Social dimension of sustainability: Assessment in the agribusiness context

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Abstract

Studies on sustainability of agribusinesses often overlook the social dimension of sustainability. The social pillar is clearly the least studied of the three traditional pillars of sustainability, and the classification and estimation of the indicators used to measure it present some weaknesses. On top of that, some social indicators lack scientific validity while others are most commonly limited to capturing intra-company realities. This paper focuses on addressing this gap by identifying the most mentioned sustainability assessment models on the literature in an agribusiness context, selecting the social indicators across the identified models and classifying those according to their thematic scope. We carry out a literature review resorting to systematic and integrative methodology, aiming at revealing the social indicators that have already been used or tested in sustainability assessments with focus on the agribusiness context. The resulting list of articles is identified according to the systematic criteria enunciated and observing the Prisma protocol. This review is then complemented by a detailed bibliometric analysis of the articles identified, which is deepened with a qualitative and quantitative content analysis using exploratory techniques that allow the visualization of semantic patterns, which may help the identification of indicators with strong relevance to the social sustainability evaluation. As a result, this paper presents information on indicators used for the assessment of Social sustainability since 1999 to the beginning of 2022, highlighting trends in the themes addressed and changes in focus. By compiling and systematising a comprehensive series of social sustainability indicators, we aim to bring valuable contributions to the future outline of an assessment framework that will incorporate social sustainability dimensions underlying a broader perspective on agribusiness sustainability. Ultimately, this research aims at supporting the sustainable development of the sector from a social perspective.

Keywords*: Agribusiness, Social indicators, Social sustainability, Sustainability assessment.*

1. Introduction

Today's companies are been forced to move from the "mere adoption of green practices toward rethinking, redesigning, and redeveloping business practices in a more sustainable way" (Ajmal *et al.*, 2018, p. 327). Given the multitude of existing definitions of sustainability, one of the key emerging research questions is: "under what conditions sustainability happens?" (Santini *et al.*, 2013, p. 11) and how does agribusiness integrate social aspects into its management?

Since the Rio Earth Summit in 1992 there is an

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overall consensus on the multidimensionality of sustainable agricultural development goals (Dillon *et al.*, 2016). This feature has been emphasised within the Sustainable Development Goals (SDGs) created in the United Nations General Assembly that represents a potential tool for sustainable development to be adopted by governments, companies and consumers (Parrilla-González and Ortega-Alonso, 2021 and 2022).

Agriculture has been able to accommodate the challenge of adhering to evolving principles of sustainability (De Luca *et al.*, 2018) but putting the theoretical concept of sustainable development into practice has proven to be challenging (Meul *et al.*, 2008).

A recent review (Chopin *et al.*, 2021) showed that the classical view of sustainability with economic, social and environmental pillars dominates the tools used for sustainability assessments at farm level. This happens alongside intense discussions around the caveats of the "trinomial conception of sustainability", specifically its failure to capture the interrelations between these and other dimensions (De Luca *et al.*, 2018).

Work by Boyer *et al.* (2016) reveals the complex relationships between the traditional pillars of sustainability, whilst Boström (2012) states these relationships are generally assumed to be compatible and mutually supportive. Integrated assessment tools have emerged as a means to consider trade-offs between and within the different dimensions of sustainability, highlighting the ways they relate to each other despite their inherent differences (Alkan Olsson *et al.*, 2009).

The environmental and economic dimensions of sustainability have been "more robustly theorized" (Hovardas, 2021, p. 13) than the context-specific, fluid and inherently subjective social dimension (Boyer *et al.*, 2016). Gaviglio *et al.* (2016) point out to the considerable lack of exhaustive approaches able to evaluate this dimension of sustainability in rural areas.

Concerns regarding the social impact of farming practices are as important as environmental impacts (Van Assche *et al.*, 2014; Thompson, 2010, cited by de Olde and Valentinov, 2019). From the stakeholders' point of view, social issues rank second after environmental issues as highest priority, above economic and governance concerns (Whitehead, 2017). Nonetheless, the social dimension is only considered in 25% of the scientific articles dedicated to sustainability in agricultural production, and the most commonly used indicators in the academic literature do not coincide with the core aspects that practitioners seek to monitor (Rasmussen *et al.*, 2017).

There are several possible explanations for the imbalance of studies on the social dimension of sustainability. Social sustainability topics are shaped by the political and socio-economic context, namely regarding healthcare provision and social protection and welfare (Havardi-Burger *et al.*, 2021), and the heterogeneous nature of social issues in different geographies results in a lack of conceptual clarity and in hesitation around setting normative targets for the social indicators (Gaviglio *et al.*, 2016). This "definitional vagueness" (Ajmal *et al.*, 2018, p. 333) adds to the technical challenge of measuring social aspects and tracking them over time and space using the same tools used for the other two pillars (Bacon *et al.*, 2012; Ajmal *et al.*, 2018).

The growing attention to social sustainability has not yet resulted in a standardized assessment framework, however social sustainable implications are significantly considered under the SDG literature and further investigation should be developed in agribusiness (Parrilla-González and Ortega-Alonso, 2021 and 2022).

Indeed, either because the definition of sustainability is strongly focused on people (Janker and Mann, 2020) or simply due to increased pressures from stakeholders (Popovic *et al.*, 2017), social sustainability concerns have been gradually integrated into the businesses.

This research aims to bring valuable contributions to the development of an actionable social sustainability assessment framework for agribusiness. To this end we identify and compile a comprehensive list of existing social sustainability indicators in the systematically queried literature in the two major research databases, Scopus and Web of Science. Following that, and to facilitate the incorporation of social sustainability dimensions in future assessment tools, we synthesized a series of social sustainability clusters grouping methodologically the indicators found in the literature.

Therefore, this paper is structured in four sections in addition to the Introduction. A Background section, which refers to some of the previous and leading investigation found on the theme, next a Methods section that details the review and analysis methodology applied in this work. The Results and discussion section was naturally included to expose the findings and the structure of the paper is completed with the Conclusions section.

In completion this research intends to support the sustainable development of agribusiness from a social perspective and help decision-makers create the conditions to assess, compare and foster sustainable agribusiness, and associated developing policies.

2. Background

The concept of social sustainability had been neglected in comparison to environmental and economic aspects of sustainability. It was only in the late 1990's, according to Rasouli and Kumarasuriyar (2016), that social sustainability was considered a fundamental aspect within the sustainability agenda. Nevertheless, and despite the enormous amount of work that has been done in this regard in the last three decades (Gaviglio *et al.*, 2016) there has been no agreement about a comprehensive definition of social sustainability (Åhman, 2013; Jaeger *et al.*, 2011; Littig and Griessler, 2005; Vallance *et al.*, 2011; Weingaertner and Moberg, 2014). However social sustainability gained significant recognition since Sachs (1999), stated that the concept should be based on the basic values of equity and the effective appropriation of all human rights, such as political, civil, economic, social and cultural dimensions. More recently other authors (Davoodi *et al.*, 2014; Eizenberg and Jabareen, 2017; Weingaertner and Moberg, 2014) suggested the inclusion of specific new social themes in this concept, like quality of life, social capital, social cohesion, integration and diversity, sense of place, equity, human capital, safety, well-being and eco-presumption as key themes for social sustainability.

Sustainability assessment tools may be classified in three categories: indicators and indexes, product-related assessment tools (with LCA being the most established method) and integrated assessment methods resulting from combinations of tools (Ness *et al.*, 2006). As far back as 2003, Heller and Keoleian (2003) argued that the life cycle indicators fell short to measure progress towards long-term food security and system stability, meaning sustainability indicators for the agricultural sector were needed. These should translate an holistic view of the connections between societal well-being, environmental health and personal health, resulting in sustainability indicators that balance these interrelated domains (Desiderio *et al.*, 2022).

There are several indicator-based tools for the agricultural sector, the majority of which applied at the farm level context (Havardi-Burger *et al.*, 2021). Some were developed to reflect the realities of specific sectors such as dairy or permanent crops, while others have a more generic nature, are less exhaustive and more adaptable to different sectors, scales and territories, (Binder *et al.*, 2010; Bonisoli *et al.*, 2018; de Olde *et al.*, 2016; Trigo *et al.*, 2022). De Olde *et al.* (2016) have conducted comprehensive reviews of sustainability assessment tools for the agricultural sector and have listed a total of 48. Later, Bonisoli *et al.* (2018) identified 15 assessment tools covering at least the three traditional pillars and recently Trigo *et al.* (2022) identified 105 methodologies in this context, of which 32% covering all three fundamental dimensions of sustainability.

As in other disciplines, the choice of indicators for sustainability assessments in agriculture is not always explained (Meul *et al.*, 2008), despite being subject to extensive discussions in the literature (Havardi-Burger *et al.*, 2021). Kühnen and Hahn (2017) highlight the need for the development of a valid and reliable selection process for the many existing social indicators. To this end Binder *et al.* (2010) point out three principles for indicator selection: vision/goal orientation, system representation, and data availability. Likewise, Popovic *et al.* (2017) identify effective social sustainability indicators as being relevant, clearly defined, reliable, quantifiable and based on accessible data. Bonisoli *et al.* (2018) add to the discussion by dividing the criteria for indicator selection in two groups: in-

trinsic requirements (data availability, relevance, analytic validity, flexibility in case of changes and measurability) and usefulness of the indicator. Also, as referred by Valls Bedeau *et al.* (2021), it is essential to consider the engagement of stakeholders in implementing a set of transformative actions towards the implementation of an harmonized social sustainability assessment tools. This is even more of a cornerstone when we recognise the need to balance sustainability assessment models of greater efficiency, greater effectiveness with new social relationships as cross-cutting axis (Corvo *et al.*, 2021).

3. Methods

Guided by the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) 2020 protocol (Page *et al.*, 2021), this literature review aimed at capturing the tools and indicators used to assess the social dimension of sustainability in agribusiness.

The information sources were the databases of Scopus and Web of Science, which are reputed and widely used research publications and citation databases covering sciences, social sciences and humanities, among other subjects. As neither database is exhaustive and both complement each other, we have integrated the results from both databases in one merged complete database to ensure broader coverage.

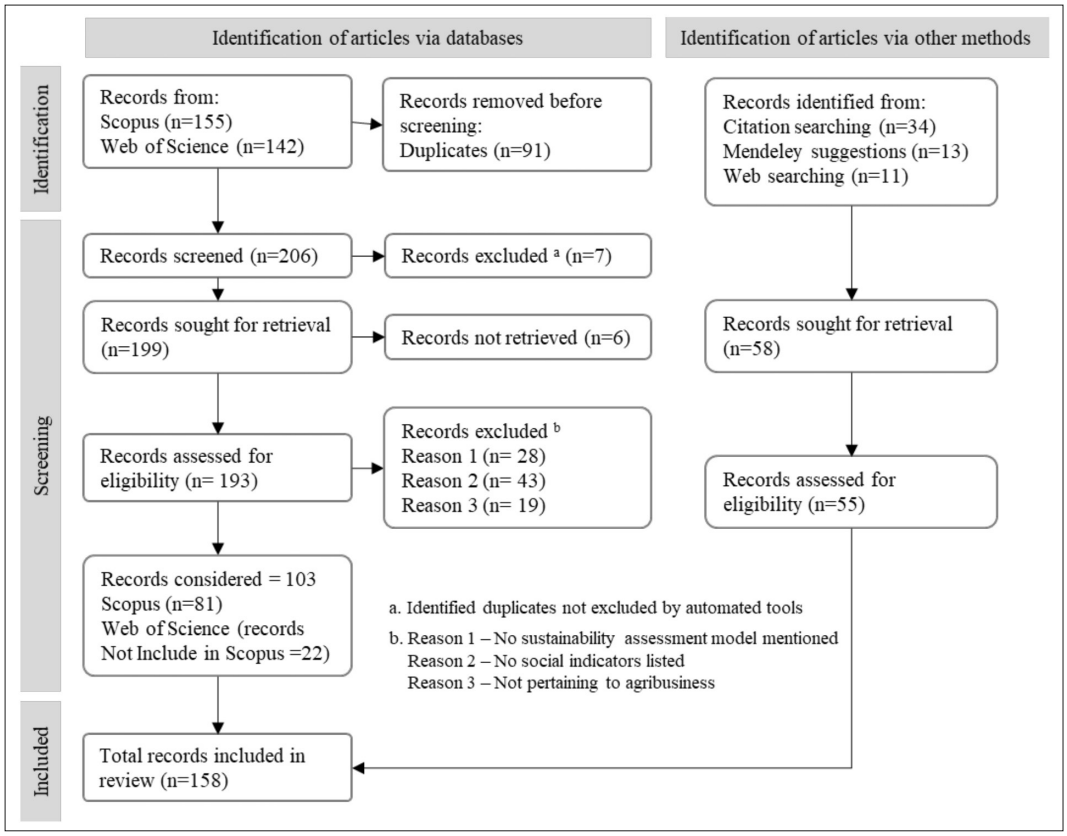
The used queries were similar for both databases and built with no date restrictions, covered peer-reviewed journal articles only, were limited to English, Spanish and Portuguese and made use of the same selection of words of interest (and the most similar search string possible) to focus the search on the exact same objectives. The Subject Themes were as overlapping as possible on both databases. As it is not feasible to use the exact same search string on both databases, we tried to limit the differences with actions described as follows.

Scopus search string: "social" W/2 "sustainab*" AND ("agra*" OR "agri*" OR "agro*") AND "indicator*". By selecting all Titles, Keywords and Abstracts of Articles with the word "social" within a distance of two words (either to right or left) of the word "sustainab*" (in order to cover words like sustainable and sustainability), we aimed to including expressions such as "social sustainability", "social sustainable", "social dimension of sustainability" or "sustainability social indicators", for example. The search string also limited the results to articles which included words starting by *agra*, *agri* or *agro* (like for example agrarian, agriculture, agribusiness or agronomy among many others) in the Title, Keywords or Abstract. The query command was completed with the rule of also having to identify the words "indicator" or "indicators". The search was restricted to the following subjects: Environmental Science, Agricultural and Biological Sciences, Social Sciences, Energy, Economics, Econometrics and Finance, Business, Management and Accounting, Engineering, Decision Sciences, Veterinary, Multidisciplinary. No time restrictions were applied. This search query ran on the 15th. of January of 2022, identified 155 articles.

Web of Science search string: "social" near/2 "sustainab*" AND (agra* or agri* or agro*) AND indicator*. This query was limited to Articles and applied on their Topics (Title, Abstract, Author keywords, and Keywords Plus). To mimic the constraints used in Scopus, a proximity operator between words was also applied: the command "NEAR" to which we append the number of words to look for on the vicinity of the anchor words (near/2). This way we replicate the scope of search in both databases looking for expressions rather than for isolated words. An effort was made to select subjects/themes of scientific investigation analogue to the ones used in Scopus, so Architecture, Business Finance, Chemistry Analytical, Computer Science Artificial Intelligence, Engineering Industrial, Engineering Manufacturing, History Philosophy of Science, Law, Materials Science Multidisciplinary, Food Science Technology, Energy Fuels, Computer Science Interdisciplinary Applications, Engineering Civil and Geography Physical were excluded. This search query was also applied on January 15 and resulted in 142 articles.

Alongside the systematic selection of articles via databases an integrative selection of documents via other methods was made. The subsequent integration of this new set of scientific

Figure 1 - Flow diagram for the systematic review following PRISMA 2020 protocol.



articles aims to offset the lack of semantic standardization on the research topic. The goal was to enhance the range of articles for analysis, by identifying and incorporating documents that add to the topic despite not fitting the query restrictions used for the systematic selection.

This integrative effort followed clear criteria for a subsequent judgemental selection: cross-references from the articles systematically selected, evaluation of Mendeley suggestions on the "social sustainability indicators" theme (suggestions based on Mendeley's artificial intelligence logarithms of search, usage and storage history), Oriented Web Search of "social sustainability indicators" diagrams, charts, graphics, maps, tables or drawings with a further stage of fine search mining to reach associated documents to those findings. The documents thus identified as relevant for the investigation were extracted for comprehensive appraisal and critical reading and added to the dataset as a separate selection.

The systematic selection process is presented in the diagram (Figure 1).

The initial group of articles identified and extracted from both integrated databases screened in a 3-step process, identified 206 articles on a first stage. These were then systematically cleaned of all non-usable documents resulting in a final selection of 103 articles of interest. Many of the documents were excluded, due to being duplicated or either by non-compliance with the research object or by denied access to download ('not retrieved').

In addition to this initial group of documents, fifty-five (55) other articles were identified using an integrative selection process as being of relevance to the scope of the research. This integrative selection of articles was added to the systematic selection previously obtained, resulting in a total of 158 articles subject to analysis (except for the bibliometric metanalysis process which could only be performed on the systemat-

ic selection of articles due to Bibliometrix© software constraints).

The Scopus and Web of Science databases were integrated, and this merging process was performed using Rx64 4.1.2 and RStudio Version 2 software, and for the specific quantitative analysis of these results the Bibliometrix 3.1 application was the chosen tool. This open-source tool for quantitative research was employed to analyse all articles that resulted from the systematic selection described.

The qualitative analysis of all articles selected was performed using NVIVO version release 1.4.1 (815) software and its analysis functionalities.

Also, to determine the hypothesis of an association between the Time Period in which the article was written (pre or post-2012) and Thematic Cluster of the indicators studied, statistical analysis methods were used to interpret the data, namely the Pearson's Chi-squared test for which 1249 social sustainability indicators; correlation was investigated by Chi-squared test for time period (pre or >=2012) and thematic group (8 clusters).

4. Results and discussion

4.1. *Quantitative analysis*

This analysis included 103 articles from 480 authors published in 64 different reviewed journals and spanning from 1993 to 2021 (January 15th. of 2022, being the date of the last database search). No other bibliometric studies on the same topic were found. Nonetheless, additional efforts were made to discuss our results, namely in comparison with other articles which content is related to our research, even if partially. The publications within this dataset have been relatively scarce until 2008 and have shown an exponential growth trend ever since. The growth in scientific production was naturally accompanied by the diversification of the sources of publication, and both facts reflect the growing awareness of the multidisciplinarity within sustainability science. The dataset is dominated by single-country publications, which can be explained by the territorial specificity of a large number of articles. In Ochoa-Noriega's *et al.* (2021) study was verified that the research on sustainability was higher in countries such us China, Spain, Australia and the United kingdom.

An analysis of the Authors' keywords evolution suggests that "social indicators" is the most recent and active trend among the topics pertaining to social sustainability in agriculture that is aligned with the findings of Parrilla-González and Ortega-Alonso (2021 and 2022) and also reported by Segerkvist *et al.* (2021).

The overall increase in publications since 2012 may have been prompted by the Rio+20 Summit held that year, encouraging efforts to promote social participation in the construction and implementation of sustainability commitments – thus also promoting scientific research on social sustainability, its indicators and frameworks for its assessment.

Annual scientific production

For a more comprehensive understanding of the scope of this selection of documents, a more extensive overview of the findings through a detailed bibliometric analysis is shown in Figure 2. The detailed quantitative description given by this analytical tool presents some curious and unique results that are outlined because of their evident interest in future research.

In an immediate analysis of the quantitative results of the "annual scientific production" (Figure 2) it is very clear that work related to "social sustainability indicators in agriculture" was very scarce from 1993 to 2008 (including no work at all from 1994 to 1997, 2000, 2002, 2004, 2007). These results clearly illustrate the period when the social pillar of sustainability was clearly demoted to the second or third research option, as identified by many authors (Binder *et al.*, 2010; Janker and Mann, 2020; de Olde *et al.*, 2016; Rasmussen *et al.*, 2017; Szolnoki, 2013).

However, and even understanding that awareness on the subject started to grow slightly in 2008, it was only from 2013 onwards that there was an exponential increase in research interest, with two different peaks of scientific production in 2016 and 2018.

However, the big boom of publications on this research topic is identified in 2020, and this surge is also advocated by other authors like Ochoa-Noriega *et al.* (2021) or Segerkvist *et al.*

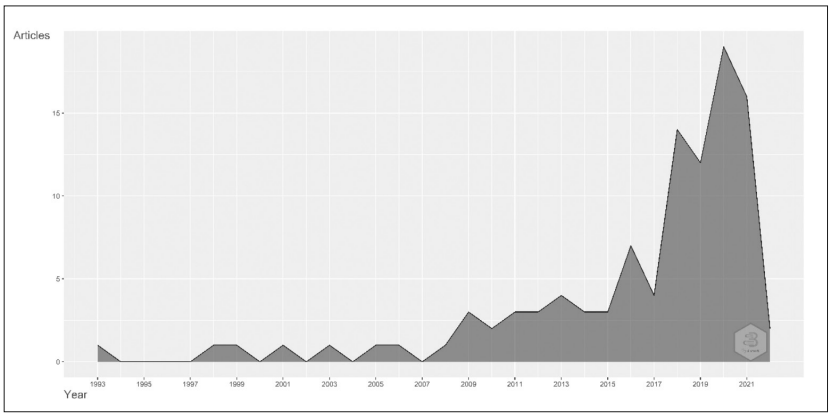


Figure 2 - Annual scientific production.
Source: Bibliometrix analysis output.

(2021). Their reliance in previous exploratory and research works provides reassurance that this is an important and relevant topic to investigate.

Word cloud and most frequent words

The quantitative analysis of the Author's keywords within the systematic selected articles to support the investigation on social sustainability indicators produced a word cloud that confirms the presence and relevance of very important keywords for our research, as well as their relative position to numerous other significant words (Table 1).

Table 1 - Most frequent words (double words in abstracts).

Words	*Frequency*
social sustainability	79
sustainable development	44
environmental sustainability	31
sustainability assessment	28
agricultural sustainability	25
economic social	24
life cycle	24
economic sustainability	21
social indicators	21
farming systems	20
sustainability indicators	20
economic environmental	16
environmental economic	16
social economic	15
agricultural land	13

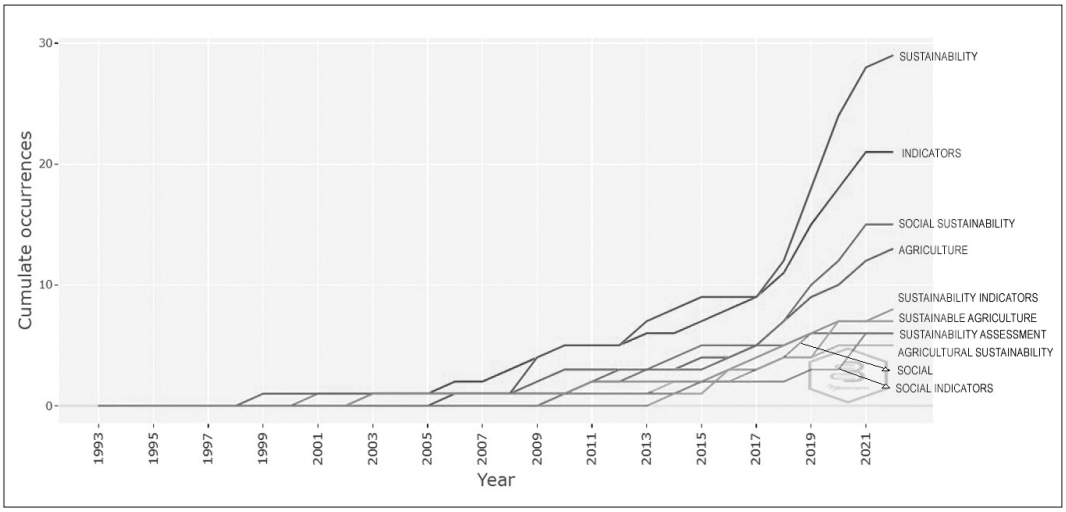
The results are very supportive of the systematic method used in parallel with the rules applied. The presence, centrality and importance of words like "social sustainability", "indicators", "agriculture", "sustainability indicators", "sustainable agriculture", "social indicators" or "agricultural sustainability" are evidence that our main research topics are reflected in this collection of selected literature documents.

Given the presence of bigrams (two concomitant words) in the word cloud, further search was conducted to investigate the occurrence of bigrams in the abstracts of the selected documents, enabling a more expression-oriented vision of the text content rather than just a count of the words' presence. Table 1 highlights the fifteen most frequent bigrams, and once again the results support the adequacy of the selected documents to our investigation. Moreover, the frequency of these words is measured in a context of expression and not just 'measuring occurrences' in the same space and independently of their non-relationship.

Word growth and trend topics on Author's keyword

The dynamics of the most important Author's keywords over the entire timeframe is represented in Figure 3. This quantitative analysis shows the slight rise of interest on the subject around 2012, and exponential growth starting between 2017 and 2018. It is of particular interest to note that the words "sustainability", "indicators", "social sustainability" and agriculture are the ones with the most expressive growth trends.

Figure 3 - Word growth of Author's keywords.



Source: Bibliometrix analysis output.

With these cumulative figures as evidence of the growing interest in the assessment of social sustainability, together with the perceived need for robust social indicators for its accurate measurement, we can have some assurance that we are on the right track in choosing this research theme.

To complement these findings, a trend topic analysis was completed only for the last 10 years (from 2012 to 2022) and having a minimum frequency of five words and also not presenting more than five topics per year. According to the Author's keywords, the topic "social indicators" is the most actual topic and just before that there were topics like "social sustainability" in 2019 or "sustainability indicators" in 2018.

Co-occurrence network and thematic map and evolution on abstract's expressions

The co-occurrence network analysis identified four thematic clusters of articles: one strongly associated with the main theme "sustainability assessment"; a second cluster comprising the indicators on the topic, namely "sustainability indicators" and "social indicators"; the third cluster primarily focus on the remainder dimensions of sustainability (environmental and economic); and the fourth cluster aggregates the works on "life cycle assessment".

Analysing the conceptual structure of the articles' connectivity and thematic inter-relationship, the calculated co-occurrence network reveals a clear and strong centrality of the "social sustainability" theme (Figure 4). This analysis also shows that the dispersion of themes is quite homogeneous and balanced in terms of equidistance to co-occurrences. In fact, of all the clusters that make up this co-occurrence network, the cluster that shows some heterogeneity in terms of overall distribution of internal themes, when compared to the other clusters identified, is the one composed of articles on the theme "life cycle assessment".

In this analysis it is also important to pinpoint the evident close relation and direct relationship of the central theme (social sustainability) with some of the other important themes of the research purpose like "sustainability assessment", "social indicators", "sustainability indicators" or "agricultural sustainability".

Regarding the thematic analysis of the–one hundred and three articles systematically selected, there is a clear identification and distribution of six thematic topics (Figure 5).

The scattered distribution of topics within the spectrum of different quadrants is depicted in the thematic map of Figure 5, in which the topic "Social dimension" emerges and is central for all quadrants (needing only a little more density, which will certainly come in the near future with more research). It is also reassuring to see "Social sustainability" and "Social indicators" classified as

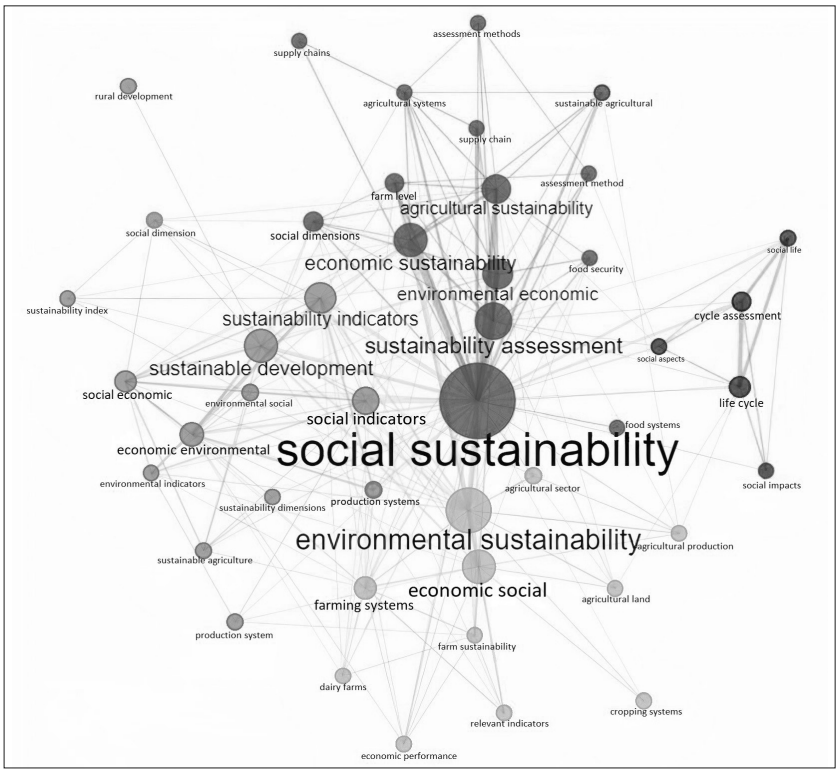
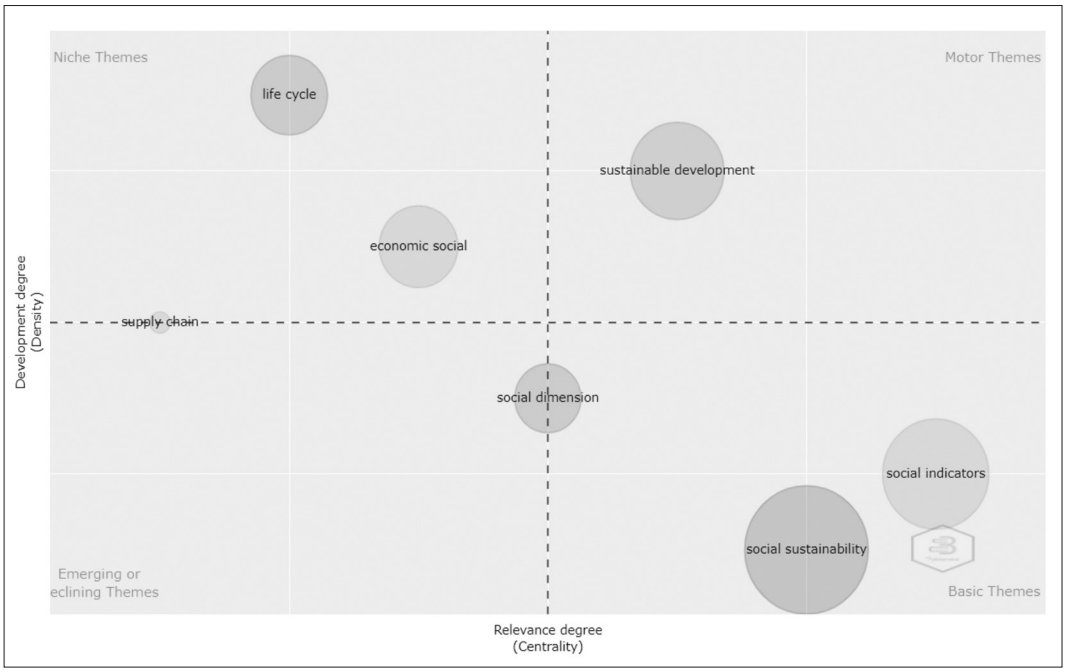


Figure 4 - Co-occurrence network – Abstracts bigrams Louvain method.

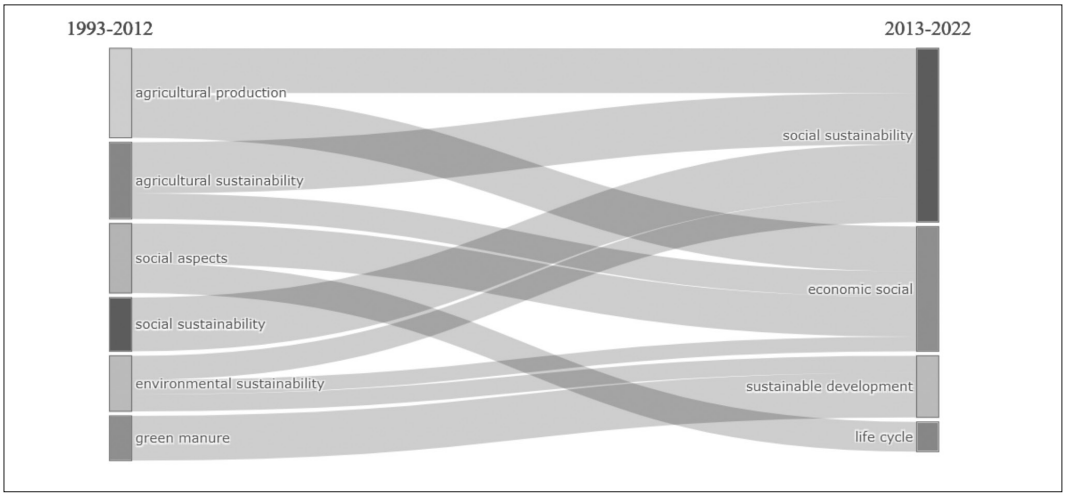
Source: Bibliometrix analysis output.

Figure 5 - Thematic map – Abstracts bigrams.



Source: Bibliometrix analysis output.

Figure 6 - Thematic evolution – Cutting year 2012.



Source: Bibliometrix analysis output.

major basic themes. This reassurance is strengthened by the allocation of the topic "sustainable development" in the motor theme quadrant what is a guarantee that the theme sustainability is a must for researchers and future investigations. Nevertheless, the classification of the topics "life cycle assessment" and "economic social" as niche themes can be interpreted as fertile ground for new studies or even to be integrated and enrich broader studies.

On the assessment of the thematic evolution of the most common conjunction of two words (bigrams) within the abstracts of the systematically selected articles, making a separation of moments on 2012 (topics until the end 2012 vs. topics from 2013 inclusive) and regarding the following software search conditions: *abstracts bigrams with the inclusion index weighted by word-occurrences and with a minimum cluster frequency of five per thousand docs*, some interesting last decade topic evolutions are revealed.

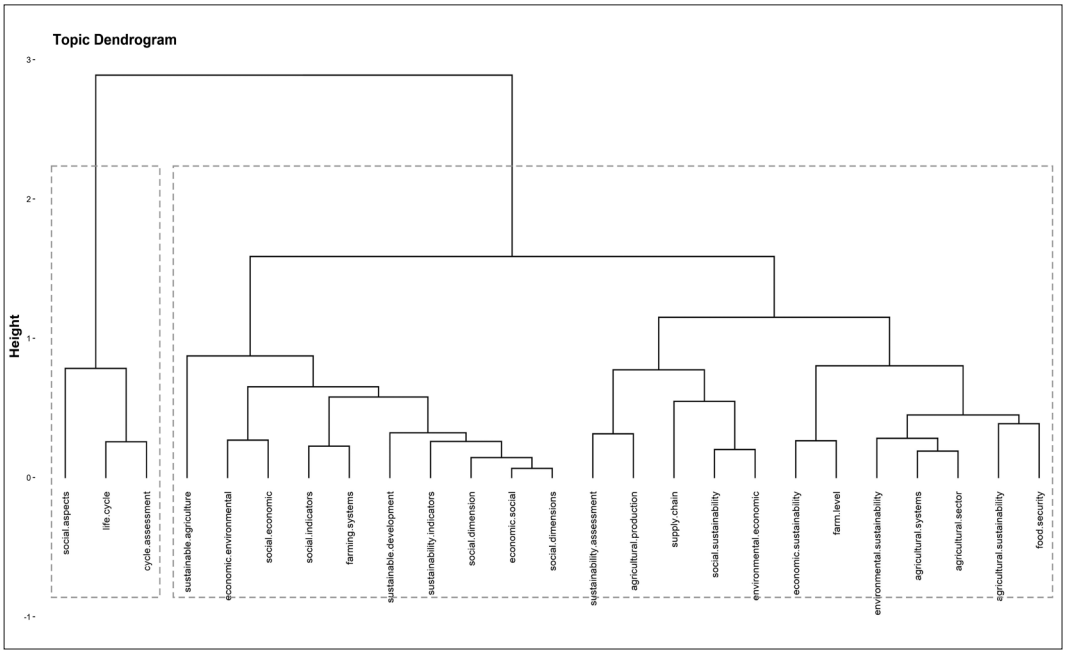
Figure 6 shows how the topic "social sustainability" has grown a lot in importance in the last decade, apparently based on the aggregation of part of the research on other topics such as "agricultural production", "agricultural sustainability" and "environmental sustainability". It is also interesting to understand that in these last ten years the socio-economic theme has also grown in interest and aggregated some other different topics in its research.

Also significant is the evolution of the topic "environmental sustainability" that has distributed its interest to "social sustainability", "social economic" and "sustainable development", disappearing from the four most important topics in the last ten years.

This is a direct reflex of the evolution social sustainability framework had in the last two decades. For instance, Mckenzie (2004) asked for equity, diversity, quality of life, democracy government; while Spangenberg (2004) recognized a macro level (income and assets) and a micro level (education, training, social contacts, communication, participation, and social security) and Colantonio (2009) identified basic needs such as health, housing, and food. The inclusion of social capital, social justice and equity, were also requested by several authors (Åhman, 2013; Cuthill, 2010; Weingaertner and Moberg, 2014; Woodcraft *et al.*, 2011). Other subjects such as cultural life, social amenities, citizen engagement, space for people and places to evolve (Woodcraft *et al.*, 2011), social cohesion, integration and diversity, sense of place (Weingaertner and Moberg, 2014) were identified as key themes for social sustainability.

Another noteworthy evolution is that the studies of "social aspects" have also been completely integrated into different topics such as "life cycle" or "social economic".

Figure 7 - Topic dendrogram – Factorial analysis (Multiple Correspondence Analysis).



Source: Bibliometrix analysis output.

Topic dendrogram

For its construction, the integrated data retrieved from the databases (Scopus and Web of Science) was analysed using Bibliometrix R-package and a factorial analysis of the most common expressions (double word expressions) using a Multiple Correspondence Analysis (MCA) within the selected article's abstracts was performed using the software. The automated Bibliometrix analysis output indicates (by inputted request) the two most clearly distinguishable research topics for the identification of social sustainability indicators within the documents: one regarding a social life cycle assessment and another regarding the traditional assessment of social sustainability.

4.2. *Semantic patterns analysis*

After introducing all the bibliographical research texts (158 articles from systematic and integrative selection) an initial analysis of the most frequent words within the entire text of the articles showed a word cloud consistent with our search criteria, hence supporting the accuracy and the validity of the selection for the proposed research. Furthermore, the subsequent qualitative and quantitative analysis on the dataset, including proximity analysis of words and expressions of interest, revealed the existence of close relationship in between words and expressions of major importance for the investigation. This type of analysis evaluated the co-existence of a set of words in the same paragraph, meaning a high likelihood of a syntactic link. This gave us full assurance that we were identifying only words that are in the defined range of proximity, but certainly in the same context and referring to the same subject.

In addition to assessing the presence of double word expressions, we felt the need to also investigate the presence of an important three-word expression (social, sustainab*, assessment). This produced 2955 results within 121 references, which when compared to querying only the double-word expression (sustainab*, assessment), which produced 3792 results across 148 references, demonstrates that these references have a fairly significant

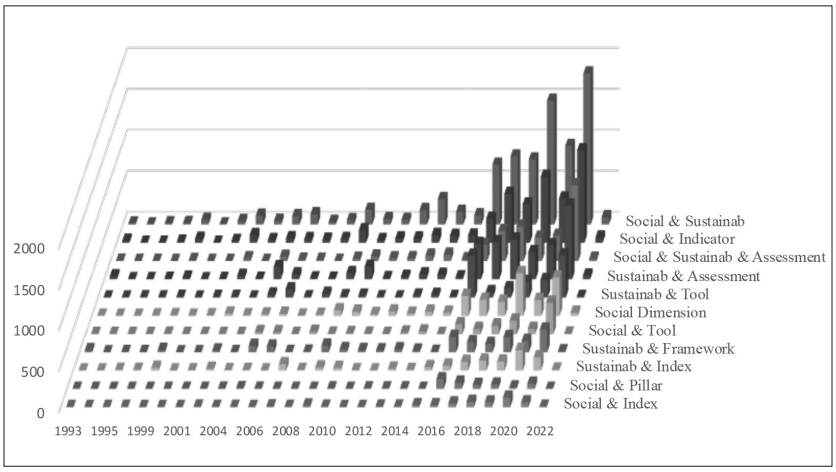


Figure 8 - Trend in word proximity – Word proximity in same paragraph analysis. Number of expressions identified per year of article.

Source: adapted from NVIVO output.

percentage of focus on social sustainability assessment and not just sustainability assessment.

As a result, the proximity analysis identified that the aggregation of the word "social" and "sustainability" is very strong and has grown significantly in recent years. As for the association of the word "social" with "indicators" or "dimension" there is also a growing trend. The findings illustrated in Figure 8 offer reassurance on the adequacy of the article selection for further work pertaining to the identification of the themes, sub-themes and indicators more frequently used on the assessment of social sustainability.

4.3. *Social sustainability indicator screening*

Following the qualitative and quantitative analysis using automated tools, the 158 articles were subject to a comprehensive screening process in order to identify those papers where social sustainability indicators were discussed, listed or tested in empirical settings. One hundred and three articles were selected and all the social sustainability indicators identified were listed. These were then categorised in eight thematic clusters – Community relations, participation and engagement, Demographic dynamics, Education and training, Employment and labour conditions, Equity and social justice, Health and safety, Living conditions and wellbeing, Productivity and food security – and later classified as 'Traditional' or 'Emerging' based on Colantonio's (2007) proposed criteria. Similar structure was proposed by Rasouli and Kumarasuriyar (2016) and Olakitan Atanda (2019) or even the main groups in the Sola model of Pieper *et al.* (2019).

This process allowed us to build a preliminary database of the most frequently explored social indicators in the agribusiness context per year of publication, consisting of 1249 individual indicators.

4.4. *Themes and indicators in the selected literature*

In this preliminary assessment of the themes and indicators in the selected literature we identified a lack of standardisation of definitions, scopes and metrics to assess social sustainability, among intense discussion on the directions for future work.

Our literature review suggests that it is no longer reasonable to state that the social dimension of sustainability is overlooked by researchers and practitioners. Recent years have seen a wealth of research on the topic, particularly since the Rio+20 summit held in 2012.

Our analysis also shows there is an evolving library of social indicators, covering an increasingly wider range of social themes. As noted by Colantonio (2007), there is a gradual shift from traditional themes of social sustainability such as

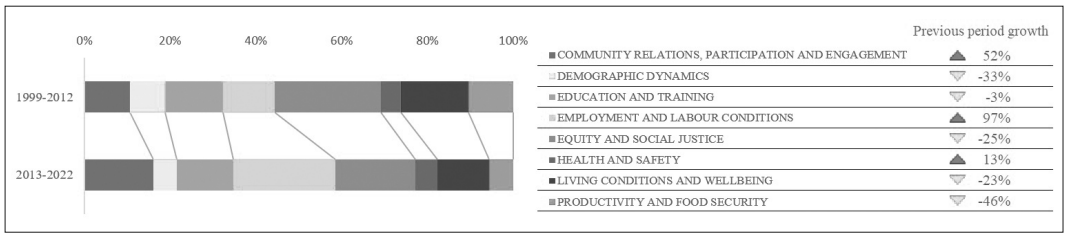
* 14,067 is the critical value of the Chi-square distribution with 7 degrees of freedom.

Table 2 - Number of social indicators per cluster and year.

	1999	2003	2005	2006	2007	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
COMMUNITY RELATIONS, PARTICIPATION AND ENGAGEMENT	1	3		2	3	1	4		4	20	6	15	24	14	39	16	40	1	**193**
DEMOGRAPHIC DYNAMICS					1	8	2		1	1	4	9	5	3	13	15	10	1	**73**
EDUCATION AND TRAINING		3		1	2	5	7		2	7	6	18	16	9	23	24	40	2	**165**
EMPLOYMENT AND LABOUR CONDITIONS		1	3	1	2	1	8		9	5	7	24	23	32	58	38	59	9	**280**
EQUITY AND SOCIAL JUSTICE	1	7	1	1	8	5	7	3	15	14	2	22	23	21	31	24	49	8	**242**
HEALTH AND SAFETY					1	2	2	1	2	2		2	5	6	10	13	16	1	**63**
LIVING CONDITIONS AND WELLBEING		1	4	2	4	6	4		7	15	5	10	14	10	25	21	28		**156**
PRODUCTIVITY AND FOOD SECURITY		3			7		4		1	2		6	5	5	6	18	16	4	**77**
Total	**2**	**18**	**8**	**7**	**28**	**28**	**38**	**4**	**41**	**66**	**30**	**106**	**115**	**100**	**205**	**169**	**258**	**26**	**1249**

Source: Result of analysis of one-hundred and fifty-eight references obtained from the bibliometric study, Author's elaboration.

Figure 9 - Evolution of the relative weight of each cluster of social indicators, pre and post 2012.



Source: Author's elaboration.

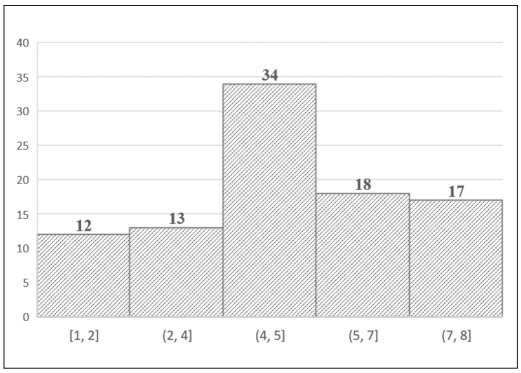
employment, social justice or poverty reduction to more subjective themes such as civic participation, access, QoL and wellbeing, reflecting the efforts by researchers, planners, and practitioners alike to "address and integrate social aspects of sustainability" (Boström, 2012, p. 3).

Using a process of identification of the social indicators mentioned in the selected literature, 1249 indicators were found. Through an individual interpretation inspired on the Boström (2012) work, these indicators – which eventually resulted in clustering of eight thematic groups considered appropriate – were able to illustrate the trends in the scientific discussion (first column of Table 2).

Using the thematic aggregation and coding above, the matrix on Table 2 presents the *"Number of social indicators per cluster and by year"*. The totals in the table summarize the number of indicators collected from the articles from the identified year.

Overall, the numbers show that social indicators pertaining to Health and safety were the least mentioned in the literature (n=63), followed by indicators related to Demographic dynamics (n=73). On the opposite end, social indicators on Employment and labour conditions dominate the research (n=280), closely followed by Equity and social justice (n=242).

Figure 10 - Histogram with the number of clusters covered per reference (from 1999 to 2022).



Source: Author's elaboration.

Based on the findings from the bibliometric analysis, we have conducted another assessment using two time periods: 'up to 2012' and 'from 2013'. Figure 9 shows the growth dynamics of each of the defined clusters between the two periods. The growing concerns with individual and societal well-being, namely work-related satisfaction and civic participation, are very noticeable.

Prior to further interpreting these findings, a Chi-Square test was performed which confirmed the hypothesis of an association between Time period and Thematic cluster (p-value: 0,007 and X^2: 19,3 > 14,067*).

With this reassurance, two main observations are worth making: (i) the most classical and structural clusters maintain their importance over time (Health and safety, Education and training, Demographic dynamics), and (ii) on the opposite, "Equity and social justice" cluster lost the first place in importance to the "Employment and working conditions" cluster, almost in a direct exchange of positions and each representing a quarter of the total relevance in the identified indicators respectively for the periods before and after 2012.

Thematic breadth of the articles

It was also considered relevant to look at the breadth of social sustainability topics covered in each selected research paper. The scope was determined by the number of thematic clusters covered by the indicators referred to in each publication. As shown in Figure 10, the representation of the distribution of the dataset results in a symmetric unimodal histogram which shows that the most frequent number of thematic clusters covered in the selected articles is 4 to 5. There are articles that focus on indicators belonging to only one or two clusters while, at the opposite extreme, there are articles that explore indicators in seven or eight clusters simultaneously. Further note to mention that a similar distribution is found when we analyse the articles divided in the two time periods used above (1999-2012 and 2013-2022).

Emerging topics

The findings in the above sections prompted additional investigation. By further classifying each indicator as 'traditional' or 'emerging' we can observe that even more classical themes such as Equity and Social Justice present a relevant proportion of indicators covering emerging top-

Table 3 - Number of traditional and emerging social indicators per cluster.

	Emerging	Traditional	Total
COMMUNITY RELATIONS, PARTICIPATION AND ENGAGEMENT	188	2	**190**
DEMOGRAPHIC DYNAMICS	70	2	**72**
EDUCATION AND TRAINING	68	96	**164**
EMPLOYMENT AND LABOUR CONDITIONS	107	166	**273**
EQUITY AND SOCIAL JUSTICE	53	189	**242**
HEALTH AND SAFETY	61	2	**63**
LIVING CONDITIONS AND WELLBEING	100	54	**154**
PRODUCTIVITY AND FOOD SECURITY	17	58	**75**
Total	**664**	**569**	**1233**

Source: Result of analysis of one-hundred and fifty-eight references obtained from the bibliometric study, Author's elaboration.

ics. As for Community relations/participation/engagement, Health and safety and Demographic dynamics indicators, these reflect current concerns requiring monitoring and evaluation that are not always covered in older sustainability assessment models. On the other hand, Productivity and food security are solidly anchored in broadly used traditional indicators.

Quick note to mention that 16 of the identified indicators could not be classified either as emerging or traditional due to their ambiguity, overlapped definitions or for being a non-purely social indicator. So, this analysis comprised 1233 indicators. Their distribution per cluster is shown in Table 3.

5. Conclusions

In this work we performed a methodical literature review and obtained an overview of the social sustainability indicators being used the most in social sustainability assessment research in agribusiness. Consistent with several articles mentioned in the theoretical framework, these initial results show an abundance of indicators accrued by the individual nuances of definitions and scopes used by authors or required by the specific agribusiness context in which they are applied.

At this very early stage of the research, our results suggest that social sustainability indicators are undergoing major transformation, growing in interest, growing in need, and growing in novelty – in consonance with the need for a more holistic view claimed by Desiderio *et al.* (2022). We have managed to identify, list and classify a large number of social sustainability indicators described in the selected literature, and to establish that there is a continuing shift in focus – with dimensions such as community engagement and labour conditions gaining momentum.

It has also become evident that many indicators that are not identified as being "primarily" social can have important implications for the assessment of the social pillar of sustainability. On the other hand, some "clearly" social indicators interact strongly with the other two standard dimensions of sustainability (economic and environmental).

The research suggests that the social dimension encompasses all pillars of sustainability assessment and acts as a main beam that ensures balance for sustainable agribusiness.

And this is perfectly reflected in the literature when authors such as Boström (2012) argue that the "social" dimension of sustainability refers to the bond between civilization and the natural world, and thus holding that this relationship comprises activities and connections of cultural, political, economic, demographic and institutional scope.

Similarly, it is also claimed that, from a structural perspective, everything can be termed 'social' from some perspective. Furthermore, the economic sociology theory advocate that the economy is deeply socially rooted and, corresponding to this perspective, environmental sociology research questions the dualism between society and nature.

This circumstance brings complexity to the isolated approach of only one dimension. Moreover, the social dimension can be understood as the basis of the concept of sustainability and needs to be articulated with the other dimensions, so it is clearly necessary and urgent to understand and measure it.

This perception is in line with recent work by Elkington (2018) who mentions how the Triple Bottom Line defined in his previously study (Elkington, 1994) has been used (and abused) over the years and tries to update the concept to a more holistic system approach rather than a simple accounting tool.

Having compiled and systematized a comprehensive series of social sustainability indicators, we believe this work may guide further explorations more systematically, notably by serving as a pragmatic segmentation basis for the design and implementation of a future social sustainability assessment framework for agribusiness.

This research will contribute in a relevant way to the identification, study and monitoring of social indicators of emerging relevance for the support and transparency of governance with regard to the definition of labour policies, migration (migrant safety) policies and also of policies of management, incentive and territorial cohesion.

Ultimately, this research aimed at supporting the sustainable development of the sector from a social perspective.

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