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Review and Categorisation of Support Types for Business Model Innovation for Sustainability**

Abstract

Sustainability is increasingly becoming a priority for business leaders as it challenges the very existence of the traditional way of conducting business. Businesses aim to reinvent themselves by engaging in business model innovation for sustainability (BMIfS). However, this journey is challenging, complex, and associated with a high risk of failure. It involves multiple development stages and changes in various business model components and may take different avenues. Researchers are increasingly addressing this challenge and have developed types of support to guide businesses on this journey. However, there is no overarching support type to address BMIfS. This article provides an overview and categorisation of 40 types of support available to business practitioners pursuing BMIfS efforts. Our work categorises the types of support based on five dimensions: BMIfS innovation stage, BMIfS type, BMIfS component, dynamic and iterative perspective, and validation status. This comprehensive overview can serve as a database for both scholars and business practitioners. Through the review and categorisation process, we uncovered BMIfS dimensions that are in need of further investigation and support. Notably, we found no available support type that addresses the acquisition of sustainable start-ups as a type of BMIfS—an increasingly prevalent BMIfS strategy employed by incumbents.

Keywords: innovation process; business model; sustainable business model innovation; sustainable development; literature review
(JEL: L26, M13, M14)

Introduction

Businesses are embracing sustainability as a core component of their strategy and innovating their existing business models (BMs) to become more sustainable. Sustainability is the balanced pursuit of economic, social, and environmental goals, also known as the triple bottom line (Elkington, 2004). Companies are under increasing pressure to become more sustainable as customers demand more sustainable prod-

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ucts and services (Bocken et al., 2015). Investors are also paying greater attention to the environmental, social, and governance (ESG) risks, factoring them into their market valuations of companies (Ademi & Klungseth, 2022), and governments are imposing stricter regulations on sustainability (Geradts & Bocken, 2019). The sustainable development agenda sees businesses alongside governments and civil society responsible for achieving the 17 sustainable development goals (SDGs) set by the United Nations (Scheyvens et al., 2016). Achieving these goals is critical; companies are crucial in reaching them by 2030 (Betti et al., 2018). SDGs also represent a unique opportunity for businesses to build a competitive advantage by focusing on sustainability challenges and how to solve them (Stubbs & Cocklin, 2008).

Scholars and business leaders recognise BMs as tools that provide innovation to help achieve sustainability (Bocken et al., 2014), resulting in a new stream of research, such as business model innovation for sustainability (BMIfS). Often, scholars refer to it as sustainable business model innovation (SBMI) (for example, Bocken & Geradts, 2020 and Geissdoerfer et al., 2018). We perceive it as a business model innovation process aiming to achieve a more sustainable business model (SBM). The difference between these two forms lies in how sustainability can be interpreted. The term sustainable can be understood as longevity and, thus, as a long-lasting BM. For this reason, we use the term ending with *fS* to emphasise that it focuses on innovation for sustainability. BMs explain the rationale for how businesses create, deliver, and capture value (Teece, 2010). BMIfS aims to incorporate "sustainable value and a pro-active management of a broad range of stakeholders into the business model" (Geissdoerfer et al., 2016, p. 1220). BMIfS allows incumbents to rethink how they create, deliver, and capture value and integrate sustainability at the core of their business strategy. Similarly, it allows entrepreneurs to shape breakthrough BM ideas built around sustainability. Therefore, BMIfS is critical for helping the business community address sustainability issues (Pieroni et al., 2019).

Integrating sustainability into business strategy and BM may require new competencies and knowledge (Ademi et al., 2024; Porter & Derry, 2012). BMIfS presents a multifaceted, complex, and iterative endeavour fraught with a high likelihood of failure (Geissdoerfer et al., 2018). It encompasses a series of interconnected stages, namely initiation, ideation, integration, and implementation (Frankenberger et al., 2013), which necessitate adaptations within one or more components of the BM itself, including the value proposition, value creation and delivery, and value capture (Foss & Saebi, 2017). Organisations striving for sustainability may pursue diverse avenues of BMIfS, such as nurturing new ventures, transforming existing models, diversifying their operations, or engaging in business acquisitions (Geissdoerfer et al., 2018). Further, organisations aiming for BMIfS face challenges in meeting sustainability-driven demands due to their limited understanding of sustainability (Schaltegger et al., 2016). So, the complexity of conducting BMIfS is associated

with the organisations' knowledge of sustainability and their learning capabilities to enhance their competencies in addressing sustainability (Ademi et al., 2024; Hermelingmeier & von Wirth, 2021).

Despite the growing body of research dedicated to BMIfS in recent years, the path toward adopting a more SBM and the practical application of an SBM remains uncertain (Baldassarre et al., 2020a; Geissdoerfer et al., 2018). As such, the need for elucidation and guidance in navigating this complex terrain is paramount. SBM is a BM that incorporates "sustainability as an integral part of the company's value proposition and value creation logic" (Abdelkafi & Täuscher, 2016, p. 75). Scholars have produced multiple frameworks, tools, and process models to support business practitioners in their efforts toward an SBM (Pieroni et al., 2019). In this article, we refer to such products as types of support. Although researchers have put great effort into developing support types for BMIfS, they remain scarce, while the available ones are generic and remain unused (Bocken et al., 2019). The lack of sustainability-driven tools and methods for business modelling is one of the key challenges in creating SBMs (Evans et al., 2017). Often, the Business Model Canvas (BMC) is used to facilitate BMIfS, although it is intended to guide traditional business model innovation (BMI) (Osterwalder et al., 2010). Gibson and Jetter (2014) argue that although BMIfS work widely applies the BMC, it is "static and leaves entrepreneurs and managers to struggle with ad hoc trial and error experimentation" (p. 1230). BMC, however, offers an important starting point for businesses to define and innovate their business models (Osterwalder et al., 2010). Many existing BMIfS support types are based on the conventional BM construct, thus inheriting BM and BMI inconsistencies (Pieroni et al., 2019). Finally, no overarching framework covers BMIfS end-to-end, and little is known about how specific components, types, and stages of BMIfS work are addressed by existing types of support (Pieroni et al., 2019).

In this article, we review support types developed by researchers by examining their compatibility to facilitate innovation across BMIfS process stages, components, and types, as well as their versatility across industries and rigorous testing and validation. We extend previous reviews, namely Bocken et al. (2019) and Pieroni et al. (2019), which reviewed existing types of support for BMIfS. Bocken et al. (2019) focused solely on tools for circular BMI, elaborating on their purposes, characteristics and forms, user groups, and validation. Pieroni et al. (2019) focused on approaches for BMI for circular economy and sustainability, evaluating them on sensing, seizing, and transforming as stages of BMI. However, the level of support provided by the existing types of support for BMIfS across different stages, components, and types of BMIfS remains a significant knowledge gap. In this review, we delve deeper into these aspects than the reviews available. For instance, although several types of support have been produced for different BMI stages, further research is needed to bridge the design–implementation gap (Baldassarre et al., 2020a). Similarly, when it comes to specific types of BMIfS, such as acqui-

sitions to renew BMs, the extent to which existing support adequately addresses these needs remains unexplored (Meglio, 2020). The absence of comprehensive knowledge about the effectiveness of different types of support for BMIfS makes it arduous for business practitioners to choose optimal assistance for their specific tasks (Bocken et al., 2019). Likewise, researchers encounter challenges in pinpointing areas where they can make meaningful contributions to facilitate the progress of BMIfS. Consequently, this article addresses the following overarching research question:

RQ: What types of support for BMIfS are available to business managers, and what dimensions of BMIfS do these types support?

To operationalise this research question, we focused on categorising the existing types of support based on the BMIfS innovation stage, BMIfS type, and BMIfS component they address. We also examined the degree to which they have been tested and validated.

This study contributes to both scholars and business practitioners. For scholars, it offers an overview of the existing types of support for BMIfS. It evaluates how these support types facilitate the various stages of BMI, the components of BMIfS, and the four types of BMIfS. It follows the advice of Baldassarre et al. (2020a) and breaks down the BMIfS process into multiple dimensions, including stages, components, and types, highlighting areas requiring more attention. As a result, we suggest avenues for further research in the emerging field of BMIfS. To business practitioners, this research offers a repository of the available types of support. It assists them in their efforts to innovate their SBMs by helping them quickly understand which types of support are suitable for different dimensions of the BMIfS process.

Table 1. Overview of the Existing Reviews Related to this Study.

Author and Year	The Focus of The Paper	Findings	Comment
Bocken et al. (2019)	Providing an overview of existing circular BMI support types	Identification of 13 circular BMI tools	Focuses solely on circular BMI
Pieroni et al. (2019)	Providing an overview of the existing support types for circular or sustainable BMI	Identification of 92 approaches to circular or sustainable BMI	It covers both circular and sustainable BMI
This paper	Providing an overview and categorization of available types of support for BMIfS	Identification of 40 types of support for BMIfS	Focuses solely on the BMIfS process and evaluates support types across five dimensions of BMIfS.

The remainder of this paper is structured as follows: The primary underlying concepts are discussed in Section 2, while Section 3 describes the systematic literature review process in detail. This is followed by a display of the results in Section 4,

which are discussed in Section 5. Section 6 concludes and suggests further research needed in the field of BMIfS.

The Underlying Concepts: Sustainability and Business Models

This section briefly discusses the main underlying concepts used in this study: BM, business model innovation (BMI), SBM, and BMIfS.

BMs and BMI

The term **business model**, introduced in the mid-1970s (Zott et al., 2011), has gained increasing attention, particularly in the mid-late 1990s, during the dot.com boom (Foss & Saebi, 2017). Since then, the term has been the focus of lively discussions (Massa et al., 2017) and has become its own research stream (Zott et al., 2011). Both business practitioners and scholars participate in these discussions. This development has been fuelled by changes in the dynamics of the business environment, including technological advancement, increased globalisation (Teece, 2010), and the quest for sustainability (Nidumolu et al., 2015). Likewise, as an '*outgrowth*' of BM literature (Foss & Saebi, 2017), the innovation of BM has turned into a separate field of research (Schneider & Spieth, 2013).

Although the literature on BMs has evolved rapidly, a standard definition has yet to be achieved. Most commonly, a BM refers to the logic of how a company creates, delivers, and captures value (Teece, 2010). BMs are closely linked to business strategy. Casadesus-Masanell and Ricart (2010) argue that the BM is "a reflection of the firm's realised strategy" (p. 205). Similarly, Smith et al. (2010) defined BMs as a:

> Design by which an organization converts a given set of strategic choices—about markets, customers, value propositions—into value, and uses a particular organizational architecture—of people, competencies, processes, culture and measurement systems—in order to create and capture this value. (p. 450).

Researchers also refer to BMs as a means for an organisation to achieve its goals. Massa et al. (2017) argue that a BM is a "description of an organisation and how that organisation functions in achieving its goals (e.g., profitability, growth, social impact)" (p. 73). In our understanding, BM refers to the logic of how a company operationalises its strategy and serves as a means to achieve company goals.

BMs are not only an outcome of innovation but can also be a source of innovation themselves (Chesbrough, 2010). The term 'innovation of BMs' has gained increased attention among scholars (Massa et al., 2017) and is perceived as crucial in achieving and maintaining a competitive advantage (Christensen et al., 2018). Consequently, BMI has emerged as a research stream. However, scholars have no consensus on a unique definition of BMI (Schneider & Spieth, 2013). Typically, BMI refers to a transformation or change process (Geissdoerfer et al., 2016) that leads to the "discovery of a fundamentally different business model in an existing

business" (Markides, 2006, p. 20) by changing "the core elements of a firm and its business logic" (Bucherer et al., 2012, p. 184). Considering mergers, acquisitions, and the creation of entirely new BMs, BMI can lead to "transformation from one business model to another within incumbent companies or after mergers and acquisitions, or the creation of entirely new business models in start-ups" (Geissdoerfer et al., 2016, p. 1220). Therefore, BMI is a process of changing and transforming an existing business model (Geissdoerfer et al., 2016).

Research has highly emphasised the BMI process, leading to the development of various approaches to support it (Schneider & Spieth, 2013). Such approaches aim to increase the understanding of the BMI process and support business managers conducting BMI. For example, Frankenberger et al. (2013) developed the 4I framework, which identified four key stages of the BMI process: initiation, ideation, integration, and implementation. The initiation stage of the BMI process focuses on understanding and monitoring the business environment and the needs of stakeholders. The ideation stage explores opportunities and generates ideas for BMs. The integration stage focuses on developing promising ideas from the ideation stage into viable BMs (Frankenberger et al., 2013). At this stage, the aim is to "integrate all pieces [value creation, delivery, and capture] of their new business model" (Frankenberger et al., 2013, p. 14). The last stage focuses on implementing a fully designed and integrated BM into a business.

SBMs and BMIfS

SBMs refer to BMs focusing on enhancing sustainability. This term can often be misleading and interpreted as BMs' longevity or financial viability. In contrast, we interpret SBM as sustainable in broader terms, including the economic, social, and environmental pillars of sustainability. To increase readability, we have chosen to use the term SBM when the focus is on business models and the term BMIfS when we focus on the innovation of the BMs. SBMs help integrate sustainability at the core of business activities and serve an expanded list of stakeholders, including the environment and society at large (Stubbs & Cocklin, 2008). Stubbs and Cocklin (2008) define SBMs as models "where sustainability concepts shape the driving force of the firm and its decision-making" (p. 103). Abdelkafi and Täuscher (2016) also argue that SBMs "incorporate sustainability as an integral part of the company's value proposition and value creation logic … [and consequently] … provide value to the customer and the natural environment or society" (p. 75). Concerning the expanded list of stakeholders, Bocken et al. (2014) argued that SBMs align the "interests of all stakeholder groups and explicitly consider the environment and society as key stakeholders" (p. 44).

The study of BMIfS, while still in its nascent phase, has witnessed a surge of interest in recent times within academic circles (Geissdoerfer et al., 2018). The increased awareness and growth in the literature on BMIfS is explained by a) increasing

attempts to integrate sustainability objectives into BMs (Baldassarre et al., 2017), b) the effectiveness of BMI for sustainability to achieve sustainable development compared to other sustainability initiatives (Evans et al., 2017; Roome & Louche, 2015; Schaltegger et al., 2012), and c) the perception that sustainability drives the competitive advantage of the business (Bocken & Geradts, 2020). Scholars have provided several definitions of BMIfS (Geissdoerfer et al., 2018). The focus of these definitions varies from change (Bocken et al., 2014) and incorporation (Geissdoerfer et al., 2016) to "conceptualisation and implementation" (Geissdoerfer et al., 2018, p. 405). Bocken et al. (2014) refer to BMIfS as innovations that "create significant positive and/or significantly reduced negative impacts for the environment and/or society, through changes in the way the organisation and its value-network create, deliver value and capture value (i.e., create economic value) or change their value propositions" (p. 44). Geissdoerfer et al. (2016) defined BMIfS as a process of "incorporating sustainable value and a proactive management of a broad range of stakeholders into the business model" (p. 1220). Such a stakeholder management approach enables businesses to understand stakeholders' needs and deliver on the 3Ps (profits, people, and planet).

BMIfS is experimental and discovery-driven; as such, it is highly dynamic and iterative (Geissdoerfer et al., 2016; Baldassarre et al., 2017; Cosenz et al., 2020). It may include multiple adjustments of the BM components, multiple rounds of data collection, the development of prototypes, and internal and external testing (Mignon & Bankel, 2022). During these iterations, external stakeholders, such as customers and business partners, are often involved in BM development and testing (Baldassarre et al., 2017). Acknowledging the nature of BMIfS, approaches such as systems dynamics and design thinking are critical in designing support types for BMIfS (Cosenz et al., 2020). Systems dynamics "adopts a systemic perspective for mapping value generation processes and underlying BM variables, thereby integrating feedback loops, accumulation and depletion processes of strategic resources, time delays, and nonlinear interplays among BM elements" (Cosenz et al., 2020, p. 656). Design thinking is a "deliberately iterative [method for designing innovative solutions] and aims to rapidly develop and test multiple possible solutions to arrive at an optimal one" (Geissdoerfer et al., 2016, p. 1220). As such, researchers call for utilising systems dynamics and design thinking in designing types of support for BMIfS (Geissdoerfer et al., 2016; Baldassarre et al., 2020a; Cosenz et al., 2020).

Although research on BMIfS has increased, and new types of support for BMIfS have been developed, implementing SBMs remains challenging (Ritala et al., 2018). Research on BMIfS falls short in exploring the implementation of SBMs (Weissbrod & Bocken, 2017), resulting in a design–implementation gap (Baldassarre et al., 2020a). Implementation challenges are due to various institutional, strategic, and operational barriers (Bocken & Geradts, 2020). At the institutional level, focusing on maximising shareholders' value, uncertainty avoidance, and short-termism aimed at maximising profits hinder the conducting of BMIfS (Bocken &

Geradts, 2020). Bocken and Geradts (2020) found that functional strategy, focus on exploiting existing capabilities, and prioritising short-term growth are barriers at the strategic level. Lastly, at the operational level, focus on functional excellence, standardised innovation processes, limited resources, incentive systems based on immediate financial results, and dominant financial metrics in place impede the implementation of BMIfS (Bocken & Geradts, 2020). Similarly, difficulties in delivering the 3Ps, integrating technology innovation in BMI, and engaging in extensive stakeholder interactions hinder BMIfS implementation (Evans et al., 2017).

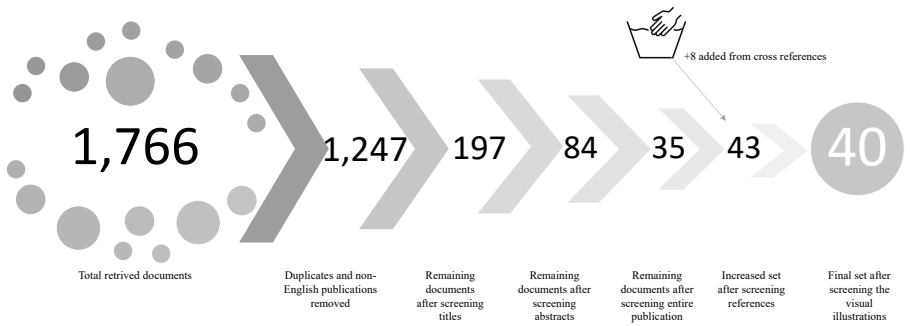
BMIfS involves multiple BMI types and components. There are four types of innovations suitable for sustainability (Geissdoerfer et al., 2018): 1) transformation, 2) diversification, 3) acquisition of SBMs, and 4) sustainable start-ups. Such innovation types can lead to incremental innovations in the existing BMs to radical/breakthrough transformations (Geissdoerfer et al., 2018). The existing players in the market actively develop new BMs focusing on sustainability while constantly scanning the market for new born-sustainable start-ups as potential acquisition targets (Geissdoerfer et al., 2018). Furthermore, innovations suitable for sustainability can be divided into components. Studying the anatomy of BMIfS, Shakeel et al. (2020) argued that BMIfS is a configuration of three components: "sustainable value proposition innovation (SVPI), sustainable value creation and delivery innovation (SVC & DI), and sustainable value capture innovation (SVCI)." These are the key components of a BM (Teece, 2010) and show that BMIfS is a subset grounded in BM principles (Shakeel et al., 2020). BMIfS often involves two or all three components of the BM, as they are interrelated.

Methodology

Literature Review Process

This article employs a systematic literature review to identify the existing types of support for BMIfS. In our systematic review, we followed the guidelines of Peters et al. (2015), Saunders et al. (2019), Weeks and Strudsholm (2008), and Okoli and Schabram's (2010) eight-step process. The review process is illustrated in Figure 1.

Figure 1. Overview of the Literature Screening Process



First step: Identifying the purpose of the literature review

First, we clarified the purpose and goals of the literature review. Our aim equals the goal of the review: to provide a comprehensive overview and categorisation of types of support for BMIfS. The purpose was to identify publications that support business practitioners pursuing BMIfS. We use the term support types as a collective term for frameworks, tools, and process models.

By frameworks, tools, and process models, we mean:

- Framework: A written or visually displayed output explaining the studied issue, focusing on elements, variables, and their relationships (Maxwell, 2012).
- Tool: An entity of instruments to support, enable, and guide the implementation of ideas and concepts (Pieroni et al., 2019).
- Process model: A series of steps taken to complete a task (Bocken et al., 2019).

Second step: Securing a shared understanding between the authors

This study involved two authors. We established a clear and well-defined review process and agreed upon it to ensure consistency in the review process. In step one, both authors developed a shared understanding of the following:

We sought to identify available types of support for BMIfS and categorise them based on five dimensions: BMIfS innovation stages, BMIfS types, BMIfS components, dynamic and iterative perspectives, and validation status. The selection criteria for the literature search were as follows: a) journal articles are available in the selected databases, b) published material is written in English, and c) search words should be present in the title or abstract of the publication.

Step 3: Agreeing on keywords to use and searching for the literature

We used a combination of relevant search words in three major academic databases: Elsevier Scopus, Web of Science, and Wiley Online Library. The search words included business model, innovation, design, sustainability, frameworks, and tools.

Following the methodology applied by Pittaway et al. (2004), operators/Booleans "AND" and "OR" were used to create the following search string *("business model*" AND sustainab* AND innovation OR design* AND tool* OR framework*).* This initial search yielded 1,766 documents and allowed us to identify and remove duplicate and non-English documents from the initial sample, resulting in a sample size of 1,247.

Step 4: Screening the titles

The first round of screening involved reviewing the titles of 1,247 documents. All titles indicating the development of a new or upgrading existing framework or tool for BMIfS were selected and transferred to the following step. The trace of this step can be seen in Table 3, where we **bolded** terms/words in the titles of the qualified articles. This screening round resulted in 197 (15.8 %) selected documents.

Step 5: Screening the abstracts

We thoroughly analysed and filtered the abstracts of the 197 documents in the same way as in Step 4. During this process, abstracts that did not confirm the development of a type of support related to BMIfS were excluded from the sample. As an example, we excluded Bradley et al. (2020) because they focused on the functionality and sustainability of BMs but not on BMIfS. 84 (43 %) of these documents were selected for further analysis and consideration.

Step 6: Screening the entire publication

We thoroughly read and critically discussed 84 articles and chose only articles that provided a type of support explicitly designed to guide the BMIfS process, meaning that articles that did not offer a type of support for BMIfS were excluded. This round included 35 selected articles (42 %) from the 84. Appendix A lists the 84 articles and their specific reasons for inclusion/exclusion.

Step 7: Screening reference sections

We scanned and analysed the reference sections of the 35 selected articles. Those suggesting developing, updating, or upgrading a new type of support for BMIfS (eight articles) were added to the sample and analysed. Consequently, 43 articles (35 + 8) were selected for the final screening round.

Step 8: Removing duplicated support types

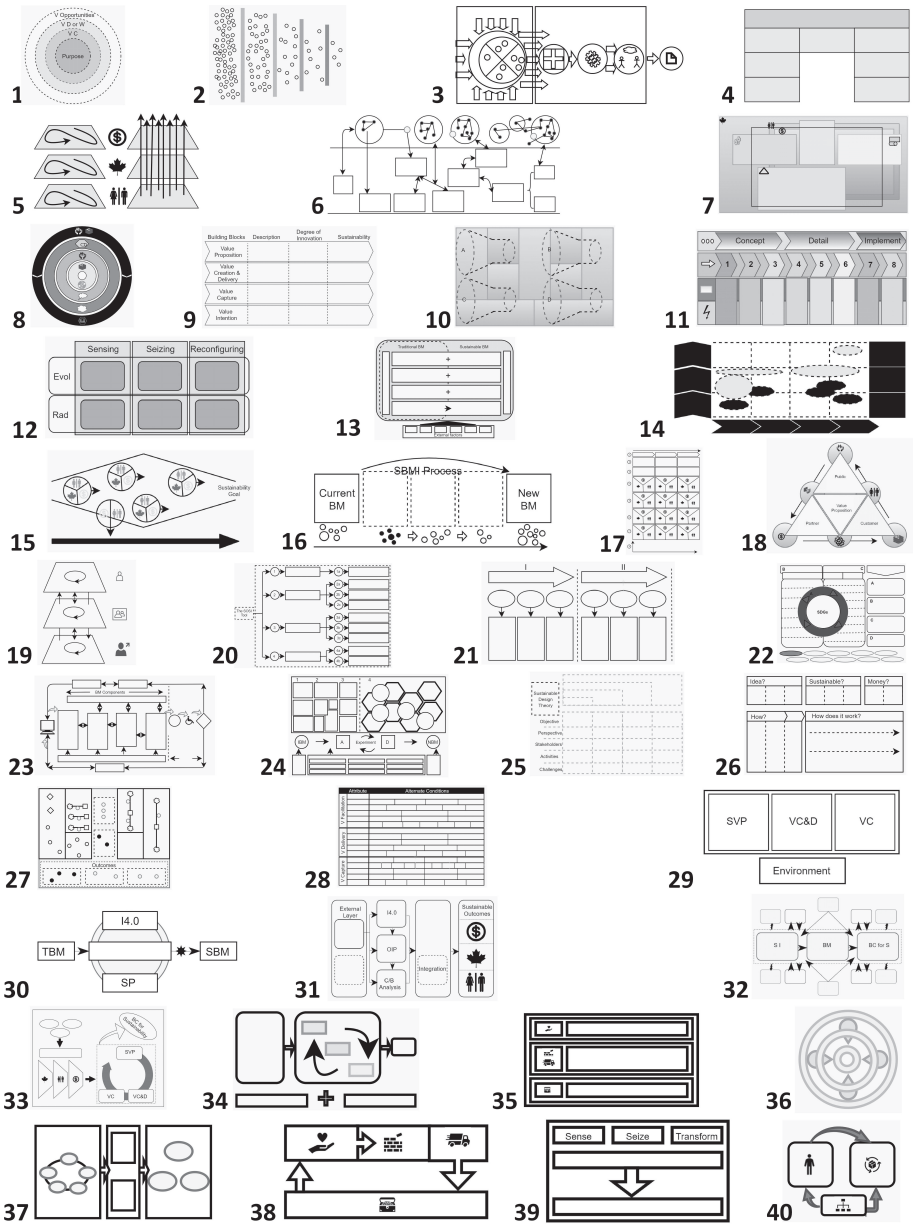
Both authors discussed and thoroughly analysed the 43 articles. This process involved a series of five meetings, an average length of 120 minutes. During this process, the authors discovered that some articles presented an initial type of support that was further refined in a later publication. In these instances, only the later publication was kept.

Sustainability is a broad concept that umbrellas multiple practices and approaches toward a more sustainable future, including circularity and circular BMs. Sustainability concerns balancing economic, social, and environmental dimensions, while specific approaches, such as circularity, focus on the environmental dimension (Geissdoerfer et al., 2020). Approaches such as circularity are beyond the scope of this article. An out-of-scope example is Bocken et al. (2018), who focused solely on circular BM experimentation and a circular economy. This final stage ensured that each selected article offered a type of support that specifically addressed BMIfS and offered a holistic approach to BMIfS.

We reduced the final example from 43 to 40 through the final screening round. See Table 2 for an overview of their references and Figure 2 for an overview of simplified pictograms illustrating their visualisations. Note that the numbering of the support types in Table 2 and Figure 2 corresponds to the figures and table in this article's result chapter and the two appendices, B and C.

Figure 2 and Table 2 create a quick and easy overview of available support types and show the sustainability debate's plurality.

Figure 2. Pictograms of the Identified Types of Support for BMIfS.



Note: Pictograms of the types of support are listed chronologically by year of publication. The pictograms in this figure simplify the figures presented in the publications listed in Table 2.

Table 2. List of Publications with Types of Support for Analysis.

No.	Title	Type of Support	Authors and Year
1	A value mapping **tool** for sustainable business modeling	△	Bocken et al. (2013)
2	**OM forum—business model innovation for sustainability**	●	Girotra and Netessine (2013)
3	Design thinking to enhance the sustainable business modeling **process** – A workshop based on a value mapping process	▢	Geissdoerfer et al. (2016)
4	Designing business models for sustainable mass customization: A **framework** proposal	●	Hora et al. (2016)
5	The triple-layered business model canvas: A **tool** to design more sustainable business models	△	Joyce and Paquin (2016)
6	Journeying toward business models for sustainability: A **conceptual model** found inside the black box of organisational transformation	▢	Roome and Louche (2016)*
7	An Ontology for Strongly Sustainable Business Models: Defining an Enterprise **Framework** Compatible With Natural and Social Science	●	Upward and Jones (2016)*
8	Bridging sustainable business model innovation and user-driven innovation: A **process** for sustainable value proposition design	▢	Baldassarre et al. (2017)
9	Towards a Conceptual **Framework** of Sustainable Business Model Innovation in the Agri-Food Sector: A Systematic Literature Review	●	Barth et al. (2017)
10	An **approach** to business model innovation and design for strategic sustainable development	△	França et al. (2017)
11	The Cambridge Business Model Innovation **Process**	▢	Geissdoerfer et al. (2017)
12	Business model innovation for sustainability: **exploring evolutionary and radical approaches** through dynamic capabilities	●	Inigo et al. (2017)
13	Transforming sustainability challenges into competitive advantage: Multiple-case studies kaleidoscope **converging into sustainable business models**	●	Morioka et al. (2017)*
14	Sustainable business models **through service design**	●	Prendeville and Bocken (2017)*
15	**Developing sustainable business experimentation** capability – A case study	●	Weissbrod and Bocken (2017)*
16	Value uncaptured **perspective** for sustainable business model innovation	●	Yang et al. (2017a)
17	Creating and Capturing Value Through Sustainability The Sustainable Value Analysis **Tool**	△	Yang et al. (2017b)
18	An eco-critical perspective on business models: The value triangle as an **approach** to closing the sustainability gap	●	Biloslavo et al. (2018*)
19	**Transformative** Sustainable Business Models in the Light of the Digital Imperative—A Global Business Economics Perspective	●	Brenner (2018)
20	Fostering sustainability-oriented service innovation (SOSI) through business model renewal: The SOSI **tool**	△	Calabrese et al. (2018)
21	Early phases of the business model innovation **process** for sustainability: Addressing the status quo of a Swedish biogas-producing farm cooperative	●	Karlsson et al. (2018)*

No.	Title	Type of Support	Authors and Year
22	From an ideal dream towards reality analysis: **Proposing Sustainable Value Exchange Matrix (SVEM)** from systematic literature review on sustainable business models and face validation	●	Morioka et al. (2018)*
23	Commercialization of eHealth innovations in the market of the UK healthcare sector: A **framework** for a sustainable business model	●	Oderanti and Li (2018)
24	Sustainable business model **experimentation** by understanding ecologies of business models	●	Bocken et al. (2019)
25	**Implementing** sustainable design theory in business practice: A call to action	●	Baldassarre et al. (2020a)
26	Addressing the design-implementation gap of sustainable business models by prototyping: A **tool** for planning and executing small-scale pilots	△	Baldassarre et al. (2020b)
27	Dynamic business modeling for sustainability: Exploring a system dynamics perspective to **develop** sustainable business models	●	Cosenz et al. (2020)
28	**Sharing economy** business models for sustainability	△	Curtis and Mont (2020)
29	Understanding sustainable business model: A **framework** and a case study of the bike-sharing industry	●	Gao and Li (2020)
30	**Sustainability Transition** in Industry 4.0 and Smart Manufacturing with the Triple-Layered Business Model Canvas	●	García-Muiña et al. (2020)
31	The perspective of capability providers in **creating** a sustainable I4.0 environment	●	Lardo et al. (2020)
32	Sustainable entrepreneurship, innovation, and business models: Integrative **framework** and propositions for future research	●	Lüdeke-Freund (2020)
33	Sustainable business model archetypes for the electric vehicle battery second use industry: Towards a conceptual **framework**	●	Reinhardt et al. (2020)
34	**Towards** Sustainable Innovative Business Models	●	López-Nicolás et al. (2021)
35	Business model innovation for sustainability: a new **framework**	●	Ferlito and Faraci (2022)
36	Digital sustainable business model innovation: applying dynamic capabilities **approach** (DSBMI-DC)	▢	Hajiheydari et al. (2022)
37	Two-Lenses Model to Unfold Sustainability Innovations: A **Tool** Proposal from Sustainable Business Model and Performance Constructs	△	Morioka et al. (2022)
38	Adding sustainable value in product-service systems business models design: A conceptual review towards a **framework** proposal	●	Moro et al. (2022)
39	**Fostering** business model innovation for sustainability: A dynamic capabilities perspective	●	Oliveira-Dias et al. (2022)
40	**Developing** Sustainable Business Models: A Microfoundational Perspective	●	Ringvold et al. (2022)

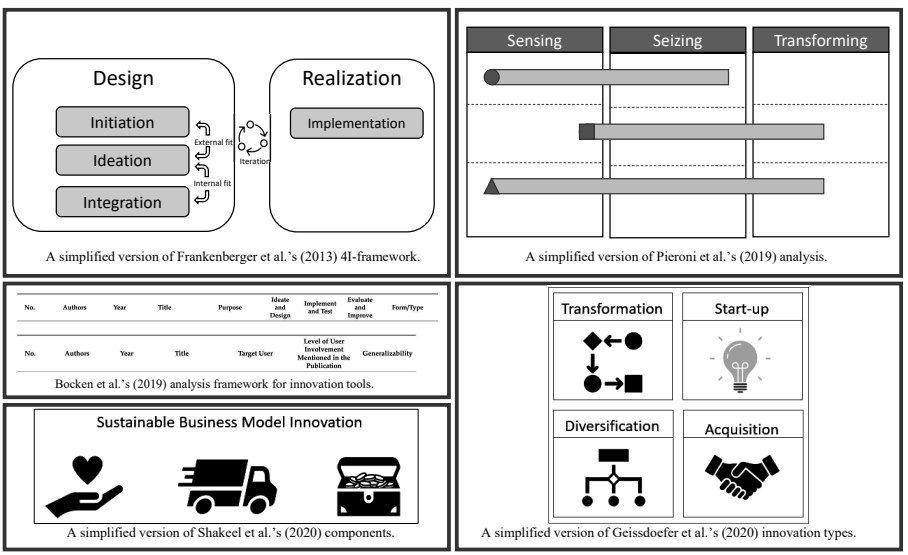
Legend: ● Framework △ Tool ▢ Process model

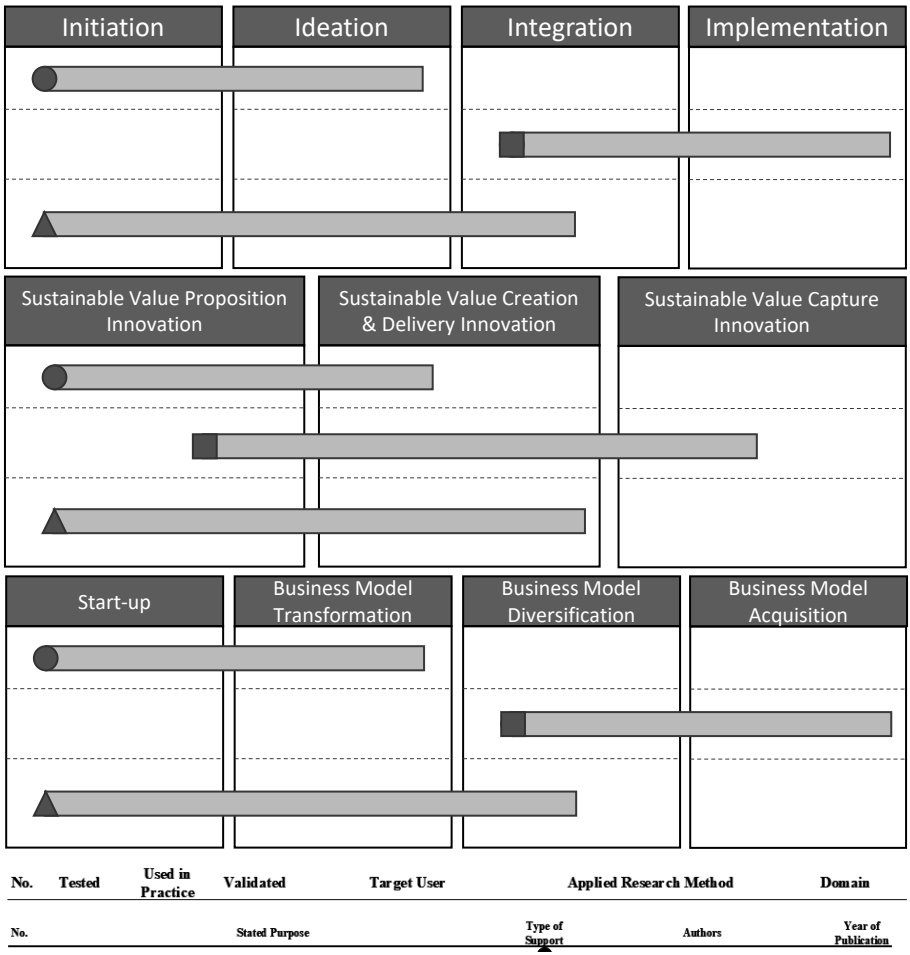
Bolded terms/words qualified the articles for selection | * Added after screening reference sections of the articles from step 6

Data Analysis

To analyse our dataset, we relied on four frameworks developed by researchers. First, we used the framework Bocken et al. (2019) developed to analyse the purpose, characteristics, forms, and validation of different support types, including testing with user groups. Second, we analysed the identified support types across the four BMI stages using the 4I framework developed by Frankenberger et al. (2013). Third, we used Shakeel et al.'s (2020) framework to analyse the identified support types across the three BMIfS components. Fourth, we utilised the four types of BMIfS developed by Geissdoefer et al. (2018) to categorise the identified types of support. Finally, we were inspired by Pieroni et al. (2019) to illustrate our findings. Figure 3 presents our framework for analysing the dataset.

Figure 3. Criteria Used to Analyse the Types of Support Identified in this Article





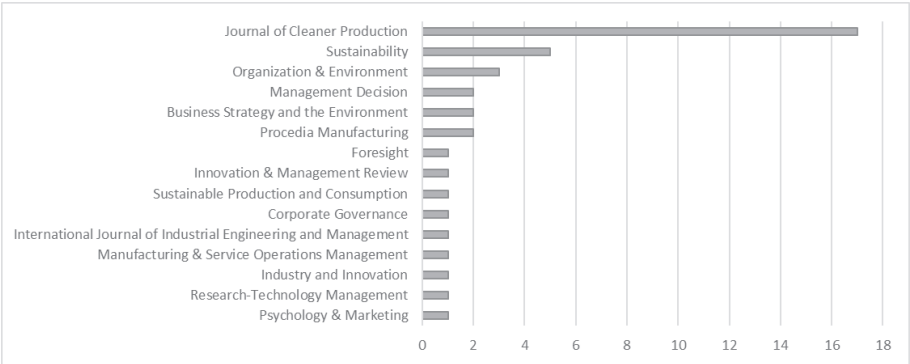
Results

This article identified 40 unique journal articles that included 40 types of support to guide business practitioners toward BMIfS after reviewing 1,766 publications. This section further scrutinises these articles.

The Journal of Cleaner Production published most of the 40 journal articles (43 %), while 14 other journals distributed the rest. Figure 4 shows the distribution of the publications by academic journal. A rapid increase in publications was found during 2016 and onwards (see Figure 5), with more than 79 % of the journals published from 2017 to 2022. This rapid increase in the number of publications has two explanations. First, many of the earlier publications call for the development of types of support to guide the innovation of SBMs (see Lüdeke-Freund, 2010; Zollo

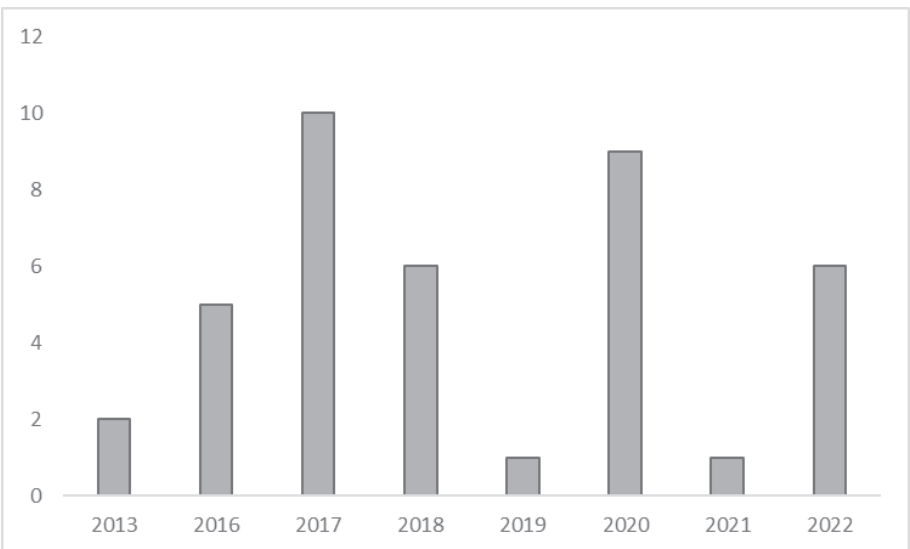
et al., 2013; Bocken et al., 2015; Roome & Louche, 2015). Second, Organization and Environment and the Journal of Cleaner Production issued two special issues on sustainability-oriented BMs in 2015 and 2018, respectively (Pieroni et al., 2019).

Figure 4. Distribution of the 40 Selected Journal Articles by the Journal



We identified types of support utilising the theoretical approach (28 %) and the experimental approach (72 %). The types of support developed from conceptual studies using literature reviews are theoretical, while those developed from case studies are experimental (Pieroni et al., 2021). Appendix B notes the details of the applied research methods in each document.

Figure 5. Distribution of the Selected Journal Articles by Year



Support Types and Related Purposes

Considering the *type of support,* the analysis identified that most (67 %) of the publications provided conceptual frameworks, while 20 % offered tools, and 13 % provided a process model for BMIfS. Regarding *purpose*, as displayed in Appendix C, each support type was developed to help understand and facilitate the BMIfS process. Typically, they focused on a) helping business practitioners understand the overall process, b) assisting in the design of SBMs, or c) guiding business managers to identify sustainability-oriented ideas. The identified support types offered different approaches to the innovation process, such as systems dynamics, design thinking, and experimentation. Key focus areas were stakeholder involvement and analysis, value mapping, and business transformation.

BMIfS Stages

According to the 4I framework presented in Figure 6, the support types were categorised, and it was observed that the implementation stage (stage 4) received the least coverage. On the other hand, stages 1 and 2 (initiation and development) were well covered, and stage 3 (integration) was often included in the support type.

Thirty-nine types of support cover two or all four innovation stages. The vast majority (95 %, 38 types of support) addressed both the *initiation and ideation stages*. Of all the identified types in this article, it is worth mentioning that *all tools and processes cover both the initiation and ideation stages,* whereas frameworks vary in this regard. Nevertheless, only two frameworks skip these first stages—frame No. 18 (Brenner, 2018) and No. 25 (Baldassarre et al., 2020a).

Twenty-three types of support focused on *the integration stage* of the process. Only one framework (No. 13) and two tools [No. 26 and 28] extend from the ideation to the integration stage. Also, one framework focuses solely on the integration stage [No. 25].

About 45 % (18 types of support) covered the *implementation stage*. No identified type maintains a sole focus on the implementation stage. This makes the implementation stage the least covered stage. Fourteen frameworks [No. 4, 7, 16, 18, 23, 27, 29, 30, 31, 32, 35, 38, 39, 40], one tool [No. 5], and two process models [No. 11, 36] extend to the implementation stage. It is worth mentioning that *one framework focuses solely on the last two stages*—integration and implementation—that is, framework No. 19.

In summary, at least one type of support addresses each BMIfS stage. The initiation and ideation stages of the process are the two most addressed stages, whereas integration and implementation are the least commonly addressed. The support types addressing all four stages focus on 1) bringing together stakeholders and considering their interests, 2) balancing economic, environmental, and social dimensions, 3) identifying starting points toward an SBM, including value uncaptured and waste,

and 4) planning and prototyping. However, no support type focuses solely on integrating or implementing SBMs, which is also considered the primary challenge for an SBM (Baldassarre et al., 2020b; Geissdoerfer et al., 2018). Both integration and implementation are challenging processes for business practitioners associated with high failure rates (Geissdoerfer et al., 2018). These findings are consistent with those of Baldassarre et al. (2020a, 2020b), who called for action to implement and execute SBMs successfully.

BMIfS Components

Figure 6 also presents each type of support according to each BMIfS component. Most (90 %, 36) addressed the first innovation component, a *sustainable value proposition*. Only two frameworks [No. 15 and 16] and two tools [No. 17 and 28] skip this component. One support type [No. 8] focuses solely on the value proposition component. Here, the identified support types consider stakeholders' perspectives and all three pillars of sustainability—economic, social, and environmental.

Most (98 %, 39 types) also addressed the second innovation component, *sustainable value creation and delivery*. Only two frameworks [No. 15 and 16] focused solely on value creation and delivery. Value creation was addressed from multiple perspectives, including uncaptured, missed, destroyed, absent, and surplus. More specifically, values missed and destroyed are present in two tools [No. 1 and 17] and two frameworks [No. 16 and 18]. The central premise is to help businesses recognise and turn the loss into a business opportunity. Furthermore, one framework [No. 18] jointly addresses value co-creation and co-delivery with relevant stakeholders. Smart manufacturing is considered a facilitator of sustainable value creation and delivery in two frameworks [No. 30 and 31].

The third innovation component, *sustainable value capture,* is the least addressed BM component. Support types addressing sustainable value capture focus on the BM's revenue and cost mechanisms. In total, 80 % (32 types of support) addressed sustainable value capture, and none focused solely on this innovation component.

Such findings show that multiple approaches to the innovation of BMIfS components have emerged, including a) focusing on the value uncaptured, value missed, and value destroyed to innovate sustainable value proposition and creation [No. 1, 16 17], b) focusing on value co-creation and co-delivery in innovating sustainable value creation and delivery [No. 18], and c) utilising Industry 4.0 and smart manufacturing in innovating sustainable value creation and value capture [No. 30, 31].

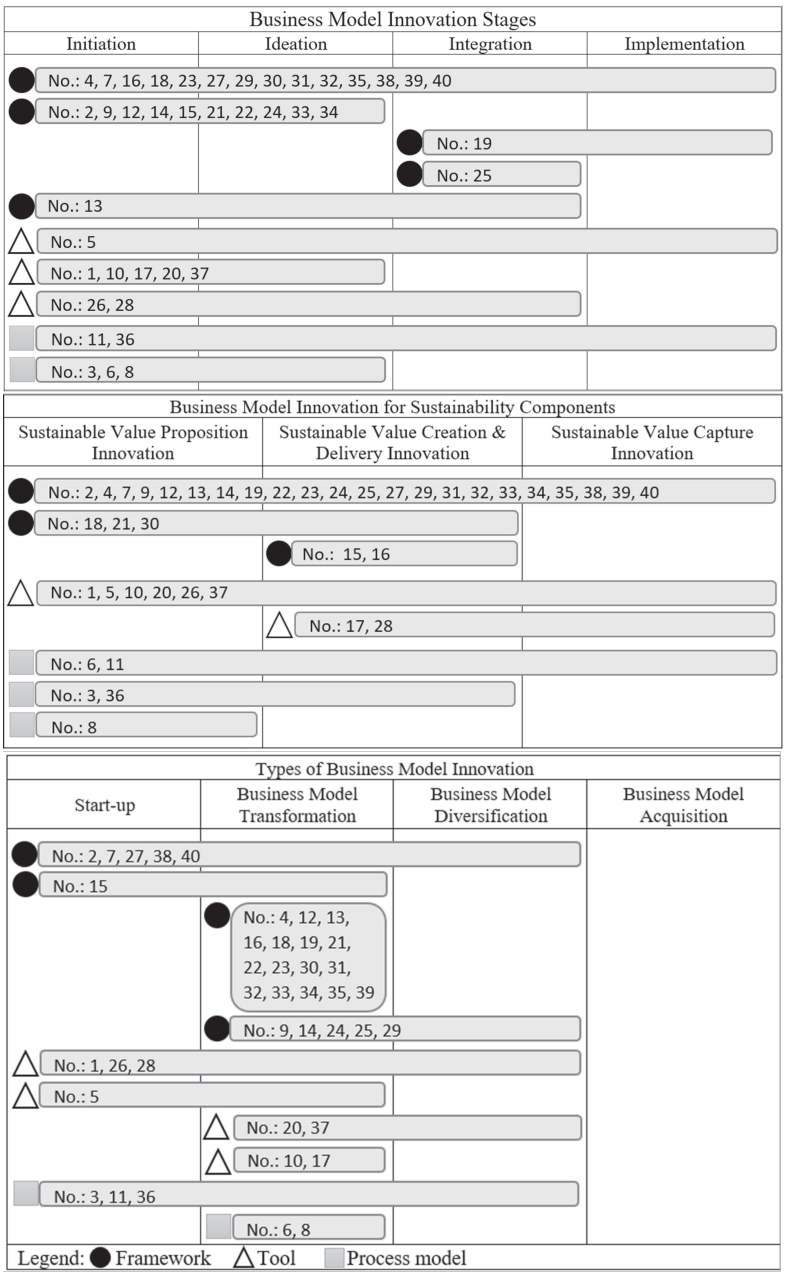
BMIfS Types

The selected types of support were analysed and categorised according to the innovation type they support (i.e., start-up, transformation, diversification, and

acquisition), as visually presented in Figure 6. One significant finding is that no support type addresses the fourth innovation type, BM *acquisition.*

One-third (13 types) encourage innovations that create a new organisation, representing the *first innovation type* of *start-up*; however, no support type is exclusively dedicated to supporting start-ups. The *second innovation type*, BM *transformation*, is the most common type of innovation addressed by all the 40 identified support types. Many solely focus on this innovation—namely, 16 of the identified frameworks [No. 4, 12, 13, 16, 18, 19, 21, 22, 23, 30, 31, 32, 33, 34, 35, and 39], two of the tools [No. 10, 17], and two of the process models [No. 6 and 8]. Those types of support initially focus on analysing existing BM to identify opportunities to improve their value proposition, creation, delivery, and capture. Two frameworks [No. 30 and 31] rely on Industry 4.0 and smart manufacturing to facilitate transformation. The framework offered by Baldasarre et al. (2020a) [No. 25] takes a broader perspective on this transformation, pushing for sustainable collaborative design, which calls for firms to collaborate with other organisations in their sector or industry to improve sustainability practices and transform the overall sector or industry.

Figure 6. BMI Stages, BMIfS Components, and BMIfS Types Supported by the Identified Types of Support



Twenty types of support focused solely on BM *transformation*, showing the need to support incumbent companies in their journey toward an SBM. They also support the innovation process, which creates a new sustainable organisation (start-ups), and BMI diversification, which creates an additional BM. However, none focuses exclusively on start-ups or diversification types or addresses BM acquisition, although identifying, acquiring, and integrating a new SBM into an existing organisation is complex and challenging. This finding could indicate a great need to develop support types to assist organisations during acquisition processes, as there may not be any suitable BMIfS support.

Eighteen types of support (45 %) address the *third innovation type,* BM *diversification*. None focused solely on diversification, and most focused on both start-up and BM diversification. This is mainly because they focus on establishing new SBMs within existing firms, resulting in business portfolio diversification.

Adapting a Dynamic and Iterative Perspective

BMIfS is a dynamic and iterative process that requires stakeholder dialogues, defining problems, and a line of experiments and tests. Most of the identified types of support embrace a dynamic and iterative perspective. Systems dynamics, sustainable design, business experimentation, and sustainable entrepreneurship serve as approaches to developing these types of support. Furthermore, they employ an experimental approach, engaging in workshops with business practitioners to bring forward process dynamics within a business setting. As one of the types of support [No. 8] that adopted a dynamic and iterative perspective, Baldassarre et al. (2017) stated that their proposed type of support "goes a step further, adopting a dynamic and iterative perspective (talking to stakeholders, thinking about the problem, testing the product/service) that leads to an actual sustainable value proposition and to a superior problem-solution fit" (p. 184). They help business practitioners map, understand, and incorporate stakeholders' needs in enriching their value proposition toward an SBM.

Several support types use the BMC as the basis for developing BMIfS support. Eight support types (20 %) [No. 4, 5, 7, 10, 23, 26, 27, and 34] build on the BMC. The use of the BMC to develop types of support for BMIfS may limit its intended impact. As Gibson and Jetter (2014) claim, it does not facilitate the experimentation and iterations needed for BMI. However, numerous types of support tend to be linear and highly depend on the BMC by Osterwalder et al. (2010), which is static, limited within its nine-block blueprint, and limits trial-and-error experimentations. Considering the nature of the BMIfS and the limitations of the BMC, this article argues that the BMC may not be satisfactory in helping business managers design and implement SBMs.

The Extent to Which Support Types Were Tested and Validated

We evaluated whether the authors of the reviewed papers had tested and validated the presented support types and if they were industry-specific or generic. This evaluation is based on the results presented by the authors of the reviewed articles on whether and how the developed type of support was tested. Less than half (45 %) had been tested and validated. Researchers performed testing and validation primarily via the workshops they facilitated. Typical workshop participants included business practitioners, entrepreneurs, researchers, and students. The need for these workshops to be facilitated by the researchers may indicate that business practitioners cannot understand and use existing types of support intended to facilitate BMIfS in practice. Other indications could be that business practitioners are not aware of them or that they prefer external assistance while exploring support types. This may also indicate that business practitioners appreciate the external perspective they receive when others facilitate these workshops. Potential application difficulties may hinder the intended impact of these support types in helping business practitioners in their journey toward an SBM. This finding is consistent with Geissdoerfer et al. (2016), who determined the need for comprehensive and user-friendly frameworks and tools to facilitate BMIfS. This need is, in many cases, mandatory. Also, no support type provides guidelines for the intended audience. Consequently, business practitioners may find them very complex to apply in their settings; hence, they are prevented from benefiting from the developed types of support.

In terms of domain, most of the selected support types are generic. As illustrated in Appendix B, 14 types of support are specific to a particular sector/industry. There is no consistency across these domains; no industry/sector appears more frequently than others. Twenty-six types of support for BMIfS can be classified as generic and applied to many companies across all industries. Those that focused on a specific sector or industry showed a need to refine generic support types to gain full value. In each case, the particular BMIfS process dimensions presented in Figure 6 need to be addressed differently depending on the sector's characteristics, industry, market, or company size. For example, Karlsson et al. (2018) addressed specific elements related to biogas-producing farms.

Discussion

This section focuses on three main sub-sections, discussing a) the main findings of this study, b) our contribution to scholars and recommendations for further research, and c) our contribution to business practice.

Key Research Findings

This article presents a comprehensive review of the existing types of support developed to facilitate the BMIfS process. We identified 40 types of support for BMIfS through a systematic literature review of searches from the Web of Science,

Elsevier Scopus, and Wiley Online Library databases. Identified types of support were designed for various purposes, including unlocking sustainability innovations, generating and brainstorming sustainability-oriented ideas, assisting in piloting those ideas, designing sustainable value propositions and sustainable value chains, implementing SBMs, and understanding the overall process of BMIfS. This review evaluates the types of support for BMIfS across five dimensions: BMIfS innovation stage, BMIfS type, BMIfS component, a dynamic and iterative perspective, and validation status.

A key finding is that the identified types of support tend to focus on the BMI process and its dimensions but overlook the need to expand on the understanding of sustainability. It is often assumed that organisations already have an established understanding of sustainability, which may not be the case. Traditional BMI is already complex (Foss & Saebi, 2017), and adding the sustainability component adds to that complexity. Sustainability is not easily integrated into the business agenda, and many business managers do not naturally feel ownership of it. Hermelingmeier and von Wirth (2021) argue that sustainability learning is mandatory in understanding the "multidimensionality of sustainability-related change processes in firms" (p. 1839). Addressing sustainability may fall out of an organisation's knowledge base and capabilities, and managers are not well-equipped to respond to sustainability (Porter & Derry, 2012). Our results show that existing types of support for BMIfS do not focus on helping managers understand sustainability challenges or capture opportunities embedded in sustainability. Further, Bocken and Geradts (2020) identified multiple institutional, strategic, and operational barriers to BMIfS. They argued that at the institutional level, firms tend to focus on maximising shareholder value, avoiding uncertainty, and short-term goals. At the strategic level, firms focus on exploiting existing BMs and capabilities and prioritising short-term growth, while at the operational level, they prioritise functional excellence and financial metrics. These barriers are too critical to avoid when addressing BMIfS, and the existing types of support do not necessarily show the way around them.

A second key finding was that most of the identified support types for BMIfS did not specify the particular stages of the process, components, or types they contribute to. Only two support types [No. 21 and 26] contextualise the BMIfS stage to which they contribute. Karlsson et al. (2018) explicitly focus on the early stages, initiation, and ideation, while Baldassarre et al. (2020b) see planning and executing small-scale pilots as contributing to the implementation stage. Although other support types contribute to one or more BMI stages, they do not explicitly state them. Similarly, only Baldassarre et al. (2017), Yang et al. (2017a), and Yang et al. (2017b) conceptualise and state the BMIfS components to which they contribute. Regarding BMIfS types, the identified support types do not conceptualise the type of BMIfS to which they contribute. Such results can be interpreted as researchers did not link the developed support types to specific types of BMIfS. If so, these support types risk being perceived as too generic and not regarded as

practical to business practitioners. Such findings are consistent with those of Pieroni et al. (2019) in their review of approaches to BMIfS.

A third key finding is that while many approaches, such as design thinking, experimentation, and systems dynamics, are used for designing types of support, most of the existing types of support are static and are based on the BMC. Though these support types add new layers, stocks, and flows to the traditional BMC, they are still confined within its boundaries. As a result, their ability to adapt to different stages, components, and types of BMIfS is limited, as discussed earlier. This also curtails their effectiveness in facilitating experimentation, testing, and line of iterations, which are crucial in innovation for an SBM.

A fourth key finding is that existing types of support prioritise the BMIfS components, such as sustainable value proposition, creation, and delivery innovation, over the sustainable value capture innovation component. To design new SBMs, managers must develop proper revenue and cost structures to capture economic, environmental, and social value (the triple bottom line) (Shakeel et al., 2020). Although they naturally focus more on economic benefits, business managers need to remember the importance of capturing social and environmental value as well. By doing so, they can facilitate the development of business cases around sustainable solutions and evaluate the financial implications of BMIfS. This will ultimately aid in overcoming obstacles to BMIfS at the institutional, strategic, and operational levels.

A fifth key finding is a lack of support types addressing BMIfS *acquisition*. Many incumbents tend to innovate their business toward an SBM by acquiring new start-ups that are already sustainable (Meglio, 2020). Acquisitions may involve many steps, such as start-up scanning, selection, integration, or other management forms, which can be challenging for business practitioners.

A final key finding is that business practitioners have only validated and tested limited types of support. None offers user guidelines. As a result, this may limit their application in business settings and hinder their goal of facilitating business in their BMIfS efforts.

Contribution to Research

This research examined 40 types of support for BMIfS available to business practitioners and categorizes them across five dimensions of BMIfS: BMIfS innovation stage, BMIfS type, BMIfS components, dynamic and iterative perspective, and validation status. Such a multidimensional analysis enables us to put forward a few recommendations for researchers in their attempts to support BMIfS implementation.

First, we encourage the development of types of support that address the overall BMIfS process from the inception of the need for an SBM until its implementa-

tion. Recognising the significance of sustainability is a pivotal step in the journey toward an SBM, as it helps put forward the direction of BMI efforts and fosters a comprehensive understanding of sustainability among individuals within organisations and its implications for them. As a result, the implementation of the BMIfS may be smoother. Additionally, the implementation stage needs a more thorough investigation in terms of the way it unfolds, what some of the main barriers and challenges could be, and how they could be addressed. This is in line with Baldassarre et al. (2020a), who suggested that "by diving deeper into this complex and multifaceted problem [implementation], it is possible to break it down into its underlying variables, resulting in smaller and more manageable subjects to focus on" (p. 13). Doing so would help business practitioners with the implementation stage of the BMI process as an under-investigated stage and would assist businesses in succeeding in their BMIfS efforts.

Second, we encourage scholars to acknowledge the four types of BMIfS and their unique nuances when designing types of support for BMIfS. Most existing support types address the transformation type to help incumbents transform into an SBM. However, few studies have focused on diversification, start-ups, or acquisitions. No type of support exists for BMIfS through acquisitions, although incumbents are increasingly targeting more sustainable acquisitions. We encourage scholars to address the process of acquiring born-sustainable start-ups and offer support types and guidelines for incumbents to identify such targets and integrate and manage them in their portfolios.

Third, we encourage the development of approaches to BMIfS, applying design thinking, experimentation, and systems dynamics to capture the dynamics and iterations of the BMIfS process. In line with Baldasarre et al. (2020b), we argue that design thinking and experimentation would allow businesses to experiment, test, and iterate new business model ideas very early in the process and quickly. This would make the BMIfS process quicker and failures along the process less costly and, hence, less risky. Consequently, such developments would help address challenges such as complexity, cost, and risk of failure, which contribute to businesses' hesitation to engage in BMIfS.

Finally, we encourage scholars to develop easy-to-use types of support that are validated, tested, and accompanied by user guidelines for practitioners. As most of these types of support aim to close the design–implementation gap and facilitate businesses in their BMIfS efforts, ease of use is critical for them to find applications in business settings. This would be confirmed by testing and validating them with businesses during the development, gathering feedback from the business practitioners, and improving them. This often requires a longer testing time as adding the sustainability component makes the already complex BMI process more complex (Geissdoerfer et al., 2018). Collaborations between incumbents and government support (funding) should consider this and provide the environment and timeframe

to test this in a protected, supported, and sustainable manner. Otherwise, this may remain an incremental endeavour. Considering that a limited number of existing types of support are tested in business settings, accompanying these types of support with clear guidelines would also help them find applications among business practitioners. Such guidelines should be clear to follow without the need to be facilitated by the authors or consultants.

Contribution to Business Practice

This article may serve as a database of support types for BMIfS for business practitioners. By categorising the available types of support for BMIfS across five dimensions, we contribute to business practices by identifying the specific support types relevant to different stages, components, and types of BMIfS. Further, it shows business practitioners which types of support have been validated and tested previously.

We invite the business community to collaborate with researchers to help improve the existing types of support for BMIfS. We encourage businesses to serve as case studies in different research projects and to engage more actively with scholars. This would enable researchers to understand the BMIfS process within business settings better. As a result, they could draw better conclusions on the process and improve existing types of support, leading to better support types for BMIfS. Furthermore, we encourage businesses to participate in testing newly developed types of support and providing feedback. Such collaboration would benefit the businesses themselves and advance the research on BMIfS.

Conclusion and Limitations

We aimed to review and categorise existing types of support for BMIfS. We posed the research question: What types of support for BMIfS are available to business managers, and what dimensions of BMIfS do they support? To do so, we investigated the support types available to support BMIfS. Through the literature review, we identified 40 types of support. One of the main contributions of this article is the comprehensive overview and categorisation it offers of these support types. This overview and categorisation make it easier for scholars and business practitioners to decide which support types to rely on in their BMIfS processes. The categorisation and summary provide quick insight into the variations within the BMIfS research.

Finally, in this article we put forward recommendations for scholars on how different types of support for BMIfS can be improved. Specifically, we encourage scholars to acknowledge the need to enhance the understanding of sustainability among practitioners, highlight BMIfS stages, components, and types that require more attention, and encourage adapting a dynamic and iterative perspective. Finally, we call for user-friendly support and user guidelines to increase adoption among business practitioners.

Limitations

This article is subject to a few limitations. First, the search for articles was performed on three major academic databases, leaving out nonpeer-reviewed material that could be relevant to the study. Other types of support might not be included in the selected databases, so there is a risk of selection bias. Second, the words "process" and "implementation" were not part of our search string, but they came forward during the analysis. For this reason, we recommend that future researchers include these terms in their research string. Third, research on BMIfS is growing exponentially, and new types of support may have been developed while this paper was in writing.

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Appendix A. List of 84 documents from step 6 in the screening process

No.	Author(s) and Year	Title	Selected for the Final Set?	Reasons for Inclusion/ Exclusion
1	Short et al. (2012)	Embedding Sustainability in Business Modelling through Multi-stakeholder Value Innovation	No	Bocken et al. (2013) is the updated version of the tool
2	**Bocken et al. (2013)**	**A value mapping tool for sustainable business modeling**	**Yes**	**Tool mentioned in the title; included as nr 1**
3	**Girotra and Netessine (2013)**	**OM Forum—Business Model Innovation for Sustainability**	**Yes**	**Framework mentioned in the abstract; included as nr 2**
4	Valkokari et al. (2014)	Road-mapping the business potential of sustainability within the European manufacturing industry	No	Focuses on opportunities and challenges of sustainable business development
5	Shao et al. (2014)	A Conceptual Framework for Business Model Innovation: The Case of Electric Vehicles in China	No	Not a clear framework for BMIfS
6	Bocken et al. (2015)	Value mapping for sustainable business thinking	No	The original tool is presented in Bocken et al. (2013). There were no updates to the original tool
7	Angeli and Jaiswal (2016)	Business Model Innovation for Inclusive Health Care Delivery at the Bottom of the Pyramid	No	Not a clear framework for BMIfS
8	Ernst et al. (2016)	The art museum as a lab to re-calibrate values toward sustainable development	No	Not intended for businesses
9	Gautier and Watrinet (2016)	Business Sustainability Study of an Innovative Multi-Stakeholders Public Concept	No	Not a clear framework for BMIfS
10	**Geissdoerfer et al. (2016)**	**Design thinking to enhance the sustainable business modeling process - A workshop based on a value mapping process**	**Yes**	**Process mentioned in the title; included as nr 3**
11	**Hora et al. (2016)**	**Designing business models for sustainable mass customization: A framework proposal**	**Yes**	**Framework mentioned in the title included as nr 4**
12	**Joyce and Paquin (2016)**	**The triple-layered BMC: A tool to design more sustainable business models**	**Yes**	**Tool mentioned in the title; included as nr 5**
13	Krivorotov et al. (2016)	Optimisation model for industrial complex competitiveness: A path to sustainable innovation process	No	Lacks a precise tool or process to follow
14	Oderanti and Li (2016)	A holistic review and framework for sustainable business models for assisted living technologies and services	No	Oderanti & Li (2018) is the updated version of the framework
15	Pekmez (2016)	Key Success Factors for Sustainable Strategic Information Systems Planning and Information Technology Infrastructure	No	Lacks a precise tool or process to follow
16	Najmaei and Sadeghinejad (2016)	Designing business models for creating and capturing shared value: An activity system perspective	No	Lacks a precise tool or process to follow

No.	Author(s) and Year	Title	Selected for the Final Set?	Reasons for Inclusion/ Exclusion
17	Schaltegger et al. (2016)	Business Models for Sustainability: A Co-Evolutionary Analysis of Sustainable Entrepreneurship, Innovation, and Transformation	No	Not a clear framework for BMIfS
18	**Baldassarre et al. (2017)**	**Bridging sustainable business model innovation and user-driven innovation: A process for sustainable value proposition design**	**Yes**	**Process mentioned in the title; included as nr 8**
19	**Barth et al. (2017)**	**Toward a Conceptual Framework of Sustainable Business Model Innovation in the Agri-Food Sector: A Systematic Literature Review**	**Yes**	**Framework mentioned in the title; included as nr 9**
20	Broman and Robèrt (2017)	A framework for sustainable strategic development	No	Focuses on describing the framework for Strategic Sustainable Development (FSSD)
21	Demartini et al. (2017)	A Manufacturing Value Modeling Methodology (MVMM): A Value Mapping and Assessment Framework for Sustainable M	No	Not a clear framework for BMIfS
22	**França et al. (2017)**	**An approach to business model innovation and design for sustainable strategic development**	**Yes**	**Tool mentioned in the abstract; included as nr 10**
23	**Geissdoerfer et al. (2017)**	**The Cambridge Business Model Innovation Process**	**Yes**	**Process mentioned in the title; included as nr 11**
24	**Inigo et al. (2017)**	**Business model innovation for sustainability: exploring evolutionary and radical approaches through dynamic capabilities**	**Yes**	**Framework mentioned in the abstract; included as nr 12**
25	Kurucz et al. (2017)	Relational leadership for strategic sustainability: practices and capabilities to advance the design and assessment of sustainable business models	No	Not a clear framework for BMIfS
26	Prendeville et al. (2017)	Uncovering ecodesign dilemmas: A path to business model innovation	No	Not a clear framework for BMIfS
27	Wadin et al. (2017)	Joint business model innovation for sustainable transformation of industries - A large multinational utility in alliance with a small solar energy company	No	Focuses on alliances for BMI
28	**Yang et al. (2017a)**	**Value uncaptured perspective for sustainable business model innovation**	**Yes**	**Framework mentioned in the abstract; included as nr 16**
29	**Yang et al. (2017b)**	**Creating and Capturing Value Through Sustainability: The Sustainable Value Analysis Tool**	**Yes**	**Tool mentioned in the title; included as nr 17**
30	Yu-Chen and Cai-Xia (2017)	The Strategies of Integrating Green Management and Business Model Innovation	No	Not a clear framework for BMIfS
31	Barth and Melin (2018)	A Green Lean approach to global competition and climate change in the agricultural sector - A Swedish case study	No	Not a clear framework for BMIfS

No.	Author(s) and Year	Title	Selected for the Final Set?	Reasons for Inclusion/ Exclusion
32	Bocken et al. (2018)	Experimenting with a circular business model: Lessons from eight cases	No	Focuses on circular business experimentation
33	**Brenner (2018)**	**Transformative Sustainable Business Models in the Light of the Digital Imperative — A Global Business Economics Perspective**	**Yes**	**Framework mentioned in the abstract; included as nr 19**
34	**Calabrese et al. (2018)**	**Fostering sustainability-oriented service innovation (SOSI) through business model renewal: The SOSI tool**	**Yes**	**Tool mentioned in the title; included as nr 20**
35	**Oderanti and Li (2018)**	**Commercialization of eHealth innovations in the market of the UK healthcare sector: A framework for a sustainable business model**	**Yes**	**Framework mentioned in the title; included as nr 23**
36	Pigosso et al. (2018)	Measuring the Readiness of SMEs for Eco-Innovation and Industrial Symbiosis: Development of a Screening Tool	No	A screening tool for eco-innovation
37	Rambow-Hoeschele et al. (2018)	Creation of a Digital Business Model Builder A Concept to Simulate a Digital Twin of a Business Model and Its Imperative Nature	No	Not a clear framework for BMIfS
38	Rezaee (2018)	Supply Chain Management and Business Sustainability Synergy: A Theoretical and Integrated Perspective	No	Does not focus on the BMIfS process
39	**Bocken et al. (2019)**	**Sustainable business model experimentation by understanding ecologies of business models**	**Yes**	**Framework mentioned in the abstract; included as the nr 24**
40	Dressler and Paunović (2019)	Toward a conceptual framework for sustainable business models in the food and beverage industry The case of German wineries	No	Introduces multiple SBMs, but not a type of support for BMIfS
41	Giourka et al. (2019)	The Smart City Business Model Canvas-A Smart City Business Modeling Framework and Practical Tool	No	Not intended for businesses
42	Zhang et al. (2019)	Developing Evaluation Frameworks for Business Models in China's Rural Markets	No	Focuses on an appraisal of BMs
43	Ali Shah et al. (2020)	Transformation toward Sustainable Business Models in Production: A Case Study of a 3D Printer Manufacturer	No	Not a clear framework for BMIfS
44	Alkire et al. (2020)	Transformative service research, service design, and social entrepreneurship: An interdisciplinary framework advancing wellbeing and social impact	No	Not a clear framework for BMIfS
45	**Baldassarre et al. (2020a)**	**Implementing sustainable design theory in business practice: A call to action**	**Yes**	**Framework mentioned in the abstract; included as nr 25**
46	**Baldassarre et al. (2020b)**	**Addressing the design-implementation gap of sustainable business models by prototyping: A tool for planning and executing small-scale pilots**	**Yes**	**Tool mentioned in the title; included as nr 26**

No.	Author(s) and Year	Title	Selected for the Final Set?	Reasons for Inclusion/ Exclusion
47	Bican and Brem (2020)	Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There A Sustainable Digital?	No	Not a clear framework for BMIfS
48	Bradley et al. (2020)	A framework to explore the functioning and sustainability of business models	No	Focuses on the functionality and sustainability of BMs rather than BMIfS
49	Copani and Behnam (2020)	Remanufacturing with upgrade PSS for new sustainable business models	No	Not a clear framework for BMIfS
50	**Cosenz et al. (2020)**	**Dynamic business modeling for sustainability: Exploring a system dynamics perspective to develop sustainable business models**	**Yes**	**Tool mentioned in the abstract; included as nr 27**
51	**Curtis and Mont (2020)**	**Sharing economy business models for sustainability**	**Yes**	**Tool mentioned in the abstract; included as nr 28**
52	El Hilali et al. (2020)	Reaching sustainability during a digital transformation: a PLS approach	No	Not a clear framework for BMIfS
53	Fritz et al. (2020)	Framework conditions to design sustainable business models for decentralized water treatment technologies in Viet Nam for international technology providers	No	Not a clear framework for BMIfS
54	**Gao and Li (2020)**	**Understanding sustainable business model: A framework and a case study of the bike-sharing industry**	**Yes**	**Framework mentioned in the title; included as nr 29**
55	**García-Muiña et al. (2020)**	**Sustainability Transition in Industry 4.0 and Smart Manufacturing with the Triple-Layered Business Model Canvas**	**Yes**	**Tool and process mentioned in the abstract; included as nr 30**
56	Hanafizadeh and Mehrabioun (2020)	A Systemic Framework for Business Model Design and Development -Part B: Practical Perspective	No	Does not cover sustainability factors
57	Lamptey et al. (2020)	A framework for the adoption of green business models in the Ghanaian construction industry	No	Not a clear framework for BMIfS
58	**Lardo et al. (2020)**	**The perspective of capability providers in creating a sustainable I4.0 environment**	**Yes**	**Framework mentioned in the abstract; included as nr 31**
59	Lin et al. (2020)	How to innovate the service design of leisure farms: The innovation of sustainable business models	No	Lacks a clear tool or process to follow
60	**Lüdeke-Freund (2020)**	**Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research**	**Yes**	**Framework mentioned in the title; included as nr 32**
61	Pardalis et al. (2020)	A triple-layered one-stop-shop business model canvas for sustainable house renovations	No	Use of existing tools
62	**Reinhardt et al. (2020)**	**Sustainable business model archetypes for the electric vehicle battery second use industry: Toward a conceptual framework**	**Yes**	**Framework mentioned in the title; included as nr 33**

No.	Author(s) and Year	Title	Selected for the Final Set?	Reasons for Inclusion/ Exclusion
63	Van der Merwe et al. (2020)	A Framework of Key Growth Factors for Small Enterprises Operating at the Base of the Pyramid	No	Not a clear framework for BMIfS
64	Sanchez-Planelles et al. (2021)	Building a theoretical framework for corporate sustainability	No	Focuses on sustainability-related concepts
65	Faria et al. (2021)	The business model innovation and lean startup process supporting startup sustainability	No	Not a clear framework for BMIfS
66	**López-Nicolás, C. et al. (2021)**	**Towards Sustainable Innovative Business Models**	**Yes**	**Framework mentioned in the abstract; included as nr 34**
67	Rehn, J. (2021)	Design Guidelines and Canvas for More Sustainable Leather Products - The Role of Design as a Driver for Sustainable Leather Goods in the 21st Century	No	No type of support offered
68	Armstrong and Grobbelaar (2022)	Sustainable business models for social enterprises in developing countries: a conceptual framework	No	Not a clear framework for BMIfS
69	Borges de Oliveira and de Oliveira (2022)	Making Hospitals Sustainable: Towards Greener, Fairer and More Prosperous Services	No	Not a clear framework for BMIfS
70	Cardeal et al. (2022)	Designing Sustainable Business Models to Reduce Spare Part Inventory	No	Not a clear framework for BMIfS
71	**Ferlito and Faraci (2022)**	**Business model innovation for sustainability: a new framework**	**Yes**	**Framework mentioned in the title; included as nr 35**
72	Gasparin et al. (2022)	Stories of value: Business model innovation adding value propositions articulated by Slow Storytelling	No	Not a clear framework for BMIfS
73	**Hajiheydari et al. (2022)**	**Digital sustainable business model innovation: applying dynamic capabilities approach (DSBMI-DC)**	**Yes**	**Framework mentioned in the abstract; included as nr 36**
74	**Morioka et al. (2022)**	**Two-Lenses Model to Unfold Sustainability Innovations: A Tool Proposal from Sustainable Business Model and Performance Constructs**	**Yes**	**Tool mentioned in the title; included as nr 37**
75	**Moro et a. (2022)**	**Adding sustainable value in product-service systems business models design: A conceptual review towards a framework proposal**	**Yes**	**Framework mentioned in the title; included as nr 38**
76	Obel and Kallehave (2022)	Designing a sustainable organization: the four I's framework	No	Not a clear framework for BMIfS
77	**Oliveira-Dias et al. (2022)**	**Fostering business model innovation for sustainability: a dynamic capabilities perspective**	**Yes**	**Framework mentioned in the abstract; included as nr 39**
78	Pedersen et al. (2022)	Navigating value networks to co-create sustainable business models: An actionable staging approach	No	Not a clear framework for BMIfS

No.	Author(s) and Year	Title	Selected for the Final Set?	Reasons for Inclusion/ Exclusion
79	**Ringvold et al. (2022)**	**Developing Sustainable Business Models: A Microfoundational Perspective.**	**Yes**	**Proposes a type of support for BMIfS; included as nr 40**
80	Sharma et al. (2022)	Business Model Innovation to Address Vegetable Supply Chain Issues: A Case Study of an Indian Startup	No	Not a clear framework for BMIfS
81	Schoormann et al. (2022)	Designing business model development tools for sustainability—a design science study	No	Not a clear framework for BMIfS
82	Venturelli et al. (2022)	A dynamic framework for sustainable open innovation in the food industry	No	Not a clear framework for BMIfS
83	Wadin and Bengtsson (2022)	The Evolution of Capabilities Underpinning Business Model Innovation for Sustainability in Large Incumbent Firms	No	Not a clear framework for BMIfS
84	Walsh et al. (2022)	A Systems Framework for Infrastructure Business Models for Resilient and Sustainable Urban Areas	No	Not a clear framework for BMIfS

Appendix B. Summary of selected types of support focusing on their testing and validation, generalization, and possible extension on previous ones.

No.	Tested*	Target User	Level of User Involvement	Theoretical / Experimental	Offers User Guidelines?	Applied Research Method	Domain
1	Yes	Businesses, academics, students	Series of 13 workshops	Experimental	No	Multiple-case studies	Generic
2	No	None mentioned	None	Theoretical	No	Conceptual approach	Generic
3	Yes	Businesses, researchers, students	Series of workshops	Experimental	No	A mix of literature review and practitioner input	Generic
4	Yes	Businesses	Series of workshops	Experimental	No	A mix of literature review and expert input	TV manufacturing industry
5	Yes	Businesses, students, entrepreneurs, industry professionals	Consulting engagements	Experimental	No	Action research	Generic
6	No	None mentioned	None	Experimental	No	Multiple-case study	Generic
7	Yes	None	None	Theoretical	No	Transdisciplinary literature review	Generic
8	Yes	Business Managers	Workshops	Experimental	No	Research through design	Generic
9	No	None mentioned	None	Theoretical	No	Literature review	Agri-food sector
10	Yes	Businesses	Workshops and meeting	Experimental	No	Single-case study	Generic
11	Yes	Start-ups	Series of workshops	Experimental	No	A mix of literature review, interviews with experts, and single-case study	Generic
12	No	None mentioned	None	Experimental	No	Multiple-case study	Generic
13	No	None mentioned	None	Experimental	No	Multiple-case study	Generic
14	No	None mentioned	None	Experimental	No	Explanatory research	Generic
15	Yes	Businesses	Workshops	Experimental	No	Multiple-case study	Clothing sector
16	Yes	Businesses	Workshops	Experimental	No	Multiple-case study	Manufacturing companies

No.	Tested*	Target User	Level of User Involvement	Theoretical / Experimental	Offers User Guidelines?	Applied Research Method	Domain
17	Yes	Business	Series of facilitated workshops	Experimental	No	Multiple-case study	Generic
18	Yes	Businesses	None	Experimental	No	Literature review and single-case study	Industrial products
19	No	None mentioned	None	Theoretical	No	Literature review	Generic
20	Yes	Project	None	Experimental	No	Single-case study	Service-oriented
21	Yes	Businesses, consultants, students	Workshops	Experimental	No	Single-case study	Farm-based biogas industry
22	No	Business practitioners	Interviews	Theoretical	No	Literature review	Generic
23	Yes	Healthcare organizations	Facilitated workshops	Experimental	No	Exploratory investigation and workshops	eHealth
24	Yes	Businesses	Experiments	Experimental	No	Multiple-case study	Generic
25	No	None mentioned	None	Theoretical	No	A mix of literature review and expert interviews	Generic
26	Yes	Businesses	Plan and execute the tool	Experimental	No	Design science methodology	Generic
27	No	None mentioned	None	Theoretical	No	Literature review	Clothing sector
28	Yes	Researchers	Feedback sessions	Theoretical	No	Literature review	Sharing economy
29	No	None mentioned	None	Experimental	No	Embedded single-case study	Bike-sharing industry
30	No	None mentioned	None	Experimental	No	Single-case study	Ceramic tile industry
31	No	None mentioned	None	Experimental	No	Single-case study	Industry 4.0
32	No	None mentioned	None	Theoretical	No	Literature review	Generic
33	No	None mentioned	None	Experimental	No	Multiple-case study	EV industry
34	No	None mentioned	None	Theoretical	No	Literature Review	Generic
35	No	None mentioned	None	Theoretical	No	Literature Review	Generic
36	No	None mentioned	None	Experimental	No	Multiple-case study	Generic

No.	Tested*	Target User	Level of User Involvement	Theoretical / Experimental	Offers User Guidelines?	Applied Research Method	Domain
37	No	None mentioned	None	Experimental	No	Mixed method	Generic
38	No	None mentioned	None	Experimental	No	Case study	Generic
39	No	None mentioned	None	Experimental	No	Case study	Generic
40	No	None mentioned	None	Experimental	No	Case study	Generic

*Applied research method indicate how support types were tested/validated.

Appendix C. Intended purposes of the selected types of support.

No.	Stated Purpose
1	Assist BMIfS by understanding the value proposition and stakeholder groups
2	Facilitate BMI for sustainability by focusing on What, When, Who, and Why attributes
3	Support BMIfS by combining it with design thinking
4	Assist in the integration of sustainable mass customization by offering generic SBM patterns
5	Help explore sustainability-oriented BMI
6	Facilitate the journey toward SBMs: organizational transformation
7	Assist BMIfS by offering a detailed ontology of a strongly SBM
8	Improve sustainable development of business practices with a sustainable value proposition design process
9	Help understand BMIfS in the agri-food sector
10	Support BMI and design for sustainable strategic development
11	Guide BMIfS process: phases, process, activities, challenges
12	Help understand social and environmental aspects of BMI via dynamic capabilities framework
13	Support BMIfS: from sustainability challenges to competitive advantage
14	Assist BMIfS through service design
15	Help SBM development through an experimentation approach
16	Offer a perspective on BMI for sustainability focusing on value uncaptured
17	Facilitate BMIfS by identifying value uncaptured via value analysis
18	Help design SBMs by focusing on value triangle (value proposition for and with multiple stakeholders)
19	Multifaceted framework for sustainable, transformative BMs
20	Help business practitioners understand how BM components can lead to sustainability innovation
21	Help transform BMs toward sustainability: focus on early stages of the process
22	Support discussion, reflection, and generation of SBM ideas
23	Support eHealth innovation commercialization through SBMs
24	SBM experimentation by understanding ecologies of BMs
25	Assist implementation of sustainable theory in business practice - help implement sustainable innovation ideas
26	Assist in bridging the design-implementation gap of SBM ideas - focus on small-scale pilots
27	Proposing a dynamic approach to business modeling for sustainability - DBMfS Canvas
28	Support design and implementation of sharing economy BMs for sustainability
29	Help analyze and design SBMs
30	Facilitate sustainability transition in light of Industry 4.0 and Smart Manufacturing
31	Facilitate implementation of sustainable Industry 4.0 BM transformation
32	Support entrepreneurs in using BMs to unlock and commercialize sustainability innovations
33	Help achieve more SBMs - focus on battery second use (B2U) market in electric vehicle (EV) industry
34	Assist BMIfS initiatives
35	Guide for organizations that aspire to increase the level of sustainability
36	Assist sustainable digital BMI
37	Assist in the process of exploring opportunities toward an SBM
38	Assist in developing SBMs through product-service systems
39	Guide achieve BMIfS
40	Facilitate established firms in adding a new SBM