

THE SUSTAINABILITY DIMENSIONS IN SUSTAINABLE BUSINESS MODEL INNOVATION: A BIBLIOMETRIC NETWORK ANALYSIS

RAFAELA CABRAL ALMEIDA TRIZOTTO

UFRGS - UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL

LEANDRO DA SILVA NASCIMENTO

PATRICIA SOLDATELLI VALENTE

MICHELE KREMER SOTT

NATALIA DA SILVIA FREITAS

Introdução

Given that sustainable business models, in addition to being economically viable, also contribute to social and environmental issues, the number of companies aiming for these models is increasing. Due to the new paradigms of sustainable production and consumption, innovation in business models becomes essential for the advancement of sustainability.

Problema de Pesquisa e Objetivo

Although the concept of sustainable business model innovation is increasingly discussed in the literature, there is no clear of which dimensions of sustainability can drive (or are driving) this kind of innovation. This paper aims to identify which dimensions of sustainability (social, environmental, and economic) are being prioritized in the SBMI literature through a bibliometric review.

Fundamentação Teórica

The traditional concept of the BM is a conceptual tool consisting of a set of elements and relationships that express the logic of a company with financial objectives (Teece, 2010). On the other hand, SBMs comprise a holistic approach that recognizes the importance of environmental and social benefits as contributors to financial viability (Karlsson et al., 2019). Lambrechts et al. (2021) explain that SBMs, by integrating social, environmental, and economic value, end up providing a range of possibilities for activities linked to sustainable value creation, delivery, and capture.

Metodologia

We conducted a bibliometric performance and network analysis mapping using a selected corpus of papers from the Web of Science and Scopus databases. 284 papers were analyzed using the SciMAT software.

Análise dos Resultados

We identified a predominance of the environmental dimension to the detriment of the social and economic dimensions. However, there has been a growing concern in recent years to portray the three dimensions of sustainability equitably in the SBMI literature. We present a strategic diagram depicting 15 clusters (themes) related to SBMI. Of these, eight clusters appear as predominant for the advancement of the SBMI literature such as Circular Economy, Business Development, Renewable Resources, and Investments.

Conclusão

Besides offering a general and international review of the scientific production of SBMI, we present the main challenges and opportunities for future research. The findings contribute to managerial practice, highlighting the importance of looking equitably and jointly at the benefits of social and environmental dimensions, associated with economic viability. The consideration of the three dimensions in the SBMI provides a range of possibilities for companies in creating, delivering, and capturing sustainable value.

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Palavras Chave

Sustainable innovation, Business models, Sustainable value

Agradecimento a órgão de fomento

CAPES

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1 INTRODUCTION

Given that sustainable business models (SBMs), in addition to being economically viable, also contribute to social and environmental issues, the number of companies aiming for these models is increasing (Täuscher & Abdelkafi, 2018). According to Teece (2010), a business model (BM) is a way in which companies create and deliver value to their consumers to attract them to pay the desired amount, converting such payments into profits. As much as this definition emphasizes monetary value, we need to go beyond it to address social and environmental issues, i.e., sustainable value. Thus, SBMs "integrate sustainability into their value proposition, value creation and delivery activities, and/or value capture mechanisms" (Geissdoerfer et al., 2018, p. 403). Stubbs (2019) highlights the idea that "if a company wants to improve its sustainability performance, it has to change its business model such that environmental and/or social objectives are integrated into the core business logic" (p. 1064). To remain aligned with the dimensions of sustainability (Triple Bottom Line [TBL]: economic, environmental and social, Elkington, 2004), SBMs need to be based on innovation (Geissdoerfer et al., 2018; Todeschini et al., 2017).

However, studies on the innovation of business models to be sustainable have been relegated in favor of studies focused on products and technologies (Stubbs, 2019). Klein et al. (2021) state that the literature provides limited results on the effects of companies' commitment to sustainability. From this, it is necessary to deepen the understanding of innovation in SBMs, specifically about which dimensions of TBL have been prioritized in strategic BM decisions. Previous bibliometric studies analyzed: i) SBMs (Marczewska & Kostrzewski, 2020), and ii) the relationship between innovation and sustainability (Franceschini et al., 2016; Maier et al., 2020). However, there is no bibliometric scientific mapping of the three dimensions of sustainability in sustainable business model innovation (SBMI). Such mapping makes it possible to analyze the state of the art of the subject, as well as opportunities for future advances.

The main objective of this paper is to identify which dimensions of sustainability are being prioritized in SBMI. Thus, we can understand if companies are contributing to truly sustainable development with the proper balance between the dimensions that such a development paradigm presupposes. To do so, a bibliometric analysis of 284 papers was carried out, collected from the *Web of Science* and *Scopus* repositories. Papers from researchers located in eight countries were selected: Germany, Netherlands, Sweden, Australia, France, Denmark, Austria, and Japan. These countries are a benchmark in sustainability, according to the latest United Nations sustainable development report (Messerli et al., 2019). We used SciMAT (Science Mapping Analysis Tool) software to map bibliometric performance and network analysis.

Results provide a review of the literature, at a macro and global level, on scientific production in SBMI. We identified a predominance of the environmental dimension to the detriment of the social and economic dimensions in the literature. However, there is a growing concern of papers in recent years to portray the three dimensions of sustainability equitably. Additionally, the main journals and authors that publish on the subject are presented, as well as the most cited papers. We present a strategic diagram depicting 15 clusters (themes) related to SBMI, such as Circular Economy, Business Development, Renewable Resources, and Investments. In addition, the findings contribute to managerial practice, highlighting the importance of looking equitably and jointly at the benefits of social and environmental dimensions, associated with economic viability. The consideration of the three dimensions in the SBMI provides a range of possibilities for companies in creating, delivering, and capturing sustainable value.

2 LITERATURE OVERVIEW

Many companies already adopt aspects of sustainable development in their operations, however, this implementation is not done in a holistic, consistent, and comprehensive way at all organizational levels (Fergus & Rowney, 2005). In order to assist organizations in the transition to sustainability, John Elkington, in the 1990s, created the concept of TBL, which encompasses the environmental, social, and economic dimensions of a company (Elkington, 2004). Commonly, sustainability is defined as the set of dimensions of the TBL (Bansal & Desjardine, 2014). The TBL concept is a business perspective of the Planet, people, and profit. It helps organizations to identify criteria, define limits and budgets, programs, and specific political strategies for the progress and development of sustainability as a whole. It is a shared vision, with lifestyle changes and new social practices (Enders & Remig, 2014). Through the structure of the TBL, it is possible to measure the performance of the business and the success of the organization in the economic, social, and environmental aspects (Goel, 2010).

Despite companies have made remarkable progress in tackling major challenges related to climate change, poverty reduction, food security, biodiversity, sustainable consumption, and equality, there has not been enough practical progress; transformations are still needed in industries to truly incorporate environmental and social sustainability into the way they do business (Bocken & Short, 2021). These transformations emphasize the need to transition from traditional to sustainable BMs. The traditional concept of the BM is a conceptual tool consisting of a set of elements and relationships that express the logic of a company with financial objectives (Teece, 2010). On the other hand, SBMs comprise a holistic approach that recognizes the importance of environmental and social benefits as contributors to financial viability (Karlsson et al., 2019). Lambrechts et al. (2021) explain that SBMs, by integrating social, environmental, and economic value, end up providing a range of possibilities for activities linked to sustainable value creation, delivery, and capture.

An example of how to align the BM for sustainability goals is shown in Parida and Wincent (2019) when they cite manufacturing companies that increasingly adopt a product lifecycle view. This allows companies to generate economic value through service standards, reduce environmental effects through extended product life, and benefit society by eliminating low-value-added jobs. Thus, academics and business professionals dealing with production and consumption systems with ecological and social impact are increasingly aware of SBMs (Lüdeke-Freund, 2020). For Bocken, Boons, and Baldassarre (2019), companies seeking to minimize the negative impact through SBMs, in addition to benefiting, end up generating significant positive value for a network of stakeholders of the organization, including society and the environment.

For the success of a sustainable future, innovation in BMs is needed for the strategic development of sustainability (França et al., 2017; Ostermann, Nascimento, & Zen, 2021). Long et al. (2018) argue that continuous innovation is an important factor in ensuring that traditional BMs become sustainable and, thus, continue to improve. The establishment of SBMs requires innovation both in terms of creating new BMs and adapting existing ones. This involves changes in the company's core values, and it can even be a radical transformation with profound sustainability implications. Sustainable innovation is an essential activity for the creation of new technologies that can contribute to the proposition of sustainable value through BMs (Jovane et al., 2017). Therefore, SBMI has a high potential for achieving sustainable development both at the organizational and societal levels.

3 METHODOLOGICAL PROCEDURES

To achieve this research purpose, a Bibliometric Performance and Network Analysis (BPNA) was carried out. This method makes it possible to extract quantitative indicators and

evaluate scientific production based on international data (Vanz & Stumpf, 2010). It was chosen because it is a method designed to answer a specific question: *Which dimensions of the TBL have been prioritized in SBMI literature?*, and enables the collection, selection, and comprehensive analysis of scientific studies on the subject.

3.1 Data Source and Collection

The collection and selection of this research corpus took place based on three steps:

1) Choice of database, keywords and other delimitations. *Web of Science* and *Scopus* were chosen because they are two of the main international multidisciplinary databases. Three search keywords were chosen: *innovation*, *business model* (refined without the quotes so that possible variations are not discarded), and *sustainab** (with the use of an asterisk so that none of the variants, such as *sustainable* and *sustainability*, were discarded). We delimited these search words because they approach the main topic of the research. Due to the ambition for a macro and international analysis, we also chose to filter only papers written in English, with the geographical delimitation of eight countries: Germany, Netherlands, Sweden, Australia, France, Denmark, Austria, and Japan. The search fields were not delimited. These countries were chosen because they were included in the last UN Sustainable Development Report (Messerli et al., 2019), with a score above 10 in the social limits achieved, despite still being in debt in some aspects that relate to the limits of biophysical resources. Despite the report's data showing that no country is yet able to fully meet the set of basic human needs at a globally sustainable level of resources, the eight countries are at minimally acceptable levels of individual and social well-being along multiple dimensions.

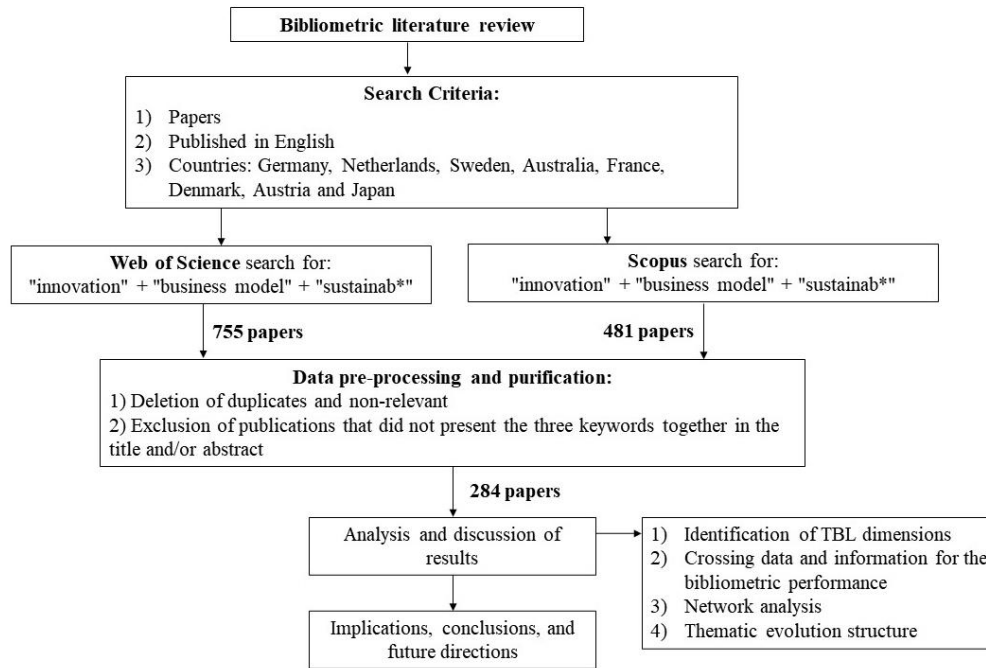
2) Pre-processing and purification of the corpus. The selection criteria for the papers mentioned above were identical in the two repositories. Thus, *Web of Science* contributed 755 papers, and *Scopus* with 481, until the date of the collection - July 12, 2021. From this, data purification was carried out with the exclusion of duplicate papers (351), as well as those not relevant to the study (11), totaling a corpus of 874 publications to be analyzed.

3) Analysis procedures. The 874 papers in the corpus were spreadsheet based on the TITLE-ABS-KEY structure and three of the authors were responsible, each one, for approximately 33% of the pre-analyses. At first, the titles and abstracts of each document were read, to select only those containing the three keywords together in one and/or the other of these two sections. All keywords received a "yes" or "no", according to their presence or absence in the titles and/or abstracts of the publications. From this, those documents that received "yes" for the three words were considered for the final analysis. Of the 874 documents, 284 papers remained as the final corpus, to be analyzed regarding the dimensions of the TBL. Figure 1 presents the methodological steps of the research.

3.2 Bibliometric Performance Analysis

Each document in the final corpus of this research was opened and superficially read by the authors (with a string search) to find the three dimensions of the TBL. When opening the papers, the following words were searched: *economic*, *environmental*, and *social*. Variations such as *economical*, *environment*, *ecological*, and *societal* were also considered. Each word was analyzed according to its presence in the text. When the word did not appear, its context was not related to sustainability issues, or its presence was inexpressive (frequency less than five appearances), the word received a "no" rating. When the word appeared in the text, its context was related to sustainability issues and its frequency of appearance was expressive, it was classified as "yes". After that, all "yes" were replaced by the number 1 (one) and the "no" by 0 (zero). The researchers were not able to access five papers for analysis, so they were classified with a zero in the three dimensions.

Figure 1. Bibliometric literature review protocol



During the superficial reading, we also sought to identify the countries that were being studied in the publications for later cross-referencing of data. Such information was extracted from the abstract or method section of papers. In all, 43 countries were mapped in the publications, considering Hong Kong independently of China, and the United Kingdom, Great Britain, and England as a single country.

From this, Excel software was used for the bibliometric performance analysis, seeking to map the following information: a) most published dimensions of sustainability, b) countries with the highest number of publications and the dimensions most worked on in each of them, c) journals that published the most on the research subject and the dimensions covered in each of them, d) periodicity of publications and evolution of the TBL narrative over the years, e) authors who published the most on the subject, and f) most cited papers among those that worked on the theme (the number of citations was verified on August 21, 2021, on Google Scholar).

3.3 Network Analysis

The 284 documents identified were inserted into the SciMAT software, developed by Cobo et al. (2012) for network analysis. SciMAT was chosen because it is software with a robust pre-processing module, which allows the creation of thematic networks and evolution diagrams of the field of study (Severo et al., 2021). First, the data was pre-processed and keywords with the same meaning were grouped, while generic words such as "article" were removed from the analysis. The data were then entered to create the network diagrams. Figure 2 presents the strategic diagram and Figure 3 shows the thematic network structure.

The strategic diagram (Figure 2) presents the most important clusters/themes of the field of study in a macro period, plotted in a two-dimensional diagram based on degrees of centrality and density. The size of the clusters is proportional to the number of documents associated with the theme. Centrality represents the ability of a theme to relate to other themes, and density the ability of a theme to maintain links with other themes over time. The strategic diagram quadrants are classified into four. *Motor themes (Q1)*: With greater centrality and density, these

clusters represent the themes with greater development in the field of study. These are themes with numerous links to other themes and a great capacity to remain predominant for a long time. *Basic and transversal themes (Q2)*: These are those that, despite the high degree of centrality, have low density and, therefore, difficulty maintaining co-occurrence with other themes over time. *Emerging or declining themes (Q3)*: These may be themes whose research is starting in the field of study, such as the emergence of new topics or technologies, or which are no longer being researched, either because of their lag or the emergence of a substitute term. Such themes require qualitative analysis by the researcher. *Highly developed and isolated themes (Q4)*: These are themes that, although they relate to other few themes, are capable of maintaining strong relationships that last over time.

The thematic network structures (Figure 3), in turn, explore the clusters of the strategic diagram and show their relationships with other themes/subthemes, where the thickness of the lines represents the strength of the connection between the clusters. To create the networks, with the help of the SciMAT software, a frequency matrix for the co-occurrence of keywords and their nodes with other themes was created, considering only the keywords used by the authors of each paper. The core mapper was used to map the co-occurrences in the documents, the similarity of the themes was calculated with the Equivalence Index, and the clustering of the networks was done with the Simple Center Algorithm. Data and networks were reduced on scales of 1 and 2, respectively, and the maximum and minimum network was determined at 12 and 3 as suggested by Cobo et al. (2012).

4 RESULTS AND DISCUSSION

4.1 Sustainability Dimensions Prioritized in Sustainable Business Model Innovation

Regarding the main objective of this research, which is to identify which dimensions of sustainability are being prioritized in SBMI, we found that: among the 284 publications analyzed, 217 showed a predominance on the environmental dimension, 205 on the economic dimension, and 196 on the social dimension. In sum, only 52.5% of the papers, that is, 149 publications, worked the three dimensions of TBL together. This result corroborates the argument of Karlsson et al. (2018) and Lambrechts et al. (2021). They state that environmental and social benefits are being sought as contributors to financial viability, also providing a range of possibilities for value creation, delivery, and capture in SBMs.

4.2 Top Countries Studying Sustainable Business Model Innovation

Among the countries surveyed, the ones with the highest number of publications on SBMI are Germany (37), the Netherlands (30), and Sweden (20). Germany and Sweden address, in an equitable way, the three dimensions, while the Netherlands concentrated on the environmental and social dimensions. As we expected, the environmental dimension is more prominent, as can be seen in the 15 countries with the most dimensions in Table 1.

We emphasize the geographic delimitation carried out for the selection of the papers, based on the UN Sustainable Development Report (Messerli et al., 2019), is consistent with the results found. Of the eight delimiting countries of the research, six are in the first positions, both in the number of publications and in the concern with working on the dimensions of sustainability in the countries. We observed, however, that China and the United States appear in the place of Austria and Japan, which are being studied less in research of this kind.

Among developing countries or emerging economies, there is a scientific concern to look at what China, India, and Brazil (which are three of the five BRICS members - which also includes Russia and South Africa) are doing in terms of SBMI. They are the first three developing nations among developed countries listed in Table 1. However, the largest number of publications on the subject of this research still focuses on studies in developed countries.

Table 1. TBL dimensions by countries

Country	Environmental	Social	Economic	N# Papers
Germany	27	28	28	37
Netherlands	26	21	18	30
Sweden	16	16	15	20
Denmark	13	9	9	14
Australia	8	6	9	10
China	7	5	8	10
USA	7	6	4	8
France	8	8	8	8
Italy	7	6	7	7
India	4	5	4	6
Austria	5	3	4	5
Finland	3	1	1	5
UK/Great Britain/England	3	3	3	4
Brazil	2	1	2	3
Spain	3	2	3	3

Regarding the sustainability dimensions addressed in the three developing countries' studies, India is highlighted, whose social dimension prevailed in five of the six publications. According to the UN Sustainable Development Report (Messerli et al., 2019), India figures with a score of one, among the lowest in the world in terms of social limits reached. Of note, India has a social system organized into castes and this originates and perpetuates huge social discrepancies between people and their quality of life. Thus, we infer that SBMI in this country may be seeking to focus on social innovations, contributing to the reduction of this problem.

4.3 Main Journals

A total of 134 different journals were mapped, with the *Journal of Cleaner Production* having the largest number of publications (60), 57 of these papers prevailed in the environmental dimension. In second place is the *Sustainability* journal, with 33 publications on SBMI and a predominance of environmental and economic dimensions, as shown in Table 2. This table shows the Top 5 journals that published the most on the subject and the dimensions of sustainability covered.

Of the total number of journals, 48 of them worked on the three dimensions of the TBL equitably in terms of the number of publications, without prioritizing any dimension to the detriment of another. For example, *Business Strategy and the Environment* published five papers on SBMI, and all of them considered the environmental, social, and economic dimensions in their narratives (Table 3). This perspective of the whole requires a holistic and shared vision, advocating changes in lifestyles and new practices, demonstrating the expansion of concern and awareness for sustainability (Enders & Reming, 2014; Goel, 2010). The consideration of the three dimensions has also increased over the last five years, as shown in Table 4.

Table 2. Top 5 journals publishing on SBMI and the TBL dimensions covered in them

Journal	Environmental	Social	Economic	N# Papers
<i>Journal of Cleaner Production</i>	57	44	45	60
<i>Sustainability (Switzerland)</i>	28	21	26	33
<i>Environmental Innovation and Societal Transitions</i>	5	3	2	6
<i>Sustainable Production and Consumption</i>	5	3	5	6
<i>Business Strategy and the Environment</i>	5	5	5	5
Total	100	76	83	110

Table 3. Top 5 journals that worked the dimensions of the TBL equitably

Journal	Environmental	Social	Economic	N# Papers
<i>Business Strategy and the Environment</i>	5	5	5	5
<i>International Journal of Innovation and Sustainable Development</i>	3	3	3	3
<i>Procedia Manufacturing</i>	3	3	3	3
<i>Agricultural Systems</i>	2	2	2	2
<i>Climatic Change</i>	2	2	2	2

4.4 Evolution of the Number of Publications Over Time

Regarding publication over the years, only from 2003 onwards, the subject begins to be included in publications still very timidly, with a large interval between 2003 and 2009 without related scientific production. As of 2009, research on SBMI begin to be annual, however, there is a considerable increase in the volume of production only after 2016. In the last five years, there is an evolution in the presence of the three TBL dimensions in the studies, as shown in Table 4.

Notably, between 2009 and 2015, the TBL dimensions appeared 26 times in a total of 53 publications, representing 49% in seven years, explored as follows: 70% environmental, 68% economic, and 66% social. In a shorter period of time, from 2016 to mid-2021 (data collection), we had an increase (5%) in the presence of the TBL dimensions in the studies, which represents 120 times in 220 publications (54%). In this period, the dimension that has been mostly addressed is the environmental one (76%), while the economic and social ones are gaining prominence, respectively, 72% and 68% of the time. Therefore, over the years, there is a predominance of the environmental dimension over the others.

Table 4. Periodicity of publications and evolution of the TBL narrative

Publication year	Environmental	Social	Economic	TBL	N# Papers
2003	1	1	1	1	1
2009	3	1	3	1	4
2010	4	3	3	3	4
2011	5	5	4	4	6
2012	6	8	7	5	8
2013	7	8	9	5	15
2014	3	3	4	3	5
2015	9	7	6	4	10
2016	14	12	15	12	18
2017	20	15	17	10	23
2018	28	25	26	19	41
2019	28	25	28	23	37
2020	51	49	44	37	61
2021	27	25	28	19	40

4.5 Main Authors and Most Cited Papers

Among the authors who most published on SBMI are Nancy Bocken (Bocken N.M.P or Bocken N.), a professor at universities in the Netherlands, Sweden, and Finland. Nancy Bocken has 20 publications, with the predominant environmental approach, not ignoring, however, the social and economic dimensions, which appear with the same degree of relevance. Next, there is Florian Lüdeke-Freund, from Germany, with seven publications whose TBL dimensions are equitable. The origin of the authors converges with the data found in the countries most represented in the scientific production of the subject, which are Germany, the Netherlands, and Sweden.

Finally, regarding to the most cited authors and papers on SBMI, Benoît Demil and Xavier Lecocq (Demil & Lecocq, 2010) lead the ranking with the work "*Business Model Evolution: In Search of Dynamic Consistency*", which has been cited in 2,161 other publications. Frank Boons and Florian Lüdeke-Freund (Boons & Lüdeke-Freund, 2013) appear in the second position for the paper "Business Models for Sustainable Innovation: State-of-the-art and Steps Towards a Research Agenda", with 2,018 citations. The third position in the ranking goes to Horst Meier, Rajkumar Roy and Guenther Seliger (Meier et al., 2010), with the paper "*Industrial Product-Service Systems-IPS2*", which obtained 1,097 citations.

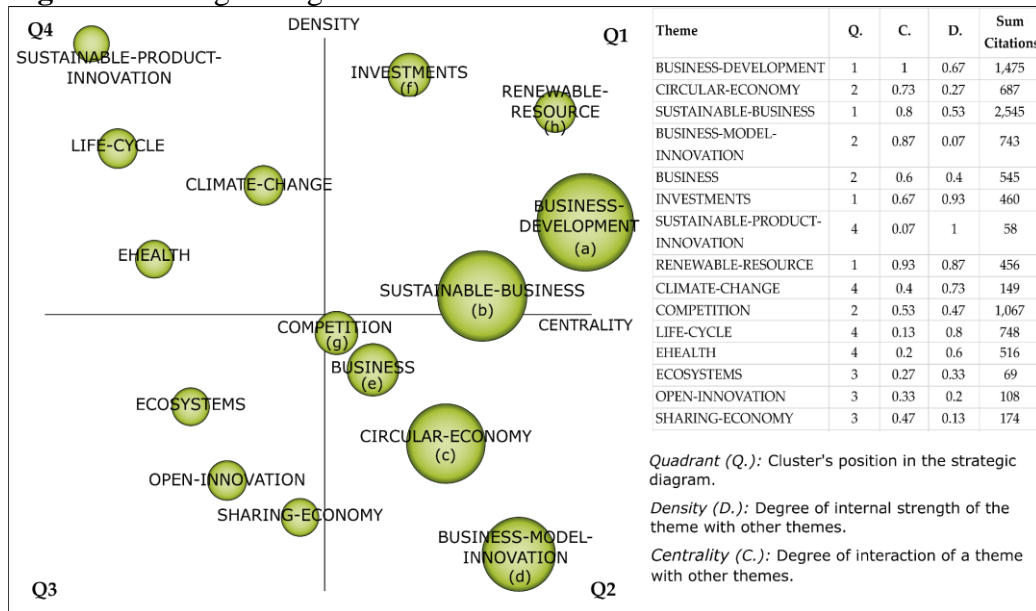
4.6 Strategic Diagram

The strategic diagram (Figure 2) depicts 15 clusters (themes) related to SBMI, distributed in four quadrants of the two-dimensional graph. Four clusters are motor themes (Q1). Four clusters are basic and transversal themes (Q2). Three clusters are emerging or

declining themes (Q3). Finally, four clusters are highly developed and isolated themes (Q4). The table in Figure 2 shows the degree of centrality (C) and density (D) of the clusters and the sum of citations of the documents comprising each cluster. The larger the number of associated documents, the larger the cluster size.

The 'BUSINESS-DEVELOPMENT' cluster is the most expressive theme. It has the largest number of associated documents and a higher centrality level, demonstrating the interaction of this theme with others and highlighting that this cluster is the most discussed in the literature. The 'SUSTAINABLE-BUSINESS' cluster also has a high centrality level and relevance to the literature on SBMI. 'INVESTMENTS' and 'RENEWABLE-RESOURCE' are also clusters in the motor themes (Q1) that can advance knowledge in the literature since they have a higher density level (internal strength – capacity of the theme to sustain and develop over time). 'CIRCULAR ECONOMY,' 'BUSINESS-MODEL-INNOVATION,' 'BUSINESS,' and 'COMPETITION' are other clusters that stand out as basic and transversal themes (Q2). In addition, 'ECOSYSTEMS,' 'OPEN-INNOVATION,' and 'SHARING ECONOMY' stand out such as emerging or declining themes (Q3). Lastly, 'SUSTAINABLE-PRODUCT-INNOVATION,' 'LIFE-CYCLE,' 'CLIMATE-CHANGE,' and 'EHEALTH' appear as highly developed and isolated themes (Q4).

Figure 2. Strategic Diagram



Although the 15 clusters emphasize specific analyzes of SBMI, the eight ones in Q1 and Q2 are the most prominent for this bibliometric study. The motor themes in Q1 highlight the evolutions expected for sustainability inclusion in business model innovation in the next few years. Besides, basic and transversal themes in Q2 can advance theoretical and practical knowledge in the field. Therefore, only the clusters represented by Motor Themes and Basic and Transversal Themes are presented in this study.

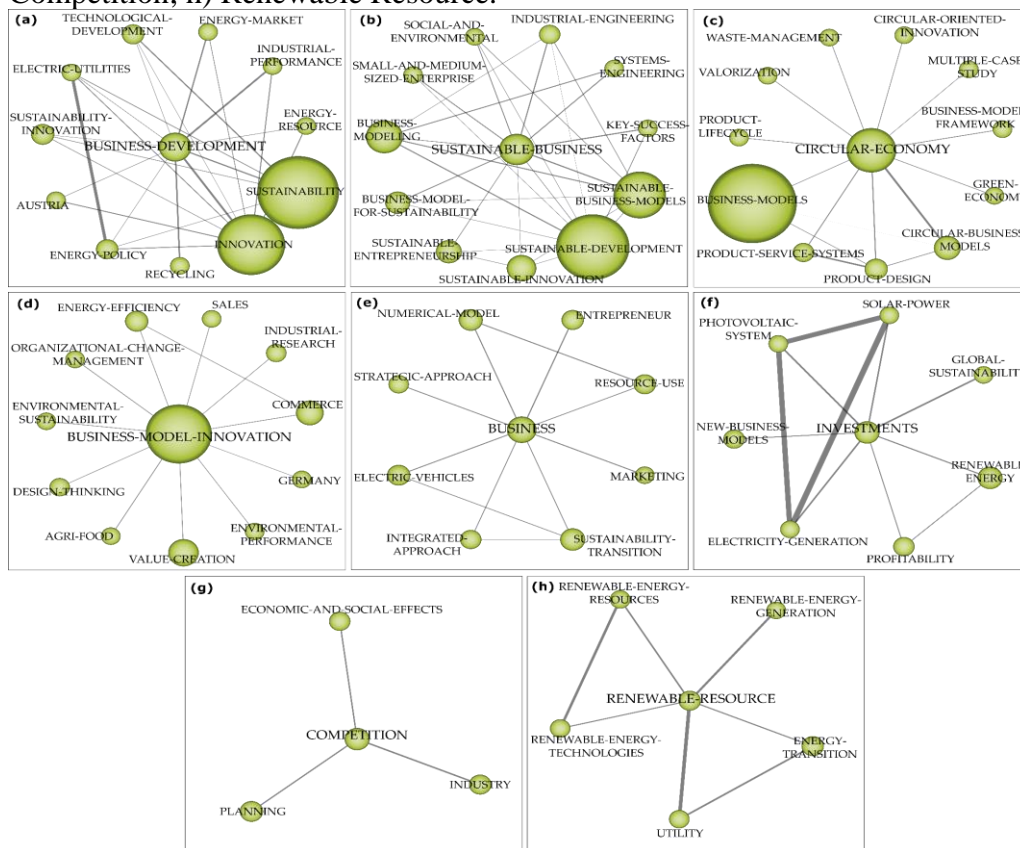
4.7 Network Structures of the Motor Themes and Basic and Transversal Themes

The relationships among themes in the eight clusters (Q1 and Q2) of the strategic diagram are exposed in the thematic network structures (Figure 3) and are discussed in the next subsections. In Figure 3, the clusters' sizes are proportional to the number of associated documents, and the lines' thickness represents the binding force among themes. Such analysis presents an in-depth view of the research field.

4.7.1 Business Development

The 'BUSINESS-DEVELOPMENT' cluster (Figure 3a) is the theme with the highest centrality and largest number of associated documents. The cluster has links with the subthemes 'SUSTAINABILITY', 'INNOVATION', 'TECHNOLOGICAL-DEVELOPMENT', 'INDUSTRIAL-PERFORMANCE' among others. Business development refers to the organizational practices, tasks, processes, and competencies to create value through the production and distribution of products and services (Margherita & Braccini, 2021; Nunhes et al., 2021). In this sense, there is an intrinsic relationship between business development and new business models, especially when the organization is working towards the pillars of sustainability. Nunhes et al. (2021) highlight that sustainable business development needs to be anchored by Triple Helix sectors, which include universities, organizations, and government for the development of Corporate Sustainability practices and scientific and technological investments. On the one hand, companies can seek to increase profits in a sustainable way, on the other hand, the government can develop public measures for the sustainable development of organizations and society. The third no less important sector, universities play a key role in formulating and recommending sustainable projects, and in training professionals capable of managing socio-economic issues with innovation and sustainability.

Figure 3. Thematic Network Structures. a) Business Development; b) Sustainable Business; c) Circular Economy; d) Business Model Innovation; e) Business; f) Investments; g) Competition; h) Renewable Resource.



4.7.2 Sustainable Business

The 'SUSTAINABLE-BUSINESS' cluster has a high centrality and is the second theme with the highest number of associated documents. The theme is related to the subthemes 'SUSTAINABLE-DEVELOPMENT', 'SUSTAINABLE-BUSINESS-MODELS',

'SUSTAINABLE-INNOVATION', 'BUSINESS-MODELING', and others. Sustainable business models are different from conventional businesses because they have great potential for the pillars of sustainability and create value through social, economic, and environmental goals. In this sense, sustainable business models develop proactive activities that focus on a long-term perspective to reduce harmful effects on the environment and society and meet economic ambitions simultaneously (Nosratabadi et al., 2019). Scholarly studies related to sustainable business evidence the current transformation in organizations and economic systems, becoming increasingly synonymous with competitive advantage (Geissdoerfer et al., 2018). The development of SBMs is an arduous task that involves numerous actors that include the entrepreneur, customers, employees, shareholders, government, competitors and influence groups, universities, society, and the natural environment (Attanasio et al., 2022). The engagement and contributions of all stakeholders significantly impact the sustainable development of the organization. Furthermore, the engagement process can facilitate and strengthen relationships between different actors and make organizational goals clear.

4.7.3 Circular Economy

The 'CIRCULAR ECONOMY' (CE) cluster (Figure 3c) has a representative level of interactions with other themes while still having a low degree of internal development. The cluster is related to the subthemes 'BUSINESS-MODELS,' 'PRODUCT-SERVICE-SYSTEMS,' 'WASTE-MANAGEMENT,' 'PRODUCT-DESIGN,' and 'PRODUCT-LIFECYCLE' among others. CE is a strategy to achieve sustainability in traditional and born-sustainable business models (Ostermann, Nascimento, Steinbruch, et al., 2021). CE represents a recursive economic model (from production to consumption) based on the logic and principles of circularity (reduce, reuse, recycle) (Geissdoerfer et al., 2017). The transition towards CE requires new business models based on innovative methods and tools to slow and close resource loops and reduce waste (Bocken, Strupeit et al., 2019). Such methods are used to identify and establish the correct product design, allowing for a longer product lifecycle with materials that can be recycled at the end (Bocken et al., 2016). Product-service systems (PSS) provide an opportunity to advance business models for CE (Salvador et al., 2021) since PSS innovation can improve servitization (Agher et al., 2021). Besides, Ostermann, Nascimento and Zen (2021) state that BMI for CE in startups have focused on sustainability's environmental and economic dimensions. Thus it is necessary to advance also on the social dimension, such as the creation or adoption of social technologies to improve circular business models (Ostermann, Nascimento, & Zen, 2021).

4.7.4 Business Model Innovation

The 'BUSINESS-MODEL-INNOVATION' cluster (Figure 3d) presents strong interaction with 'DESIGN-THINKING,' 'VALUE-CREATION,' 'AGRI-FOOD,' and 'ORGANIZATIONAL-CHANGE-MANAGEMENT' among other subthemes. Design thinking is a process of ideation of solutions to deal with sustainability problems and high uncertainty contexts (Brown et al., 2021; Micheli et al., 2019). Such processes can be useful for SBMI, especially in value creation propositions. For instance, including consumer values and concerns in BMI is a way to enhance social, environmental, and economic value creation (Karami & Madlener, 2021). Advancing sustainable value creation through BMs is relevant also for value chains (Jensen et al., 2019). Since innovation is hinged on a circle of constant adaptation and change, BMI requires organizational change processes such as cultural transformations and initiatives to integrate the entire organization into sustainable decision-making (Santa-Maria et al., 2021). Furthermore, the agri-food industry is a representative locus for studying SBMI since many socio-environmental impacts resulted from agribusiness firms' activities. For Barth et al. (2017, p. 7), advancements in agri-food BMI can consider: i) *value proposition* based on chain integration to allow standards for traceability, quality, and safety of products; ii) *value creation*

and delivery based on animal welfare, social justice, ecological preservation, and ethical consumption; iii) *value capture* based on sustainable food systems to improve revenue streams; and iv) *value intention* based on clear identification of sustainability as a means or a goal. Hence, both technological and non-technological innovation can boost SBMs in the agribusiness sector.

4.7.5 Business

The 'BUSINESS' cluster (Figure 3e) reveals a theme with medium centrality and low density. In other words, the theme has many interactions with other subthemes, but these interactions are weak over time. Some of the links are the following subthemes: 'STRATEGIC-APPROACH', 'SUSTAINABILITY-TRANSITION', 'ENTREPRENEUR', and 'INTEGRATED-APPROACH'. As "business" is a term already very well consolidated and refers to the main object of study or work in Management, it is used in various theoretical and practical contexts. In order to be successful and create value for the business, an entrepreneur needs to align its new or existing BM to the new environment demanded by society, which means sustainability innovations and system perspectives – integrated perspectives (Lüdekefreund, 2019). The mention above is, for example, the point where the theme connects with the subthemes, but with difficulty in maintaining co-occurrence over time because of the contexts and trends of research year by year. Zott et al. (2011) brings that, since 1995, there was an explosion in the number of papers published where the notion of BM is addressed. But a common and widely accepted language that could unify the different lenses of the subject has yet to be developed.

4.7.6 Investments

The 'INVESTMENTS' cluster (Figure 3f) has the highest density among all of the clusters, which means it is a theme with the greatest capacity of keeping bonds with others over time. The cluster connects strongly with the subthemes 'ELECTRICITY-GENERATION', 'PHOTOVOLTAIC-SYSTEM', 'SOLAR-POWER', and 'GLOBAL SUSTAINABILITY'. Inside this cluster the three first mentioned subthemes also have a tight link between them. It reveals a trend of studies focusing on investments related to renewable energy sources for the Planet, especially those associated with solar energy. As Geissdoerfer *et al.* (2018) present, maximizing material and energy efficiency and replacing non-renewable resources with renewable ones and artificial processes are two of the most adopted SBMI strategies for sustainability. Also, the 'INVESTMENTS' cluster shows a connection between the major subthemes, that talk about energy, and the main publisher: *Journal of Cleaner Production*. This journal emphasizes research on reducing waste and promoting sustainable use of resources. When we think about "being sustainable", a BM needs to be rethought along its chain. More than the development of new products, technologies, or incremental refinements in the company's operation, a holistic value system is required. Then the investments must be on multiple fronts to achieve a model where social, environmental, and economic objectives are integrated into the core business logic (Stubbs, 2019).

4.7.7 Competition

The 'COMPETITION' cluster (Figure 3g) is related to the subthemes 'ECONOMIC-AND-SOCIAL-EFFECTS,' 'PLANNING,' and 'INDUSTRY.' However, it has low centrality and density, demonstrating difficulty in maintaining co-occurrence with such themes over time. Large corporations, such as the ones in manufacturing industries, tend to perceive innovation in SBMs as the key to increasing competitiveness (Bocken & Geradts, 2020) and business success (Matinaro et al., 2019). For new entrepreneurs, it is possible to compete in *Business Plan Competition* programs. Such programs can influence the level of integration of

sustainability into new business by offering support for specific sustainable entrepreneurship activities (Fichter & Tiemann, 2020). For von der Gracht and Stillings (2013), the proactive management of companies focused on innovation is a central factor of competitiveness. These companies use scenario planning to expand their market share even in times of crisis (von der Gracht & Stillings, 2013). On the economic and social effects of competitive advantage, Broman and Robèrt (2017) comment about companies that plan sustainable solutions and resort to changes in legislation, regulation, and taxation to stay ahead of competitors that will be most affected by the change.

4.7.8 Renewable Resource

Presenting high levels of centrality and density, the 'RENEWABLE-RESOURCE' cluster (Figure 3h) has connections with subthemes of greater development in the field of renewable energy, such as 'RENEWABLE-ENERGY-GENERATION,' 'RENEWABLE-ENERGY-TECHNOLOGY,' and 'ENERGY-TRANSITION' among others. Such themes have a great capacity to remain predominant for a long time. For instance, green technologies promoting ecological sustainability are changing the business environment (Trapp & Kanbach, 2021). Much of this is driven by reducing costs and capturing increasing returns that open up new business strategies and leave behind old business models associated with fossil fuels and resource waste (Mathews, 2020). Gsodam et al. (2015) claim that environmental problems associated with increased energy demand require a radical transformation in current energy systems to transition to higher levels of sustainability. An example is the energy utilities that need to adapt their structure and BM to find new ways to create, deliver, and capture value from renewable energy technologies (Richter, 2013a; 2013b). Richter (2013b) explains that the generation of energy from renewable sources is not a competition with traditional sources but is a strategic gateway to this emerging market.

5 CONCLUSION, LIMITATION, AND FUTURE DIRECTION

This bibliometric study was developed with the objective of discovering which dimensions of sustainability are being prioritized by the SBMI literature. The dimension of sustainability that appeared most frequently and intensely was the environmental one. However, we identified an increase in publications contemplating the TBL over the last five years. This shows a tendency to increase awareness and concern about the three dimensions of sustainability in the SBMI field. We then contribute to the literature on the subject by demonstrating that the field must advance beyond the environmental dimension of sustainability. Therefore, we call the attention of scholars and practitioners in the field of SBMI to advance scientific and managerial practice to the social dimension of sustainability.

Besides, this study presented a review, at a macro and global level, of the scientific production in SBMI. Our scientific mapping showed the state of the art of SBMI. The main journals and authors that publish on the subject were presented, as well as the most cited papers. For instance, we found that *Journal of Cleaner Production*, *Sustainability*, *Environmental Innovation and Societal Transitions*, *Sustainable Production and Consumption*, and *Business Strategy and the Environment* are the top five journals on the subject. They are thus great repositories of knowledge in the field. Such results can assist researchers and practitioners interested in seeking and advancing knowledge about SBMI.

Also, a Strategic Diagram was presented with 15 clusters (themes) treated in the SBMI literature. Of these, eight clusters appear as predominant for the advancement of the SBMI literature: 1) Business Development; 2) Sustainable Business; 3) Circular Economy; 4) Business Model Innovation; 5) Business; 6) Investments; 7) Competition; 8) Renewable Resource. Through network analysis, a discussion about the eight clusters (themes) and their respective subthemes was presented. Therefore, we clarify which motor themes and basic and

transversal themes should be prioritized for the development of theories on SBMI. These eight themes and their subthemes' interconnection can also be used to advance managerial practice on SBMI.

Contrary to what is generally thought about BMs, which create and generate value only aiming at financial profits, this review confirms that innovations in SBMs are emerging to go beyond this traditional view, thus concerned with the environmental and social dimensions. However, it was not possible in this bibliometric review to deepen the knowledge about the three patterns of value in the SBMI literature: creation, delivery, and capture of sustainable value. Thus, due to the nature of the method adopted, our scientific mapping of the literature has a descriptive character, not focusing on the critical and reflective analysis of the SBMI field.

Future studies, specifically systematic literature reviews, can stress how the three dimensions of sustainability are treated in each of the three value patterns in the SBMI literature. Further studies can also investigate why the *Journal of Cleaner Production* has been the outlet that publishes the most about innovations in SBMs and what perspective it follows when mostly addressing the environmental dimension. Are we only looking at the environment when we think of a sustainable production level? In addition, a more detailed research agenda on India is indicated. There is a tendency towards a greater presence of the social dimension, an indication that more innovations in SBMs may be emerging, focused on alleviating social discrepancies and injustices in this country.

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