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Recent Development of Sustainable Business Model Innovation in Engineering and Industrial Systems: A Systematic Literature Review

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ABSTRACT

The digital transformation in the fourth industrial revolution (Industry 4.0) disrupts the entire industry system and forces the industry to innovate by shifting the traditional business model to business model innovation that enables sustainable development. However, research suggests that the business progress of sustainable business model innovation, the subsets of business model innovation, is lagging behind. Despite the growth of literature on the topic, the bridges between conceptualization and implementation are relatively unexplored. This study provides a comprehensive review of sustainable business model innovation through a systematic literature review. Its key contributions are a review of the development of the concept by pointing out the evolution of definitions, also key components, and frameworks or tools identification; a factor identification through barriers and drivers; and an acknowledgment of the roles of sustainable business model innovation in the implementation of sustainable business model.

Keywords: Digital transformation, Fourth industrial revolution (Industry 4.0), Sustainable development.

1. INTRODUCTION

The Fourth Industrial Revolution, commonly referred to as Industry 4.0, was born from the diffuse technological progress of the latest industrial revolution [1,2], globalization, and the development of artificial intelligence technology, all of which are prerequisites for developing Industry 4.0 [3]. Industry 4.0 has been identified as a major contributor to the era of digitalization [4]. The speed of the current breakthrough by the fourth industrial revolution is evolving at an exponential rather than a linear pace, disrupting almost every industry in every country [2]. The breadth and depth of these changes herald the transformation of entire systems of production, management, and governance [5]. Therefore, these changes push the entire industry to innovate.

Industry 4.0 will be the most powerfuldriver of innovation, triggering the next wave of innovation over the next few decades [6]. Many academics and practitioners emphasize the need to rethink the existing business models as traditional barriers of industry break down from rapid digitalization [7]. From an Industry 4.0 macro perspective, horizontal integration network interplays different value creation factors into value creation modules that are cross-linked throughout the whole value chain of a product life cycle [8]. These networks create an environment for a new and innovative business model, thus leading to a shift in business models [8]. Business model is a powerful tool that enables managers to control the industry and respond to share ideas [9], which also holds a tremendous capacity for sustainable development through

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their core business activities by providing goods and services in their domestic markets and abroad [10]. Success within each aspect of the business model creates motivation for innovation [10].

According to [11], two definitions of innovation represent essential distinctions. The first definition presents innovation as a process, and the second definition presents innovation as a result. Therefore, innovation should be considered a process and an outcome. As a process, innovation specifically addresses the way in which innovation is and should be organized so that the outcomes can come to fruition. As an outcome, innovation emphasizes the output; one of them is business model innovation (BMI). BMI aims to encourage and implement certain sustainable types and strategies through supporting the creationof sustainable business models (SBM) by enabling companies to identify and capture new value propositions, reduce resource consumption and waste, and enhance stakeholder engagement and collaboration.

From the innovation process perspective, BMI has a subset that works as a bridge that widens boundaries, develops new ways of economic value while also addressing social and environmental challenges, it is called sustainable business model innovation (SBMI). Geissdoerfer et al. [12] defined SBMI as the conceptualization and implementation of SBM. Bocken and Short [13] stated that, according to Ritala et al. [14] and World Business Council for Sustainable Development (WBCSD) [15], there is a noticeable gap. Although there has been a rise in both academic and business interest in SBM, the business progress towards SBMI has lagged. Hence, further study is needed to comprehensively investigate the concept and bridge between the knowledge and practice gap to enable more understanding and effective strategies to address the identified gap.

This study uses the Systematic Literature Review (SLR) method to bridge the "knowledge-practice gap" [16] and to integrateit into professional practice [17]. The importance of innovation in business models to help industry shift indicates a significant need to address the gap by defining the factors and role of SBMI in the practice of SBM. The purposes of this study are to examine the conceptual development of sustainable business modelinnovation, to identify factors that influence sustainable business model innovation, and to recognize the role of sustainable business model innovation insustainable business model implementation. This study is expected to support the development of sustainable business model theory and provide additional sources of reference and information about sustainable business models.

2. MATERIAL AND METHODS

A protocol for this study used the latest SLR guideline by [18], which has six steps and fourteen decisions, and adapted the three phases of SLR by [19]. The three stages of the SLR process are adapted from [19], which consist of planning, conducting, and reporting phases (Figure 1). The planning phase aims to establish the foundation and direction for the entire review process, the conducting phase carries out the actual review process based on the established plan to provide a comprehensive review, and the report phase aims to communicate the findings of the review clearly and transparently [19].

2.1 Stage 1. Define Research Questions

The first step of the SLR process contains the details of why the study is being initiated by establishing relevant and timely research questions, which determine large parts of further decisions. This step consists of three decisions: specify the research gap and related questions, opt for a theoretical approach, and define the core theoretical framework.

Specify the research gap and related research questions.

The urgency of this study started from the industry's need for innovation in the business models to help them shift from the industrial revolution and technological disruption. Ferlito and Faraci [20] stated that business model innovation (BMI) provides opportunities to integrate sustainability principles and practices into business activity. Along with [12], the sustainable business model (SBM) has gained attention from researchers as one of the forms of BMI. But at the same time, lagged business progress toward sustainable business model innovation (SBMI), the subset of SBM [12] that works as a bridge to widen boundaries for SBM is identified [14, 15]. However, the main objective of this study is to provide a review of SBMI to address the identified gap. The authors devised the following research questions:

RQ1: How is the concept development of sustainable business model innovation? The first question is designed as an initial step that helps establish a clear understanding and strong foundation for the study. Abyu [21] stated that study concepts are essential because (1) concepts are used to develop theories, (2) concepts can be operationalized by analyzing the application in practice, and (3) concepts can be used to enhance practice. He also stated that exploring a concept as a first step is a critical analysis of the literature because it shows the scientific rigor of the research, reduces prejudices of the research, and clarifies the nature of conceptual problems.

RQ2: What factors affect sustainable business model innovation? Factors identified in this study were explored through the barriers and the drivers involved. By examining these factors, one can gain valuable insights into the key drivers and barriers, as well as the enabling factors that can help bridge the gap between the conceptualization and implementation of effective SBMI. This question considers contextual conditions and strategic considerations in order to effectively implement SBMI.

RQ3: What is the role of sustainable business model innovationin sustainable business model implementation? Understanding the role of SBMI in the practice of SBM is beneficial in deciding which part of SBMI is responsible for implementing sustainability aspects in the business model. This question answers how the process of SBMI is translated into practical actions within a business; it uncovers the significance and impact of SBMI on the actual implementation and adoption of SBM.

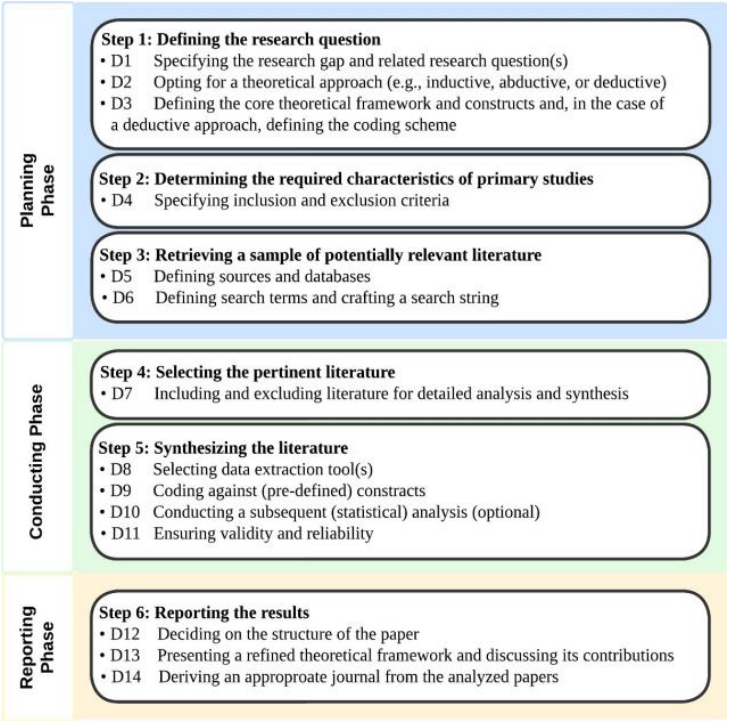

Figure 1: SLR Steps. Source: Modified from [19].

Theoretical approach

The theoretical approach of this study adopts an inductive approachas the research process does not start with a hypothesis to alter the direction of the study after the research process has commenced. Inductive approach starts with the observations and theories are proposed towards the end of the research process as a result of observations, it aims to generate meanings from the data set collected in order to identify patterns, resemblances, and regularities in experience (premises) in order to reach conclusions [22].

Theoretical framework

Adapting the inductive reasoning, the theoretical framework in this study is written and captured in the background chapter which author use the definition of SBMI from [22] as the theory base and in the literature review chapter which the theory lens is defined, equipped with a research framework.

2.2 Stage 2. Determining the required characteristics of primary studies

Inclusion and exclusion criteria are applied to ensure that the selected studies are aligned with the research framework (Table 1). It also minimizes ambiguity and reduces the possibility of poor reproducibility [22].

Table 1: Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion	Justification
Year of publication	Articles published in the last 10 years(2013 – 11th July 2023)	Articles publishedout of range of thetime frame	A five-year timeframe may be a typical lower threshold to analyze the development of such a field [18].
Type of publication	Peer-reviewed research articles Book chapter/section	Non-peer-reviewed journals Grey literature	To ensure the quality, reliability, and validity of the evidence included, the authors chose articles that have been peer-reviewed. The quality of grey literature was lower than publishedliterature [69] and on average, published literature showed a larger intervention effect than grey literature [18].
Language	English and Indonesian No constraint on the country of publication	Language other than English and Indonesian	The authors implement a language restriction based on the language proficiency of the authors. However, language restriction should be used only at the stage of selecting and not at the stage of searching to minimize language bias [25].
Entirely/ Fullness	Full text article Full availability access (openaccess)	Incomplete article Closed access availability	To ensure the articleis based on a comprehensive evaluation of the complete study. Only text with full availability means there are limited selections of literature [26]. However, in order to minimize bias, the authors use databases with multidisciplinary coverage to give supplementary evidence.

Criteria	Inclusion	Exclusion	Justification
Scope	Articles in the business, management, and accounting (BUSI) subject field	Non-business, management, and accounting (BUSI) subject field	To ensure the included articles follow the base theory subject field and framework
	Articles had to include the term related to sustainable business model innovation through the concept and implementation of a sustainable business model.	Not include the term related.	To ensure it's aligned with the research framework.

2.3 Stage 3. Retrieving a sample of potentially primary studies

The selected literature is retrieved from two databases to cover most articles, authors should use more than one database [27]. Chosen databases for this study are Scopus (https://scopus.com) and ScienceDirect (https:// sciencedirect.com). The database is selected based on its usability and suitability in a systematic search and review process, such as the search system proposed by [26]. They also stated that the multidisciplinary database was chosen due to open access inclusion criteria, and broadening the scope of the study seems beneficial to complement the search method. Furthermore, the search keywords of this study are sustainable business model innovation, concept, factors, role, and sustainable business model. The search string was constructed using Boolean operators to connect keywords. Every search string adjusts the search system of each database (Table 2).

Table 2: Search string.

Databases	Scopus	Science Direct
Search date	11 July 2023	
Search string	(TITLE-ABS-KEY (("business model" AND TITLE-ABS-KEY (innovation OR innovative OR development)) AND TITLE-ABS-KEY (sustainable OR sustainability)	(("business model" AND (innovation OR innovative OR development)) AND (sustainable OR sustainability) AND (driverOR challenge OR factor)

2.4 Stage 4. Selecting the pertinent literature

This is the final step of collecting data techniques, where the search system above is applied, i.e., framework, database, inclusion, exclusion, and search string. This study used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram, which included a search of databases and other sources as a tool that helps with a transparent step-by-step selecting and reporting process. Page et al. [28] stated that PRISMA was developed to facilitate transparency and a complete report on systematic reviews. The newest version of PRISMA reflects recent advances in systematic review methodology and terminology. PRISMA also ensures consistency and completeness in the review process [29].

Article identification is carried out via databases and other methods. In identification via database, the first round of revisions is carried out using database filter systems, which eliminate entries without open-access availability, entries outside the time range, entries outside the business, management, and accounting subject fields, and duplicated entries. The next step is carried out by manual screening, which reviews the results for relevance; any entries that the publication type meets with the exclusion criteria are removed. The second round of revision

assesses the articles based on the abstract. The authors only include those articles that concern the main framework and exclude those that are not in peer-reviewed journals. However, article identification via other methods is carried out by citation searching from the articles included in the identification via database search. The abstract screening process and revision for eligibility were also carried out. With that process, the identified articles from databases and citation searching are combined and result in included articles for this study. The retrieved articles are used for the extraction and analysis process, i.e., the conducting phase.

2.5 Stage 5. Synthesizing the literature

The data extraction step is carried out on the included article from the results of the PRISMA flow diagram. Tranfield et al. [19] stated that data extraction forms were carried out to reduce human error and bias by explicitly stating the general information (title, author, and publication details), as well as specific information such as study design and methods. By conducting data extraction, the authors compile a comprehensive dataset that enables a thorough analysis, synthesis, and interpretation of the findings from the included studies. Data extraction activities facilitate the drawing of robust conclusions and provide evidence-based insights.

This step description in the SLR guideline, written before, only mentioned guidance for studies that use content analysis, which is not suitable for this study. However, the authors take a note from Tranfield et al. [19] that they recommended using an a priori-defined coding structure to extract relevant study details on different levels, such as general information, study features, and specific information. Durach et al. [19] stated that the coding step is concerned with study synthesis, as it is the first step to code the relevant data from primary studies. Thus, the authors defined this step as part of the data extraction step, which codes each retrieved article based on the study's theoretical framework to help the process of analyzing and interpreting data. From the coding and extraction results, the included articles are analyzed and integrated [18]. As written in the theoretical framework and aligned with the data extraction and coding step, descriptive analysis is used to synthesize and analyze each included article based on the predefined construct.

The validity and reliability decision step is an additional consideration for explaining and justifying every step of the research process [31] with logical reasoning and valid motives [32]. This step aims to state the quality of the review implicitly. This study explicitly defined bias, which can be seen in every choice that the authors made, such as the theory framework, inclusion and exclusion criteria, the databases chosen, coding, and synthesizing. However, the authors provide the potential bias at the end of the review to be reflected in further research; the list is modified and written based on a guideline by [30].

3. RESULTS AND DISCUSSION

There are 15,558 articles identified from Scopus and 33,780 articles identified from ScienceDirect. Due to closed-access articles, the author removed 9,878 articles from Scopus and 25,276 articles from ScienceDirect. There are also 344 articles removed from Scopus and 221 articles removed from ScienceDirect due to articles published outside of the specified time frame. There are 4,089 Scopus articles and 6,993 ScienceDirect articles that have been removed because they are not related to business, management, or accounting subject fields. 41 duplicate articles are also removed from both databases. 78 articles were eliminated before abstract screening following the publication type and language exclusion. Abstracts of 2,527 articles were screened, resulting in 18 articles that could be evaluated for eligibility, which included peer-reviewed journal publications and study framework focus criteria. As the 18 articles met the eligibility criteria, those articles were included from the results via a database search (Figure 2). Moreover, there are 15 articles identified in the identification process through citation searching. Five

articles were removed after an abstract screening and assessed for eligibility. There are 10 articles included from the results viaother methods, as all articles met the peer-reviewed journals and frameworksinclusion. The total number of retrieved articles combined for this study is 28 articles (Figure 2).

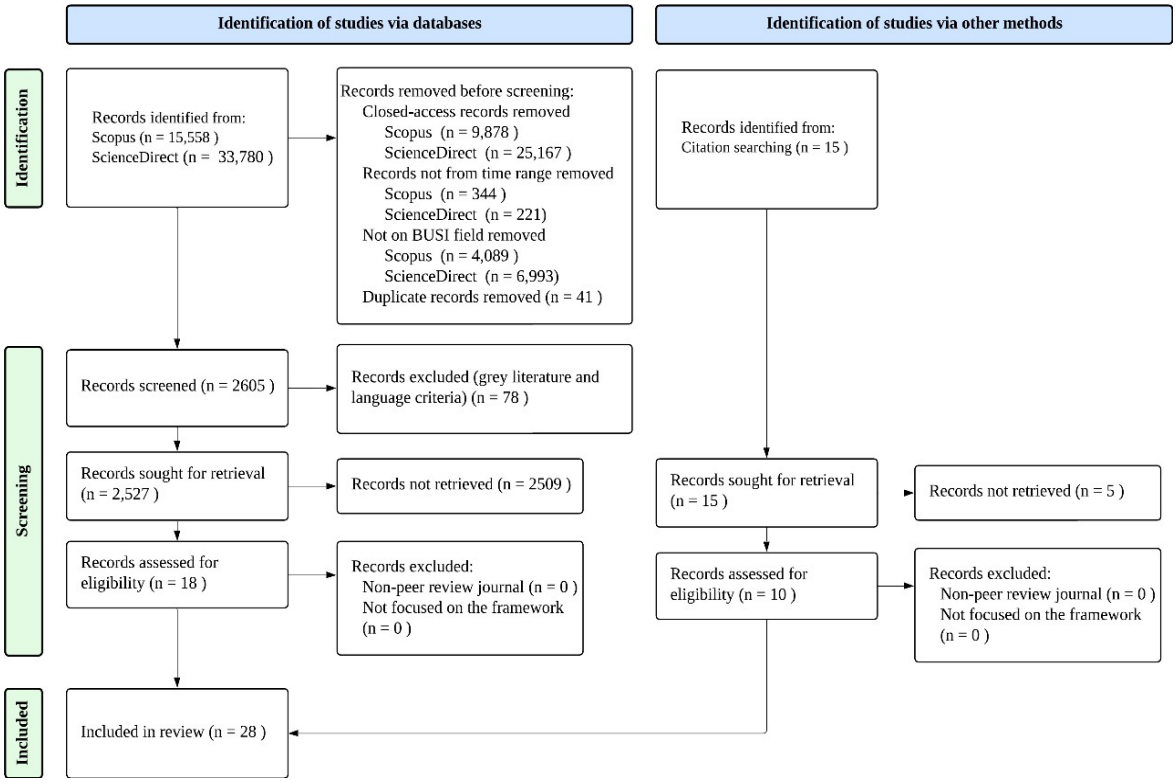

Figure 2: Final result of PRISMA flow diagram via database and other sources.

The articles represent a diverse range from the past decade (Table 3). From the growth of SBMI in the early 2000s [33], the literature in the last decade has gradually shifted towards a more holistic and comprehensive approach over time. Based on the extracted data, it can be concluded that there has been a significant increase in recent years in publications focusing on various industries and practical implementation frameworks.

Table 3: Included articles by publication year.

Year of Publication	Year of Publication and Author	Number of Articles	Percentage
2013– 2014	Boons and Lüdeke-Freund [34]; Girotra and Netessine [35]; Laukkanen and Patala [36].	3	10.3%
2015 – 2016	Geissdoerfer et al. [37].	1	3.4%
2017– 2018	Evans et al. [38]; Yang et al. [39]; Baldassarre et al. [40]; Koistinen et al. [41]; Geissdoerfer et al. [12]; Niosi and McKelvey [42].	6	20.7%
2018– 2020	Ciasullo et al. [43]; Aagaard and Lodsgård [44]; Biloslavo et al. [45]; Bocken and Geradts [46]; Velter et al. [47]; Shakeel et al. [48].	6	20.7%

Year of Publication	Year of Publication and Author	Number of Articles	Percentage
2021– 2022	Oskam et al. [49]; Bashir et al. [50]; Bhatnagar et al. [51]; Ferlito and Faraci [20]; Oliveira-Dias et al. [52]; Velter et al. [53].	6	24.1%
2023	Schlüter et al. [54]; Mignon and Bankel [55]; Reinecke et al. [56]; Pies and Schultz [57]; Dhir et al. [58]; Pan et al. [33].	6	20.7%
	Total Articles	28	100%

Based on some literature reviews published from 2013 to 2023, the authors found that the selected articles reflect the significant growth in SBMI literature that emerged after SDGs were launched by the United Nations (UN) in 2015. On the other hand, the author did not find any specific articles that explicitly mentioned SDGs as the urgency of the study. The correlation between the rise of SBMI literature and the emergence of the SDGs emphasizesthe growing importance of aligning business practices with sustainable development principles to address the challenges of the industry revolution.

The authors categorized the selected articles by their publication sources (Table 4). Furthermore, this study incorporated articles from a book chapter, which were extracted based on the book's title. As this study only includes articles within the business, management, and accounting fields, the selected articles mainly centered around innovation, management, economy, and sustainability. Notably, the articles from the Journal of CleanerProduction were featured prominently in the dataset, with its articles being the most cited in this study.

Thereafter, articles from the Business Strategy and the Environment and the Technological Forecasting and Social Change demonstrated a notable representation, highlighting the recognition of SBMI as a crucial area for fostering innovation through business strategy, with an emphasis on environmentally and socially responsible. The presence of articles in journals from various industries underscores the applicability and relevance of SBMI across diverse organizational contexts. However, it is essential to note that the focus of the journal included in this study was primarily on innovation and management. The authors encourage more interdisciplinary collaboration to address complex sustainability challenges and enhance the field of SBMI.

Table 4: Included articles from publication sources.

Publication	Author	Number of Articles
Journal of CleanerProduction	Boons and Lüdeke-Freund [34]; Geissdoerfer et al. [37]; Yang et al. [39]; Baldassarre et al. [40]; Geissdoerfer et al. [12]; Velter et al. [47]; Shakeel et al. [48]; Bhatnagar et al. [51]; Schlüter et al. [54].	9
Manufacturing & Service Operations Management	Girotra and Netessine[35];	1
International Journal of Innovation Management	Laukkanen and Patala [36].	1

Publication	Author	Number of Articles
Business Strategy and the Environment	Evans et al. [38]; Mignon and Bankel [55].	2
Journal of Evolutionary Economics	Niosi and McKelvey [42].	1
Italian Journal of Management	Ciasullo et al. [43].	1
Long Range Planning	Bocken and Geradts [46].	1
Business & Society	Oskam et al. [49].	1
Journal of Innovation and Knowledge	Bashir et al. [50].	1
Innovation & Management Review	Ferlito and Faraci [20]	1
Management Decision	Oliveira-Dias et al. [52].	1
Circular Economy andSustainability	Velter et al. [53].	1
Scandinavian Journal ofManagement	Pies and Schultz [57].	1
Technological Forecasting and Social Change	Dhir et al. [58].	1
Review of Managerial Science	Pan et al. [33].	1
(Book) Sustainable Business Model	Koistinen et al. [41]; Aagaard and Lodsgård [44]; Biloslavo et al. [45].	3

The findings show the utilization of various approaches, including case studies, literature reviews, and mixed-method approaches (Table 5). It contributes to the robustness and credibility of the research findings. Notably, the literature review holds a prominent position in the dataset, signifying its significance in synthesizing existing knowledge and theoretical frameworks in the SBMI fields. While a literature review is essential for consolidating information, the analysis underscores the need for more empiricalresearch approaches, such as experiments and observations, to complement and strengthen existing theories of SBMI.

Table 5: Included articles by study design.

Study Design		Author
Descriptive study	Comparative case study	Oskam et al. [49]
	Exploratory case study	Ciasullo et al. [43]; Velter et al. [47]
	Empirical casestudy	Yang et al. [39]; Mignon and Bankel [55]
	Multi-case study	Oliveira-Dias et al. [52]
	Longitudinal casestudy	Reinecke et al. [56]
	Case study	Niosi and McKelvey [42]
Review study	Literature review	Boons and Lüdeke-Freund [34]; Evans et al. [38]; Koistinen et al. [41]; Geissdoerfer et al. [12]; Aagaard and Lodsgård [44]; Biloslavo et al. [45]; Shakeel et al. [48]; Ferlito and Faraci [20].
Theory-building study	Grounded theory	Bocken and Geradts [46].
	Scale development	Bashir et al. [50].
	Upper echelon theory	Dhir et al. [58].
	Design methodology	Baldassarre et al. [40].
Qualitative study	Design science approach	Bhatnagar et al. [51].
	Delphi study	Laukkanen and Patala [41].
	Ordonomic approach	Pies and Schultz [57].
	Workshop based	Geissdoerfer et al. [37].

The authors code the included articles based on a pre-defined construct that aims to provide a comprehensive answer to each research question and facilitate the process of data synthesis (Table 6). The coding results evidently show that the primary topic of urgent discussion in the past decade has strongly gravitated towards the exploration of SBMI frameworks and tools, followed by the discussion of key components.

Table 6: Coding extraction of included articles.

Topic Discussion		Number of Articles	Percentage
Conceptualization	Definitions	9	21%
	Key components	12	28%
	Frameworks and tools	14	33%
	Barriers	2	5%
	Drivers	4	9%
Implementation	Role of SBMI on SBM implementation	2	5%

3.1 Concepts Development of Sustainable Business Model Innovation

3.1.1 The concept of SBMI

The findings in SBMI's research theme were relatively in a period of rapid development, with most publications focused on business, management, and accounting subject categories [33]. Many of these definitions incorporate SBMI with BMI and SBM, along with sustainable value, concerning the triple bottom line element (economy, environment, and social). Some of them focus on society and environment [20,34], economy and society [41], but no specific articles address the whole element of the triple bottom line. Besides those, many of these definition highlights the importance of sustainable value [37,39,48] and mention the underlying concept of SBMI, such as business model [33,37,39]; BMI [48]; and SBM ([37,48]. Nevertheless, those definitions are equally focused on innovation through sustainable value to create a new business model that includes a broader notion of value (Table 7).

Table 7: Sustainable business model innovation definitions.

Authors	Definition
Boons and Lüdeke- Freund [34]	Is about creating superior customer and corporate value by addressing societal and environmental demands.
Geissdoerfer et al. [37]	"Sustainable business innovation processes specifically aim at incorporating sustainable value and a proactive management of a broad range of stakeholders into the business model" (p. 6).
Yang et al. [39]	"Sustainable business model innovation can be more easily achieved by identifying the value uncaptured in current business models, and then turning this new understanding of the current business into value opportunities that can lead to new business models with higher sustainable value." (p. 5).
Koistinen et al. [41]	"Sustainable business model innovations create, deliver,and capture economic, social, and ecological value for customers and other stakeholders in various societies" (p.105).
Geissdoerfer et al. [12]	"We define sustainable business model innovation as the conceptualization and implementation of sustainable business models" (p. 407).
Biloslavo etal. [45]	"An innovation that supports the transition of BM to SBM is called sustainable business model innovation (SBMI)".
Shakeel et al. [48]	"SBMI is an overlapping conception of BMI and SBM. The theoretical grounds for SBMI are based on underpinning business model value creation logic but incorporate sustainable value and value

Authors	Definition
	innovation" (p. 8).
Ferlito and Faraci [20]	"We define SBMI as a change in how a firm operates to create positive impacts or reduce negative consequences for the environment and society" (p. 222).
Pan et al. [33]	"SBMI is regarded as adding elements of sustainable innovation into each component of the traditional business model" (p. 779).

The exploration of the theoretical approaches used by authors in defining SBMI reveals a diverse range of perspectives. Some of the definitions are rooted in the innovation field [34,42,44], emphasizing the significance ofinnovation in embedding sustainability value to the current business models, allowing the process of SBMI. On the other hand, definitions from the management field mainly underline the component of SBMI and the pivotal role of actors involved in the SBMI process [48,49].

Besides the selected articles that explicitly define SBMI, many authors just come up with a piece of conceptualization, e.g., [36,45,46]. Bocken and Geradts [46] stated that embedding social factors into BMI processes can be termed as SBMI. Biloslavo et al. [45] implied that SBMI is similar to BMI, but it focused on SBM instead of the classical business model. On the other hand, Laukkanen and Patala [36] use SBM and BMI as the underlying concepts and provide updated archetypes of SBM by [59] as it is incorporated with the type of BMI [34]. Similar to them, Shakeel et al. [48] provide the definition by deriving it through the philosophy of underlying concepts of SBMI (i.e., business model, BMI, andSBMI) proposed by [12] and come up with a new definition.

Geissdoerfer et al. [12] complement its definition by identifying the aims of SBMI, which is (1) characteristics of a sustainable business model – sustainable value creation, proactive multi-stakeholder management, and a longterm perspective; (2) four types of innovation – sustainable startups, sustainable business model transformation, sustainable business model acquisition; (3) creating sustainable business model type – circular business models, social enterprises, bottom of the pyramid solutions, or product-service systems; (4) the implementation of one or more sustainable business model strategies.

It is noteworthy to highlight the evolution of the definition itself. Initially centered on value creation alone, devoid of contextual anchoring and encompassing only minimal elements like social and environmental considerations, the definition has traversed a transformative journey. It has transitioned into a more pronounced integration with value creation within the broader business model and BMI framework. Additionally, the elements encompassed in the definition have expanded into the entirety of sustainability elements, i.e., society, environment, and economy.

These changes show the trajectory of the definition, which initially laid the conceptual groundwork. As it progressed, it shifted into a more robust formulation that accentuates not just the concept but also places enhancedemphasis on its contextual implementation. The evolving definition effectively mirrors the growth of the SBMI topic. It signifies an emerging understanding that encapsulates both theoretical essence and practical realization. As a result, the authors derive a working definition of SBMI. SBMI is a strategic process that purposefully integrates principles of sustainability in the shape of innovation in order to update business models that allow the creation of sustainable value. It involves an active engagement and collaboration of all stakeholders to foster responsible business practices and contribute positively to society and the environment.

3.1.2 Key components of SBMI

In a business model, there are value components that are fundamental inorder to understand how a business creates and delivers value to the customers, broader market, and stakeholders, which in turn become one of the actors in the process of SBMI. The value components consist of value proposition, value creation, value delivery, and value capture [60]. With an innovation strike through, it changes the perspective of value components. Lindgardt et al. [61] stated that at least two value elements of business models have to change to be called BMI. The transformation also stresses the interrelations between the elements and the value networks [12]. Meanwhile, in SBM, Baldassarre et al. [40] proposed that the core of SBM is a sustainable value proposition withfour key aspects of it i.e., value captured, value destroyed, value missed, and value opportunities. In the same year, Evans et al. [38] developed five value propositions that provide a theoretical foundation for SBMI. Lüdeke-Freund [62] mentioned value network; explained that in a systemic perspective, SBM integrates the creation of economic, environmental, and social valuewithin a value network. It can be said, the SBMI process revises current value components and embeds a sustainable component, it is often called sustainable value [41]. Shakeel et al. [48] identify components of SBMI through the components of BM, SBM, and BMI. They define three value components based on sustainable value innovation and sub-components of SBMI – new/change sustainable value through value proposition, value creation and delivery, and value capture. Pies and Schultz [57] proposed three design elements of SBMI, namely, sustainable value proposition, sustainable value creation and delivery, and sustainable value capture.

Stakeholders are one of the important actors in the process of SBMI. The roles of stakeholders in the innovation process arevaried, as those who can affect or are being affected by the innovation outcomes, their involvement is important [63], as digital transformation urges the stakeholder approaches to become more relevant as the process of value creation and value capture are evolving to be more decentralized, multidirectional, and open. Sustainable business innovation processes are specifically aimed at incorporating sustainable value and a proactive management of a broad range of stakeholders into the business model [37].

Baldassarre et al. [40] explained a combination of both conceptualization and the process of sustainable value proposition in order to understand and manage several needs and objectives across a network of multiple stakeholders when creating shared value. Pies and Schultz [57] clarify the demands of management stakeholders that affect the sustainable value proposition, value creation, and value capture, aiming for mutual gains for enhanced value network activities.

For the identified key components that influence SBMI itself, i.e., organizational identity, dynamic capability, boundary work, and organizational boundaries. This also addresses the urge to imply sustainability on a system-level [36]. The first one, organizational identity, is a shared perspective of an organization's purpose, values, meanings, and culture. Biloslavo et al. [45] proposed that SBMI must be supported by a proper organizational identity in order to imply a strategic meaning and correspond to the sustainable meaning at the level of SBM.

Dynamic capability is a firm's ability to integrate, build, and reconfigure internal and external resources to address and shape a rapidly changing business environment. It plays a significant role [46,52] in the conceptualization of SBMI. Koistinen etal. [41] stated that the firms capabilities to act as an agent of sustainability is acknowledged through different disciplines, and within the dynamic capabilities approach, dynamic capabilities provide a feasible explanation for the success or failure of BMIs [50], the higher dynamic capabilities in an organization, the greater their propensity to move towards an effective and sustainable form of business.

Other components that should be pondered as they influence SBMI are boundary work and organizational boundaries proposed by [47]. Since several studies emphasize the need for

collaboration to enable SBMI [53], there is a need for alignment between stakeholders. They address those gaps through the boundary work perspective. Being correlated with the actors involved in the value network, organizational boundaries – intentionally constructed boundaries between the organization and the environment to enhance the purpose of each actor involved [64], are explored. Apparently, the existing organizational boundaries in the value network build a negotiation and alignment process in SBMI. Boundary work inSBMI is exploring, negotiating, disrupting, and realigning organizational boundaries. Therefore, those key components are interconnected and become parts of one another that cannot stand alone. Those key components are also aligning with sustainable elements which create a holistic and effective process of SBMI (Table 8).

Table 8: Summary of key components of SBMI.

Context	Key components	Sources
Value components	(1) Sustainable valueproposition (2) Sustainable value creation and delivery (3) Sustainable valuecapture	[48,57]
Stakeholders	Stakeholders' engagement and stakeholders' alignment (multi-stakeholders included)	[37,40,47,53,57]
Organizational	Organizational identity, dynamic capability,boundary work, and organizational boundaries, boundary spanning	[42,45-47,50,52,53]

3.1.3 Framework and tools for SBMI

Along with the key components, frameworks are evidently linked as they provide practical tools to operationalize the identified concepts. From the article identified with literature review or bibliometric analysis type, they often mention that the SBMI field still lacks a universal design framework [33,48] and a lack of a clear measurement system [38] to bridge the gap between theoretical frameworks and implementation. However, the selected articles in this study show an increasing number of articles providing frameworks and tools. Some of the articles also specificallyprovide rare approaches, such as start-ups [43,56], and SMEs [50]. The summary of frameworks and tools identified is presented in Table 9.

Girotra and Netessine [35] provide a conceptual framework by discussing systematic study and identification of new business models, proposing that the key is understanding the context of decision-making in the existing models and associated inefficiencies. Meanwhile, Ciasullo et al. [43] proposed a framework from the result of the exploratory case study of Progetto Quid business model, which is more focused on the sustainable value, and apparently, these BM enable further specification of macro-dimensions of SBM. Stated that sustainability is not just an outcome of business processes but assumes the role of a driving force for the development of sustainable innovation that emerges from a dynamic and circular value propositionmechanism.

Following the focus on sustainable value, these two articles specifically address the gap in sustainability assessment [51,54]. The topic at hand warrants discussion in order to establish a mutual understanding among all parties involved in the collaborative process, including both internal and external stakeholders. The former one analyzes existing sustainability assessment tools and frameworks and proposes a list of design principles as a guideline to integrate sustainability assessment into its BMI process. Meanwhile, the latter one provides a guideline that integrates systems thinking (ST) as a new approach to sustainability assessment. Embedding ST into the tools of the SBMI process allows organizations to reduce unintended consequences and negative trade-offs of the process.

The frameworks and tools also came within the definition identified. Yang et al. [39] proposed a framework based on an uncaptured value – they found that it can be used to understand the conditions and turn them into value opportunities, which can lead to a new business model with higher sustainable value. Moreover, Koistinen et al. [41] discuss how organizations create and capture sustainable value through BM at a system leveland propose preliminary frameworks for it. They emphasize the importance of integrating innovation between system level (system transition) and company level (business model change) by considering system level influences on the change process. In addition, Ferlito and Faraci [20] proposed a conceptual framework that helps to understand the dynamic vision of how business modelchanges incorporate sustainability elements.

Some frameworks and tools also came aligned with the identified key components. Baldassarre et al. [40] proposed a methodological framework that managers can use to understand stakeholders. Starting with an empirical problem and identifying the initial value proposition, the user-driven iterative process involves talking, thinking, and testing through team meetings and project diaries. The framework process is intended to build a sustainable value proposition and the design process of it. The framework proposed by [47] underlines the importance of aligning organizational boundaries between multi-stakeholders through boundary work, and then later provides a boundary tool [53] as a guideline that facilitates that alignment between multi-stakeholders.Aligned with the key components, Bashir et al. [50] address the gap in measurement tools. They provide an item scale of SBMI from the business model components identified. Those tools have also been tested through a case study.

There are also frameworks and tools within both of the sub-sections identified, such as [48]. The framework is based on the comprised components of sustainable value innovation, which consists of sustainable value proposition innovation (SVPI), sustainable value creation & delivery innovation (SVC&DI), and sustainable value capture innovation (SVCI). Despite the increasing number of available frameworks and tools of SBMI, many of these approaches lack contextual factors; only a few of them have a clear picture of the intended size of the organization and the specific industry.This gap may hinder the effective integration of sustainability principles into business models, leading to inaccurate results and a failure to address the real challenge. Hence, there is a need for further exploration of these contextual factors to improve the practicality and applicability of SBMI.

3.2 Factors that affect SBMI

A comprehensive analysis of the factors affecting SBMI consists of barriers and drivers. Barriers are the challenges that need to be addressed through strategic solutions, while drivers represent influential factorsthat collectively contribute to the overall success of sustainable innovation. Identifying drivers of sustainable practices can bring up indicators that assess the impact of the value created [43]. Thus, this section simultaneously addresses factors in the conceptualization and implementation.

The barriers and drivers of SBMI are often linked to the proposed concepts, frameworks, and key components. Sustainability, according to Ciasullo et al. [43], is not solely an outcome of business processes; rather, it plays a pivotal role in driving sustainable innovation. Biloslavo et al. [45] suggested that organizational identity is also a significant driver of SBMI, in line with their proposed key components and framework. Conversely, Bocken and Geradts [46] identified the barriers and drivers of dynamic capability, one of the proposed key components. They categorized these factors into three dimensions: institutional, strategic, and operational. They also explain how those drivers manifested in corporations, enabling management to take appropriate action.

Table 9: Summary of SBMI frameworks and tools.

Type of frameworks or tools	Name of frameworks or tools	Perspective	Objective	Authors
Preliminary framework	-	Combining approaches of transition management, sustainable value creation, and corporate sustainability levels	-	[41]
Conceptual framework	Value uncapturedfor SBMI	Identifying valueuncaptured in the current business model can trigger SBMI	Can be usedby industrial practitioners	[39]
	Boundary workin SBMI	Using organizational boundaries, actors' collaboration, and iterative process boundary work	Can be used to smoothen boundary alignment that needed in SBMI collaboration	[47]
	Multidimensional vision of sustainable BMI	Based on valueproposition, value creation and delivery, and value capture	Guideline for corporate reorganization	[20]
Methodological framework	Sustainable value proposition design	Current sustainable valueproposition goesthrough an iterative process of user-driven innovation	Can be used for managers	[40]
Governance framework	The ordonomic 'sustainability cube'	Identify governance andits impact framework condition, contributing to sustainablecorporate	Management tool for the governance ofSBMI	[57]
Framework for management	SBMI Framework	Within five dimensions of value strategies;strategy, culture,resources, partnership, andleadership		[43]
Workshop framework	Workshop routine - evaluation	Based on value mapping process	Enhancing value proposition by includes positive sustainable value and a wider range of stakeholder interests	[37]
Sustainability assessment	Six design principles (DPs)	Analyzing existing frameworks through the CAMO (Context, Actions, Mechanisms, and Outcomes) lens	-	[51]

Type of frameworks or tools	Name of frameworks or tools	Perspective	Objective	Authors
Guideline	Systems thinking integrated guideline	Systems thinking (ST) asa tool for early- stage sustainability assessment of SBMs	Used to reduce unintended consequencesand negative trade-offs in SBMI process	[54]
Process tool	Boundary tool: 5-steps guidelineto facilitate multi-stakeholder alignment	Boundary workconcept approach in SBMI collaboration process	Can be used in a workshopwith multi- stakeholder	[53]
Measurementscale	10-item scale	Conceptualized under three SBMI value component: SVPI, SCV&DI,SVCI	Can be usedby SMEs	[50]

Within the landscape of the innovation system, Laukkanen and Patala [36] categorized barriers into three groups: technological, social, and organizational.Technological barriers encompass the lack of strict legislative pressure and economic incentives. Social barriers may involve the lack of acceptance by consumers or customers, as well as the need for economic incentives. Organizational barriers refer more to the diffusion of SBMI attitudes and values within a larger structure.

Building upon previous research by [58, 65], emphasize that top management teams (TMTs) are considered an important driver of SBMI by utilizing upper-echelon theory approaches. Their research focuses on the relationship between TMTs and ambidextrous learning, which refers to an organization's capacity to invest in both exploitative and explorative organizational learning to enhance synergies among existing resources and capabilities and to identify new opportunities and adapt to changes in the environment to promote sustainability.

It is important to recognize that the interplay of barriers and drivers discussed below unfolds within varied contextual frameworks, be it within corporate structures or when evaluating emerging opportunities (Table 10). However, within this discussion, it became evident that certain facets of barriers and drivers remain unexplored. Therefore, it is recommended that more research be conducted in this field of SBMI to improve its practicality (Table 10).

Table 10: Summary of barriers and drivers of SBMI.

Dimensions	Barriers	Drivers
Internal	SBMI attitudes and values diffusions	Organizational identity
	Dominant focus onexploitation	Organizational ability in ambidextrous learning
	Prioritizing short-termgrowth	Dynamic capability
	Functional strategy	
External	Focus on maximizingshareholder value	Balancing shareholder and stakeholder value
	Customer's lack of acceptance	Collaborative innovation
	Lack of economic incentives	Organizational boundary
	Lack of innovation policy	
	Lack of legislative pressure	
Technological	Lack of economic incentives	

3.3 Role of SBMI in SBM Implementation

As stated in the research framework and theoretical framework, the research question in this study is based on the SBMI definition by [12]; they encapsulate SBMI as not merely a conceptual framework but a dynamic process that bridges the realms of idea and realization. Thus, through the review process, SBMI was found to be mostly discussed within BMI and SBM.

SBM categorization itself in the current time, whereas this review was conducted, is still growing and has various approaches, such as SBM archetypes by [59], differentiation of SBM by [66], an SBM taxonomy based on price and revenue patterns by [68], and SBM typologies that are specified on product-service-system (PSS) or circular business model such as [67]. Hence, those differences may be difficult for firms to adopt, and one of the ways to face such challenges is bystrategizing BMI towards sustainability [55].

It appears that SBM is not all about the 'title' or 'type' of a business model. SBM is a set of principles, whereas an existing or new business model purposefully integrated with sustainability elements aims to build a business model that runs sustainably. That way, it can be understood and translated that SBMI is the strategy that bridges firms to make or adopt an SBM, allowing them to adjust themselves to which SBM is most suitable for the organizationand stakeholders' needs.

Innovation, in the broadest sense, introduces change via something new. The same logic applies to SBMI; it plays a big role as a starting point. However, in line with the principle that innovation is both an outcome and a process, it must be underlined that SBMI constitutes a comprehensive process. This approach is respectively illustrated by numerous articles that highlight the importance of experiments in the SBMI field (e.g., [35,42,56]. Consequently, the trial-and-error phase is included in the learning process and is a part of the strategy.However, it is important to note that these experimental elements and mannerin SBMI are part of the strategic plan, minimizing losses within the process.

Furthermore, within the SBMI conceptualization, there are key components, frameworks, guidelines, tools, and drivers and barriers that collectively shape the innovation process. In one of the articles, Mignon and Bankel [55] specifically discussed the adoption process of SBM by reviewing an empirical case study. Their study reveals that key elements identified in this study are implemented in various contexts. For instance, the experimental elements and mannerisms are a common strategy to achieve generalBMI, but are also distinctly proven to facilitate SBMI. Additionally, organizational components like boundary spanning or organizational boundary are strategies used that are grounded in explicit sustainability motives. It is worth noting that while their study illuminates specific instances, as the discussion unfolds, these insights collectively underscore the intricate web of components and strategies that underpin the multifaceted process of SBMI.

It is noteworthy that while SBMI plays a critical role in the early stages of SBM development, the relationships between ongoing SBMI and the long-term sustainability of SBMs require more exploration. To maintain alignment with the evolving sustainability and external pressures, continuous innovation is needed. Nonetheless, the connection between SBMI and the successful implementation of SBMs is evident, positioning SBMI as a critical agent that propels the translation of sustainability aspirations into tangible and actionable business models.

4. CONCLUSION

A dynamic evolution marks the development of the SBMI concept. Initially focused on the concept of value creation with few considerations, the concept has sharpened to encompass value creation within the context of BMI, called sustainable value creation. SBMI emerges as a strategic process that harmonizes comprehensive sustainability elements. Those developments are paralleled by the unfolding discourse on key components and frameworks/tools discussion, mirroring growing recognition of SBMI as a guiding force in the implementation of SBMI.

The factors influencing SBMI are categorized into three dimensions: internal, external, and technological. The factors were explored through barriers and drivers of SBMI. The internal dimensions identified 4 barriers and 3 drivers that encompass the organizational culture, strategy, and capabilities. The external dimensions identified 4 barriers and 3 drivers, which are mainly shaped by regulatory pressures, market dynamics, stakeholders' interests, and the collaboration process required in SBMI. The technological dimensions uncover 2 identified barriers that are attributed to the policy and economic limitations on innovation facilitation.

SBMI operates as a strategic subset within the realm of SBM, facilitating organizations in aligning with their optimal SBM fit and with stakeholder needs. From the beginning, SBMI allows BMI adoption by providingdirection in strategic planning and encouraging exploration throughout the process. As a continuous process, SBMI also gauges adoption impact and identifies avenues for further exploration, resulting in the implementation of a sustainable business model with long-term sustainability.

This study's findings show a lack of key components and factors that constitute an SBMI. The review of frameworks and tools revealed that despite a large number of them, they still lack contextual factors and still contain complexity, which is increasing the difficulties of firms in adopting those tools. For instance, several authors do not provide an objective for whom the frameworks or tools are proposed. Furthermore, the discussion lacks various sizes of organizations. It mainly focuses on a big firm, with just a few of them approaching small-sized organizations such as start-ups and SMEs [43,50]. To increase the practicalityof SBMI, future research on SBMI is carried out based on a consistent concept and more deeply within the industry. With that, the SBMI field can grow with the possibility to compare case-by-case, providing more contextual factors, and maximizing the clarity on how the industrycan adopt an SBMI. To broaden the landscape of the SBMI topic, forthcoming literature study should widen and diversify the range of resources, including 'gray literature' sources (conference papers, reports, government documents, or policy literature), they can serve as an addition which infuse the discourse of SBMI with industry or stakeholders' insights and potentially foster more comprehensive and holistic understanding of SBMI.

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