect of indigenous rights	[28,47,52,53,55]
	Community engagement	[28,46,47,55]
	Local employment	[25,46–48,50,55,56], C33
	Secure living conditions	[47,55]
	From other studies	
	Area reputation	[44,46]
	Cohabitation	[47]
	Level of globalization of the value chain/promotion of exchanges between local VCAs	[48], C32
	Natural and built heritage	[27,28]
	Agro-environmental practices/environmental management	[28,47]
	Protection of small-holder family farming	[27] (C38)
	Contribution to local food needs	C36
Society	From the Guidelines	
	Public commitments to sustainability issues	[28,46,47,56]
	Contribution to economic development	[28,44,46–48,56]
	Prevention and mitigation of armed conflicts	[52]
	Technology development	[28,46,47]
	Corruption	[28,47]
	From other studies	
	Labor intensiveness of processes	[44], C31
	Contribution to public expenses	[28,44], C34
	Transparency	[28]
	Animal welfare	[28,47,52], C30
	Reflection of all costs in prices	C35

Another divergence with reviewed studies is the centrality given to criteria relating to VCAs, which count 15 criteria. In our framework, we propose to distinguish criteria linked to *chain/VCAs governance and relations between VCAs* (e.g., price fairness) and criteria linked to *VCAs themselves* (e.g., VCA's profitability). Currently, there is as yet in the Guidelines no subcategories relating to VCAs

themselves, and included subcategories (fair competition, social responsibility, relations with suppliers and respect of intellectual property) belong rather to the former since it regards the behavior of VCAs regarding other VCAs (generally supplier and competitors).

5.2.1. The Centrality of Relations between VCAs/Chain Governance

This comparison highlights the lack of attention being paid to criteria qualifying the relations between VCAs. Yet, the accompanying methodological sheets of the Guidelines for S-LCA state clearly that practices of the lead firm towards its suppliers may influence social conditions in supply chains, positively in the case of a deep engagement towards suppliers, or negatively in the case of, for example, "tight purchasing deadlines and low pricing policies" [57]. These indicators seem a good basis to consider these aspects in S-LCA, even though they are designed for big companies and do not fit every context [46].

From over 14 studies applying the Guidelines, only four actually include one or more of the Guidelines' subcategories [28,46,47,49]. One reason to that could be that currently S-LCA practice focuses on practices of each VCA regarding other stakeholders (e.g. employment and working conditions), these issues being often considered to be the main social problems in product chains, but does not include potential explanatory factors or causes of such social problems [15], such as trading practices between actors of the chain, since it is mainly a reporting tool [1]. Yet, including stressors of social impacts could be a way to improve our understanding of mechanisms that lead to negative social impacts in product chains (e.g., indecent working conditions), and to identify improvement levers [3].

While confirming the relevance of two of the Guidelines' subcategories (fair competition and supplier relationships), our list of C&Is suggests additional criteria, which are confirmed by other studies: price fairness [48] and the distribution of added value [25,28,48,51]; possibility for value-chain actors to participate in decisions and effective bargaining power [27]; market power or industry concentration [48]. Some other of our criteria are unusual and are to be linked to the alternativeness of the consulted stakeholders: chain length (the shorter the chain, the better) and competition management (competition should be limited and promote complementarities). This last criterion even conflicts with the subcategory on fair competition that is about preventing "anti-competitive behavior".

This "radicalness" in our C&Is is more visible when looking at indicators and corresponding reference points: Pricing mechanisms should be in favor of those producing the good—the suppliers; competition should be managed and actually minimized; there must be a commitment between VCAs, other VCAs should participate in decisions of intermediaries, etc. Globally our criteria seem to be more prescriptive for VCAs than the ones proposed by the Guidelines or other studies, with ambitious basic requirements that reminds the tone of the Guidelines' subcategories relating to workers.

5.2.2. The Introduction of Criteria Informing on the Situation of VCAs Themselves

Contrary to the Guidelines for S-LCA, our framework and some other studies propose criteria reflecting the situation of VCAs. Some criteria have a direct link with the product life cycle: efficiency/cost of processes (as proposed in our list) and contribution of the process/product to VCAs income [28,48]. For some others, the link to the product life cycle is less obvious: profitability [44], reliance on external incomes and funding [52], and accessibility of the industry for a worker/a VCA [48]. Two less usual criteria that we propose focus on autonomy of VCAs (level of diversification in terms of output and outlets) and on the quality of their social ties with other VCAs.

We may ask why such criteria are not in the Guidelines (and neither in the Product social metrics, the other main framework for S-LCA). The list of subcategories of the Guidelines reflects practices/behaviors of life-cycle VCAs towards other stakeholders (other VCAs (suppliers, competitors), workers, final consumers, etc.). The five stakeholders included correspond to stakeholders which are impacted by behaviors of VCAs and the subcategories reflect practices/behaviors of VCAs towards these stakeholders. Thus, it is logical not to have subcategories reflecting the situation of VCAs (e.g., the economic situation) and only subcategories reflecting behaviors. However, if the situation of VCAs

themselves (e.g., their profitability) is overlooked, we might miss some information that could help understand the behavior of those VCAs (e.g., towards their workers or the employment conditions they provide, or towards final consumers or the product's safety and quality).

Additionally, this choice of excluding the situation of VCAs from assessed criteria leads to odd situations where studies look at the working conditions of farm workers, but not of farmers. It has to be noted that in the new version of the Product social metrics [7], there is a new stakeholder category for "small-scale entrepreneurs", which is a step in the right direction to have a more comprehensive picture, but which highlights the oddity included in this framework: Why not a stakeholder category VCAs, including small-scale and large-scale companies?

5.2.3. More Ambitious Criteria for Workers

Our participatory process gives importance to worker-related criteria, so do other reviewed studies. However, our criteria do not touch upon all basic subcategories of the Guidelines (such as child or forced labor, which are issues that are supposed to be absent in the assessed product chains), but upon more ambitious criteria (stability of work contracts, participation to decision making, work hardness, and satisfaction). It could be worth expanding the list of the Guidelines in this sense, as S-LCA practice suggests also.

5.2.4. For Final Consumers, More Basic Criteria, and Adapted to Any Product Chains

On final consumers, our proposition is congruent with S-LCA practice: Most studies assess health and safety as well as transparency, while feedback mechanisms, consumer privacy, and end-of-life responsibility are barely used by other reviewed studies. These three later subcategories seem actually to be tailored to big companies, and might not be relevant for most product chains. Our list stands out from other studies with new criteria on accessibility and product's taste, while our choice for consumer education is also confirmed by two other studies [54,56].

5.2.5. A Certain Divergence on Local Community and Society-Related Criteria

On local communities and society, we observe a rather structural divergence, since the Guidelines' subcategories—which are extensively used by the reviewed studies—are not in our list, except for two of them (out of 14) (cultural heritage and local employment). The six additional criteria we propose are barely used by other studies and might again show a certain radicalness: Level of globalization of the chain/exchange between local VCAs [48], reflection of all social (and environmental) costs in the price, contribution to local food needs/to food sovereignty, labor intensiveness of processes [44], animal welfare [28,47,52], and contribution to public expenses. This latter criterion has not been found in any of the reviewed studies while paying taxes is presumably the first duty of an organization towards society, and the first step to contribute positively to the wellbeing of people and the common good.

5.3. Discussion on the Process to Build the List of Criteria and Indicators

In this subsection, we look at the contributions by the stakeholders involved in the configuration of the C&Is frame with our participatory approach; subsequently, the limits and implications of adopting such an approach are also addressed on the basis of our experience.

5.3.1. Contributions

As expressed by the co-researchers involved in the co-creation process (the retailers/facilitators of the AFNs), they experienced three kinds of learnings. The first one is the impact on their understanding of sustainability issues and of sustainability in general and on their ability to express their views analytically. By facing the points of views of others, one participant expressed that she could better structure her ideas on sustainability. One other participant claimed that his view on sustainability

expanded during the process, from a view limited to environmental issues, to integrate also social, economic, and territorial sustainability issues.

Building such a list apparently gave the opportunity for a wider set of stakeholders and participants to exchange their knowledge, beliefs, and point of views. Thus, it was also a way to facilitate dialogue between value-chain actors who usually do not have the opportunity to speak to each other and to stimulate reflection and understanding on each other's own practices and ways of functioning.

Finally, another participant expressed that the learning was about how to work together and how to behave with others, rather than "scientific knowledge", and how to build knowledge collectively.

5.3.2. Limits and Implications/Requirements

Next to these rather straightforward claimed benefits, the process of building a list of C&Is within a participatory action-research project entails a number of limits and implications that could hamper its wider and general application. Firstly, it requires time, available funding for academic researchers and field co-researchers, and the availability of a relatively wide set of chain actors to participate in the consultations. Within our project, the process itself lasted nearly one and a half years.

As put forward earlier, the issue of the sample to be consulted is very important since the entire raison d'être of participation and co-creation is about taking influence on results. Included criteria rely on interests and knowledge of participants consulted. In our case, it resulted in a list of criteria directed towards farms (i.e., primary production actors). The sample should be sufficiently broad to include actors from all life cycle phases, otherwise some issues within the system could be neglected, as we noticed in our case. In the latter case, further work can be done by academic researchers to address potential shortcomings; however, there is a risk for the result of the participatory process to be altered.

The questions to be asked to participants must be clearly defined and comprehensively communicated to the participants, otherwise the obtained results could differ from what has been expected. In our case we had to adapt the list of criteria since the participatory process was used to build two different tools (the reported C&Is for S-LCA, and a self-assessment tool for distribution systems and supply chains) with different scopes, so a substantial work of reformulation and criteria adaptation was done to criteria to fit all life cycle phases. If the participatory process would have targeted a single use, the results would have been more tailored towards the configuration of a particular highly contextualized assessment tool. However, an obvious limitation of our process expectations, in particular with respect to future repetitions of the exercise, is the particular situation of having resources to allow for three field partners to engage thoroughly in a three-year research project in order to co-create an assessment tool that they could actually hardly implement by themselves.

The use of a framework like PC&Is or of a conceptual framework like the three-pillars approach to sustainability can be useful to structure ideas, but such a framework can be hard to be combined with a participatory process, since it can restrict and preconfigure the expression of ideas or bring confusion. At the very early stages of the process, academic researchers put forward the three-pillars approach to sustainability, but this framework was rejected by co-researchers who felt it brought a superficial partitioning that was not able to account transversal issues properly. However, from the beginning there was an impression shared by researchers from academia that a conceptual or theoretical framework was needed to frame the process. In order to finalize the list of C&Is for S-LCA, the chosen theoretical framework was introduced later in the process, when the participatory process was actually already completed, in a near-to post-production phase.

The multidisciplinary approach required by the participatory process (as highlighted by Mathe (2014) [8]) can indeed be an impediment, as can be illustrated by the criteria identified for which indicators could not be found or by criteria which could not be assessed (cf. part two of this article in the present special issue [11]). But the participatory process necessarily implies the participation of actors with various knowledge bases which actually facilitated the process in our case, including the building of indicators.

A limit that is often raised in literature, and which is also quite inherent in strong contextualized participation, is the relative impossibility to use the results straightforwardly in other contexts or even to compare results between studies. This is clearly a potential main limit of participatory processes conducted at local level, such as the one we implemented. However, the absolute non-relevance and non-applicability of a list such as ours to other similar contexts would still need to be proven; in particular as the context of the exercise (i.e., European, urban, co-creational ...) is not necessarily particular in itself, but can be found in some other situations. In the same vein, we feel that such a process is a good way to help the consolidation of the list of subcategories of the more generic S-LCA Guidelines, notably because it can help give ground to the work of the task force that led to the Guidelines' list of subcategories, and eventually streamline the S-LCA practice.

6. Conclusions

The participatory approach has been implemented to give the floor to actors or people who are active in the food sector of a specific region and who are hardly heard, as well as to build a meaningful list of C&Is for S-LCA. The result of the implementation of this approach proves that it is relevant, since the resulting list of assessment C&Is is substantially different from what is proposed and done more generally in S-LCA. The radicalness of AFNs' chain actors is reflected in the ambitious and innovative criteria proposed, particularly on the functioning and governance of product chains, as well as on the situation of VCAs themselves, which can be considered as potential explanations of positive and negative performances along the chain. In this sense, our list stands out from other lists, which aim at describing and reporting on social performances and hotspots in product chains, but not at investigating potential underlying root causes.

For further S-LCA studies and in the framework of the revision of the Guidelines' subcategories, we argue, on the basis of this work, that criteria relating to VCAs themselves, to chain governance, and to relations between VCAs (including economic relations; i.e., transaction modalities) should be added.

Our list also rejects—in a way—the relevance of some of the subcategories proposed by the Guidelines to our specific context, such as those adapted to big companies only (e.g., feedback mechanisms, public commitment to sustainability issues) and those which are not directly related to the product life cycle, such as some of the subcategories of the local community stakeholder category. However, a main recommendation for further S-LCA research is to replicate such a participatory process to build assessment criteria with field actors at the local level, including chain actors, as a way to continue the discussion on the richness of what S-LCA should assess. Such discussion could also feed the content of existing and future labelling initiatives (i.e., their specifications), which, apart from a few exceptions such as participatory guarantee systems [58], are built following a rather top-down approach and often face shortcomings on social and socioeconomic issues.

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Appendix A

Table A1. Intermediary list of sustainability principles and corresponding criteria (P&C list, from step 3).

Principles	Associated Criteria
1. Fair trading practices	Terms of trade and balanced relationship between VCAs; added value distribution; number and role of intermediaries; fair competition; competition management based on complementarities; prices reflect economic, environmental, and social costs; cooperative management and participation of stakeholder to decision making
2. Economic viability of VCAs	Commitment between VCAs and stability of income/takings; profitability of VCAs; efficiency of processes along the chain
3. VCAs autonomy and resilience	Reliance on subsidies; reliance on external funding/on debt; diversification and innovation
4. Decent work conditions and worker wellbeing	Respect of labor legislation, including on equal opportunities; living and legal wage; income fairness between workers; distribution of added value between VCAs; work contract stability; physical and psychological work hardness; work satisfaction; match between tasks, skills, and interests of workers; participation of workers to organization's decision making; accessibility to practice the profession
5. Territorial development	Job creation; use of local labor; geographical scale of trade/relocation of trade and collaboration between economics actors
6. Solidarity, social ties and participation	Promotion of interaction between chain actors; support to collaboration between producers; accessibility of products to any consumer; recognition of the work of suppliers by consumers; involvement and commitment of consumers in the system
7. Economic and financial transparency	Compliance to tax return and contribution to public expenses; use of formal/regular/declared work/labor only
8. Product's quality, consumer and producer health	Transparency on production methods; level of traceability; use of harmful inputs; healthy products, free of residues; nutritional and taste quality
9. Awareness raising and practices improvement	Promotion of awareness raising of consumers to sustainability issues; provision of information by the system on health, environmental, social and economic implications of consumption choices; promotion of continuous improvement and revaluation of practices, including farming practices; number of intermediaries
10. Conservation of cultural heritage and know-how	Valorization of local and traditional know-hows, and their handover; support to peasant- and small-scale production methods; support to autonomous farms
11. Food sovereignty	Contribution to local food needs; promotion of diversification to meet basic nutritional needs of people
12. Respect of animal welfare	Match between herd size and number of workers; ban on battery farming; curative treatment not used as preventative treatment and preventative treatment are only natural; ban on hormone use; respect of natural life cycle of animals; painless end-of-life
13. Respect, conservation and regeneration of nature	Water management; minimization of air and water pollution; ban on synthetic chemical treatment; plant protection methods based on positive interaction between plants, predators and on development of organic life of soils; regenerative farming practices; use of land that matches geographical and geological characteristics; minimization of soil erosion; respect of the productive function of the soil, including humus and organic matter regeneration, mineralization, and soil structure
14. Conservation of biodiversity	Ban on genetically-modified organisms (GMOs); conservation and regeneration of biodiversity and of local native and hardy species
15. Reduction of energy footprint	Optimization of logistics; promotion of soft mobility; reliance to fossil energy; use of renewable energy; promotion of local and seasonal inputs and products
16. Circularity of resources flows along the chain	Limitation of food waste; limitation of waste, including packaging used and produced; reuse and recycling of waste; circularity of waste flows and their use in the system

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