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Article — Published Version

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Business Strategy and the Environment

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John Wiley & Sons

Suggested Citation: Lüdeke-Freund, Florian (2019) : Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research, Business Strategy and the Environment, ISSN 1099-0836, Wiley, Hoboken, NJ, Vol. 29, Iss. 2, pp. 665-681, <https://doi.org/10.1002/bse.2396>

This Version is available at:

<https://hdl.handle.net/10419/230003>

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RESEARCH ARTICLE

Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research

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Abstract

This article introduces the *business models for sustainability innovation* (BMfSI) framework to study how business models mediate between sustainability innovations and business cases for sustainability. The BMfSI framework integrates two major perspectives (implicitly) found in the sustainable business model literature. The first is the *agency perspective*. It takes into consideration that some form of agency is needed, that is, “someone” who takes decisions and acts. Sustainable entrepreneurs are discussed as those agents who align their new or existing business models with sustainability innovations in order to be successful in business and to create value with and for stakeholders. The second perspective is the *systems perspective*, which acknowledges that business models are always embedded within sociotechnical contexts through which, for example, public policies, private financing, or stakeholder interests influence whether and how business models can be developed. The agency and systems perspectives are integrated in the so-called business model mediation space. This theoretical notion embraces the decisions and activities pursued by sustainable entrepreneurs as they align their business models with sustainability innovations on the one hand and the influence of environmental contingencies, barriers, and stakeholders from the sociotechnical context on the other hand. The paper concludes with propositions for future research derived from the BMfSI framework.

KEYWORDS

sustainable entrepreneurship, business model, sustainability innovation, sociotechnical context, stakeholders, sustainable value creation, innovation theory, framework

1 | INTRODUCTION

Inventions with the potential to create positive ecological and social effects need to leave their niches to turn into effective sustainability innovations (Boons, Montalvo, Quist, & Wagner, 2013; Geels, 2010). Sustainable entrepreneurs face this challenge whenever they try to disseminate new solutions to sustainability problems through commercial

activities and whenever they aim for large market shares and socio-political influence (Hockerts & Wüstenhagen, 2010; Schaltegger, Hansen, & Lüdeke-Freund, 2016; Schaltegger & Wagner, 2011). Sustainable entrepreneurs tie their business success directly to the achievement of positive effects for the natural environment and humankind and thus to the creation of value for a broad range of stakeholders (Freudenreich, Lüdeke-Freund, & Schaltegger, 2019). However, current

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research reveals significant uncertainties related to innovation-centric approaches: "Innovation has been widely regarded as a panacea for sustainable development, but there remains considerable uncertainty about how it will lead to a more sustainable society" (Hall & Wagner, 2012, p. 183).

The most important uncertainty for sustainable entrepreneurs is whether they can build successful businesses based on their innovations (Schaltegger & Wagner, 2011), despite the different barriers they may face (Kiefer, Del Río González, & Carrillo-Hermosilla, 2019). Depending on personal, organisational, and sociocultural values, business success can be defined as financial returns, nonfinancial effects such as improved innovative capacities, or a positive societal impact through the reduction of ecological and social ills (Breuer & Lüdeke-Freund, 2017a, 2017b). But regardless of personal motivations and success metrics, sustainable entrepreneurs need to commercialise their problem solutions and transform markets to create private and public benefits on a significant scale and for various stakeholders (Freudenreich et al., 2019; Schaltegger, Lüdeke-Freund, Hansen, & Lüdeke-Freund, 2016). This means that they must reduce or even eliminate the market imperfections and negative externalities that lead to humanity's unsustainable development (Cohen & Winn, 2007). Some sustainability scholars even argue that the worsening state of the world in terms of increasing ecological degradation, poverty, and social injustice calls for radically different ways of doing business with net positive effects (Ehrenfeld, 2004; Upward & Jones, 2016).

Academics and practitioners increasingly discover a management concept that promises alternative approaches to deal with these challenges: the business model. This concept is changing the management and innovation discourses in remarkable ways. Innovations of all sorts are combined with business model thinking to renew and extend innovation and strategic management, whereas diverse intrafirm and interfirm issues are addressed, such as organisational change, value network design, or knowledge and innovation management (Wirtz, Pistoia, Ullrich, & Göttel, 2016; Zott, Amit, & Massa, 2011). The business model also has the potential to become an innovation in itself (Amit & Zott, 2012; Chesbrough, 2010; Massa, Tucci, & Afuah, 2017). Its main practical purpose is to allow organisations to model their approaches to creating, delivering, and capturing value, whereas management scholars use the business model as an analytical frame and unit of analysis (e.g., Bohnsack, Pinkse, & Kolk, 2014; Doganova & Eyquem-Renault, 2009).

The strategy and innovation mainstream treats the business model mainly as a "mediating device" between technology, strategy, and economic value (Chesbrough & Rosenbloom, 2002; Doganova & Eyquem-Renault, 2009). But the question of how business models can support sustainable entrepreneurs and their innovations in creating ecological, social, and economic value for various stakeholders has so far received little attention (Boons et al., 2013; Evans et al., 2017; Lüdeke-Freund & Dembek, 2017; Schaltegger, Hansen, & Lüdeke-Freund, 2016). Therefore, this article presents a conceptual framework to delineate major interrelations between sustainable entrepreneurship, sustainability innovation, and the business model concept. By doing so, it offers conceptual clarity to researchers dealing with an essential question at

the intersection of sustainable entrepreneurship and business model research: *How can business models support the commercialisation of sustainability innovations and contribute to the business success of sustainable entrepreneurs?*

To approach an answer to this question, the next section describes the research method applied to develop the *business models for sustainability innovation* (BMfSI) framework. Its development builds upon the theoretical foundations of sustainable entrepreneurship, sustainability innovation, business models, and environmental contingencies, which are discussed in Sections 3 and 4. Section 4 then introduces the complete BMfSI framework. Finally, Section 5 discusses limitations of the framework and its relationship to other streams of research and concludes with propositions for future research.

2 | RESEARCH METHOD

Conceptual frameworks are important links between initial descriptions of phenomena (e.g., sustainable entrepreneurship; Cohen & Winn, 2007) and theories capable of explaining and predicting these phenomena (e.g., when such entrepreneurs emerge; Hockerts & Wüstenhagen, 2010). The typical research cycle, as described by Meredith (1993), iterates between describing, explaining, and testing with the goal of developing and refining theory (Figure 1). This iterative process requires conceptual models and frameworks to move from phase to phase (cf. Netter, Pedersen, & Lüdeke-Freund, 2019). Although many researchers seem to be critical of conceptual research because of an assumed lack of evidence or rigour, it is indispensable to capture new and insufficiently described phenomena, reduce complexity, consolidate and reflect upon the available knowledge, and finally allow for systematic theorising (Whetten, 1989, 2009). Most of current research on sustainable entrepreneurship and business models seems to be moving from description to explanation (e.g., Boons et al., 2013; Evans et al., 2017; Schaltegger, Hansen, & Lüdeke-Freund, 2016) and thus calls for conceptual models and

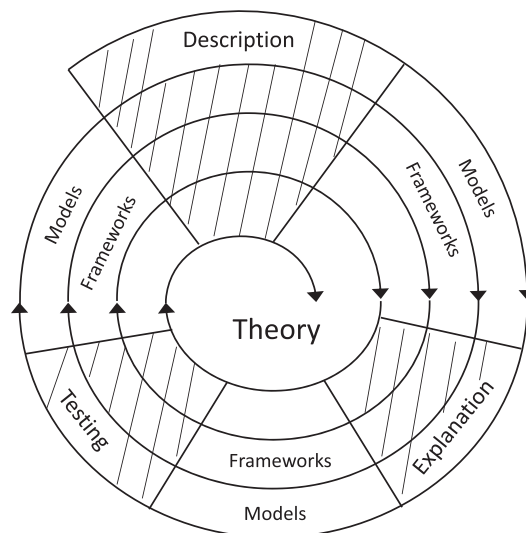


FIGURE 1 The research cycle (source: Meredith, 1993)

frameworks that consistently integrate the available knowledge and allow for systematic empirical testing. This article develops an analytical framework of BMfSI to support this research endeavour.

Conceptual research involves the development of concepts, models, and frameworks, where a “*concept* is a bundle of meanings or characteristics associated with certain events, objects, or conditions” (Meredith, 1993, p. 5, *italics added*). Sustainable entrepreneurship, for example, is a concept to represent ecologically and socially motivated forms of business. “A *conceptual model* is ... a set of concepts, with or without propositions, used to represent or describe (but not explain) an event, object, or process” (Meredith, 1993, *italics added*). An example is Schaltegger and Wagner's (2011) sustainable entrepreneurship typology, which integrates two conceptual dimensions (i.e., the magnitude of market effects and the priority of sustainability as a business goal). *Conceptual frameworks* are developed for explanatory purposes (cf. Whetten, 1989, 2009). They can take the form of conceptual induction (inferences from analyses of examples), conceptual deduction (inferences from premises and logical conclusions), and conceptual systems. The latter type “is characterized by the many interactions occurring among the elements of the conceptual framework. That is the conceptual system consists of multiple concepts with many interrelated propositions” (Meredith, 1993, p. 10). Conceptual systems can be as complex as theories but typically do not have the same explanatory power.

Using Meredith's terminology, the BMfSI framework can be best characterised as a conceptual system. It connects *sustainable entrepreneurship* to the *business model concept* and considers the peculiarities of *sustainability innovation* and *environmental contingencies*. Two major perspectives that are (implicitly) articulated in the sustainable business model literature are integrated in this framework. The first is the *agency perspective*, which takes into consideration that some form of agency is needed, that is, “someone” who takes decisions and acts (e.g., entrepreneurs). The second perspective is the *systems perspective*, which acknowledges that business models are always embedded within wider sociotechnical contexts that have an influence on whether and how business models can be developed. The resulting framework is used to identify and structure major relationships between these concepts and perspectives and to support systematic analyses of the role business models play for sustainable entrepreneurs and their innovations. Based on such analyses, detailed explanations and testable hypotheses can be developed in later stages of the research cycle. Evaluating the explanatory strength of the conceptual framework requires empirical testing and moving forward in the research cycle. Such evaluations are beyond the scope of this article and are thus proposed as an avenue for future research.

3 | THEORETICAL BACKGROUND

In the following, *sustainable entrepreneurship* is introduced and connected to the *business model concept*, which leads to the conclusion that business models matter for sustainable entrepreneurship because they can increase the likelihood of sustainable value creation with and for a broad range of stakeholders. In this regard, the business model's

mediating function plays a crucial role. This mediating function is introduced to explain that deliberate business model design can support internal and external alignment of a firm and its business activities, which in turn is of particular importance for business success with sustainability innovations.

3.1 | Sustainable entrepreneurship and business cases for sustainability

Schaltegger and Wagner (2011) characterise sustainable entrepreneurship as contributing “to solving societal and environmental problems through the realization of a successful business” and promoting “sustainable development through entrepreneurial corporate activities” (p. 224). Innovations are central to these activities: “Sustainable entrepreneurship is in essence the realization of sustainability innovations aimed at the mass market and providing benefit to the larger part of society. By realizing such (radical) sustainability innovations sustainable entrepreneurs often address the unmet demand of a larger group of stakeholders” (p. 225). Schaltegger and Wagner (2011) see sustainable entrepreneurship as a progression of ecopreneurship, social entrepreneurship, and institutional entrepreneurship, each of which shows a different emphasis on the solution of ecological or social issues, the importance of financial success, and the need to influence societal norms. Theoretically speaking, sustainable entrepreneurs bring forth sustainability innovations that convert market imperfections into business opportunities, replace unsustainable forms of production and consumption, and create value for a broad range of stakeholders (cf. Hockerts & Wüstenhagen, 2010; Schaltegger, Lüdeke-Freund, et al., 2016).

The sources of such business opportunities and the motivations of sustainable entrepreneurs, that is, their entrepreneurial sustainability orientation, are widely discussed in the literature (e.g., Amankwah-Amoah et al. 2018; Kiefer et al., 2018). Cohen and Winn (2007), for example, identify market imperfections in the form of inefficient firms, ecological and social externalities, flawed pricing mechanisms, and imperfectly distributed information as sources of business opportunities. In some cases, these opportunities are directly explored and exploited by entrepreneurs, whereas in other cases, additional motivation through laws and regulations is required (cf. Ács, Autio, & Szerb, 2014; Simón-Moya, Revuelto-Taboada, & Guerrero, 2014). Stakeholders, such as customers, non-governmental organisations, or the media, demanding that firms integrate sustainability considerations into their core businesses can be another important motivational factor (Amankwah-Amoah et al. 2018; Hörisch, Freeman, & Schaltegger, 2014; Schaltegger, Hörisch, & Freeman, 2019). And on the individual level, personal values such as altruism, universalism, or benevolence can drive sustainable entrepreneurship (Breuer & Lüdeke-Freund, 2017a, 2017b). One of the most prominent examples is Ray Anderson, late founder and CEO of Interface Inc., who used the reduction of his firm's ecological externalities as an opportunity to revolutionise the floor covering industry. He was convinced that regulations addressing climate change and the use of natural resources were insufficient and

decided to change his firm in a way that significantly exceeded regulatory measures (Anderson, 2011). An example of a regulation-based case is the renewal of Germany's big energy utilities E.ON and RWE. Their ongoing transformation is motivated by a complex blend of laws and regulations. However, making use of this situation also requires entrepreneurial innovations such as new business models for the production and distribution of renewable energies (Richter, 2013). It seems appropriate to say that different motivations of sustainable entrepreneurship, including laws and regulations, stakeholder pressure, and values, may have an effect and even work together.

Exploring and exploiting market opportunities for their sustainability innovations should allow entrepreneurs to realise so-called business cases for sustainability (Schaltegger & Burritt, 2018). In essence, business cases for sustainability are based on positive interrelations between business success and contributions to a sustainable development of the natural environment, society, and economy (Dyllick & Hockerts, 2002; Salzmann, Ionescu-Somers, & Steger, 2005; Schaltegger et al., 2019; Schaltegger & Burritt, 2018; Schaltegger, Lüdeke-Freund, & Hansen, 2012). Assuming that radical innovations are crucial for improving a firm's sustainability performance—without neglecting the effects of accumulated incremental steps—the theoretical relationships between a firm's financial success and its ecological and social performance can be illustrated as in Figure 2.

It is important to note that the horizontal axis shows the *voluntary* (or mainly voluntary) ecological and social performance of a firm, that is, additional initiatives beyond laws and regulations (Schaltegger & Burritt, 2018). This means that mandatory and compliance initiatives should not be confused with “real” business cases for sustainability. A firm is compliant with ecological and social laws and regulations at point 0 and FP_0 , respectively. This is where the original “Porter hypothesis” (Porter & van der Linde, 1995) ends. Beyond this point,

moving to the right, firms are voluntarily striving for additional ecological and social performance. The financially optimal business case is point A. Beyond this point, for example, in point B, trade-offs occur and the financial performance decreases as the marginal costs of further sustainability innovations increase after all low-hanging fruits have been picked (Hahn, Figge, Pinkse, & Preuss, 2010). The ecologically and/or socially optimal business case would be slightly above point B, with the potential of further benefitting stakeholders beyond the firm itself. However, even if further profitable innovations exist, a firm's financial performance will at some point have its culmination and decline (Schaltegger & Burritt, 2018; Schaltegger & Synnestvedt, 2002), that is, the overall business case potential is limited. However, it is important to consider that Figure 2 takes a firm's perspective, which tends to favour an interpretation of business cases as improved financial performance under the constraint of positive ecological and/or social contributions. Seen from another perspective, for example, a stakeholder group representing the natural environment, Figure 2 will most likely be interpreted in a different way, namely, as optimising the ecological performance of a firm under the constraint of its economic survival, which speaks more to a business case represented by point C. Along these lines, Schaltegger et al. (2019) argue that business cases (plural!) are co-constructed by diverse stakeholders, that is, the meaning of business cases, be it primarily financial success or success in terms of solving a pressing social problem, is socially constructed, multifaceted, and negotiable.

This interpretation of business cases is closely related to the notion of stakeholder value creation (Freudenreich et al., 2019), which is less limited than a supposedly financial interpretation of business success. Stakeholder value creation implies that entrepreneurs, for example, through their innovations, create portfolios consisting of different kinds of value (e.g., dividends, customer solutions, reliable contracts, employment, or reduced environmental harm), which are created with

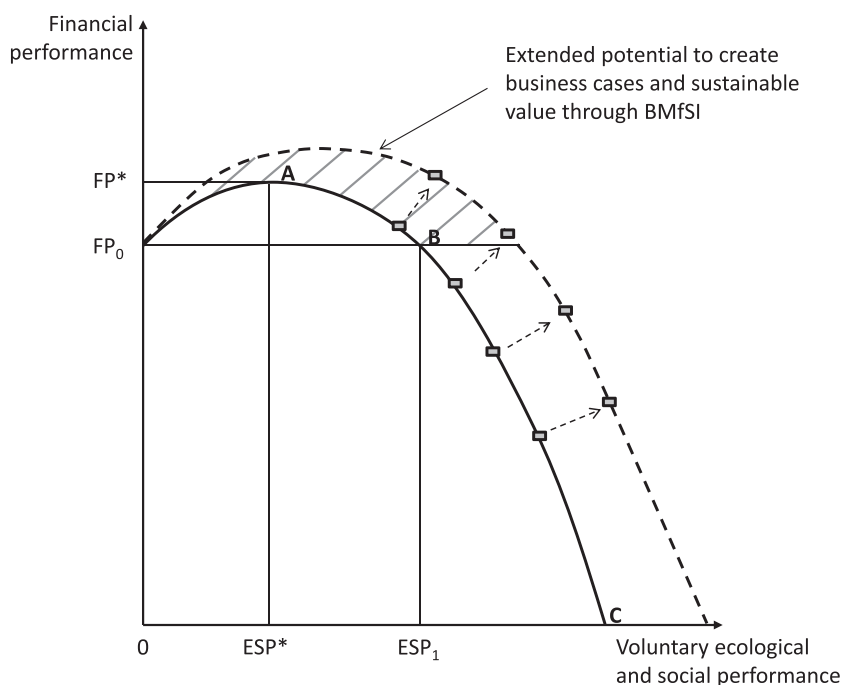


FIGURE 2 Relationships between financial and voluntary ecological and social performance (based on Schaltegger & Burritt, 2018; Schaltegger & Synnestvedt, 2002). BMfSI, business models for sustainability innovation

and for multiple stakeholders. Theoretically speaking, business cases for sustainability leading to value creation with and for stakeholders should be synonymous with *sustainable value creation* (Evans et al., 2017; Freudenreich et al., 2019; Hörisch et al., 2014). And this is where the business model and its mediating function can play an important role.

3.2 | The business model as mediating device

In accord with Chesbrough and Rosenbloom's (2002) findings on the value-creating effects of business models for new technologies (see also Baden-Fuller & Haefliger, 2013), it can be assumed that sustainability innovations together with deliberately designed business models can create and extend business case opportunities—indicated by the dashed line in the upper right of Figure 2. Transferring the notion that business models serve as mediating devices that allow creating value with new technologies and other kinds of innovation, respectively, to sustainable entrepreneurship, leads to the assumption that business models could also support the creation of ecological, social, and economic value. Seen this way, the movement towards the upper right in Figure 2 represents market success with ecological and social innovations, such as emissions-free mobility or access to affordable health care, which need new or modified business models to be successful and to unfold their positive ecological and social effects (Schaltegger et al., 2012).

The assumption that business models can support such sustainable business practices was explicitly formulated over the last 10 years (Evans et al., 2017; Lüdeke-Freund & Dembek, 2017; Schaltegger, Hansen, & Lüdeke-Freund, 2016; Stubbs & Cocklin, 2008). At the outset of the discourse, Charter, Gray, Clark, and Woolman (2008) outlined some major issues and argued that sustainable consumption and production require radical innovations, which, however, mostly start in niches and struggle to reach mainstream markets (see also Geels, 2010). They saw that by “designing the elements of value proposition, value creation and revenue delivery appropriately a firm can tune its offering, although the challenge is to develop a business model that is environmentally, socially and economically sustainable” (Charter et al., 2008, p. 59). In their view, developing sustainable business models is a question of new organisational structures, new offerings such as product–service systems (Reim, Parida, & Örtqvist, 2015; Tukker, 2015), and alleviating poverty through business development at the “base of the pyramid” (Kolk, Rivera-Santos, & Rufin, 2014). In parallel, Stubbs and Cocklin (2008) published their “sustainability business model ideal type,” which addresses some of the issues raised by Charter et al. (2008), such as the development of new organisational structures, products, and services. They define specific structural and cultural attributes of internal capabilities and the external socio-economic environment of an organisation, such as community spirit, employees' trust and loyalty, or sustainability accounting and reporting. Moreover, six propositions about sustainable business models are put forward, including a business purpose that integrates ecological, social, and financial goals, accordingly designed

performance management and measurement systems, and leaders who stimulate cultural and structural change.

Combining the main findings from these early works on sustainable business models and more recent publications (e.g., Evans et al., 2017; Lüdeke-Freund & Dembek, 2017; Schaltegger, Hansen, & Lüdeke-Freund, 2016) reveals that the business model concept is seen as means to open up new business opportunities for sustainable entrepreneurs (in the upper right area of Figure 2), as suggested by Charter et al. (2008) and as a means to stimulate organisational development (as a precondition for moving towards the upper right area of Figure 2), as suggested by Stubbs and Cocklin (2008). Building on these assumptions, Schaltegger, Hansen, and Lüdeke-Freund (2016), p. 6) propose the following definition of a sustainable business model (used interchangeably with “business model for sustainability”): “A business model for sustainability helps describing, analysing, managing, and communicating (i) a company's sustainable value proposition to its customers, and all other stakeholders, (ii) how it creates and delivers this value, (iii) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organisational boundaries.”

This definition highlights important business model functions that are discussed by most business model scholars, that is, creating, delivering, and capturing value (Massa et al., 2017; Zott et al., 2011). Teece (2010) discusses further functions related to the commercialisation of innovations. He questions the assumption of standard economic theory that innovations enable value creation by some kind of automatism and scrutinises that market offerings create customer value per se, because neither demand nor a sufficient willingness to pay can be presumed, which is particularly critical with green or social innovations (e.g., Belz, 2006). Teece (2006, 2010) concludes that commercialising innovations often requires the development of new market segments and additional willingness to pay and is therefore a business model function. In analogy, commercialising ecologically and socially beneficial products, services, or product–service systems is not only driven by supply, demand, or public policies, it is also a question of business model design, making use of the business model's *mediating function* (Doganova & Eyquem-Renault, 2009) and its ability to connect green and social innovations to potential markets (Boons & Lüdeke-Freund, 2013; Schaltegger, Hansen, & Lüdeke-Freund, 2016).

The business model's mediating function refers to iterative inter-mediation and alignment between different areas of a firm and its business (e.g., manufacturing and sales) as well as different social actors (e.g., owners, managers, and investors; Al-Debei & Avison, 2010; Chesbrough & Rosenbloom, 2002; Doganova & Eyquem-Renault, 2009). The most prominent description of the mediating function can be found in Chesbrough and Rosenbloom's (2002) article on Xerox Corporation's technology spin-offs, in which they study the business model's cognitive implications for commercialisation success and failure with new technologies that do not conform to the dominant business logic of a firm. They find that “[t]he business model provides a coherent framework that takes technological characteristics and potentials as inputs, and converts these through customers and markets into economic outputs. The business model is thus conceived

as a focusing device that mediates between technology development and economic value creation" (Chesbrough & Rosenbloom, 2002, p. 532). They describe the mediating function as an iterative alignment of the characteristics of an innovation (e.g., a new photocopier or document service) and the business model needed for its commercialisation, ranging from the definition of value propositions and respective market segments to positioning the firm within its supply chain and overarching value network.

Going beyond the basic idea of creating economic value from technology, we see that the mediating function also refers to the creation of fit between strategy, organisation, innovations, and a firm's business environment: "... with a business model approach companies can react faster to changes in the business environment ... the business model concept improves the alignment of strategy, business organization and technology" (Osterwalder, 2004, p. 21). Al-Debei and Avison (2010) call the business model accordingly an "alignment instrument" and "intermediate theoretical layer" and add that it can also be used to ensure consistency with the interests of a firm's stakeholders.

Simplifying the differences between conventional and sustainable entrepreneurs, it is often found that the former have a rather narrow focus on creating customer value for the sake of making financial profits and therefore tend to align their business models in first place with the interests of their customers and financial stakeholders (Freudenreich et al., 2019). In contrast, sustainable entrepreneurs try to solve ecological and social problems through their business activities and aim at value creation for various stakeholders, which adds further complexity to the task of designing business models and aligning them with the manifold and even conflicting interests of a firm's diverse stakeholders (cf. Breuer, Fichter, Lüdeke-Freund, & Tiemann, 2018; Upward & Jones, 2016). In addition, sustainable entrepreneurs often face a lack of complementary assets, resources, or competencies to align their business models with existing or new markets and to develop a solid positioning towards competitors (Kiefer et al., 2019; Schaltegger & Wagner, 2011). Overcoming these challenges and further barriers, which are discussed in more detail below, requires a thorough understanding of how business models can help mediate between sustainability innovations and business success and thus allow sustainable entrepreneurship to unfold.

4 | BMfSI—INTEGRATIVE FRAMEWORK

Building on the identified mediating relationships between *sustainability innovation*, *business model*, and *business cases for sustainability*, this section introduces the BMfSI framework. The influence of environmental contingencies is considered as well. *Public policy*, *private*

financing, *stakeholder relationships*, and *barriers to sustainability innovations* are added to the initial framework. These concepts and their relationships together form the *business model mediating space*, which is the space, or totality, of decisions and activities that sustainable entrepreneurs pursue to align their business models.

4.1 | Initial framework

The aforementioned proposition that business models are required to create value with innovations (Chesbrough, 2010; Chesbrough & Rosenbloom, 2002; Teece, 2006) is specified by linking the concepts of *sustainability innovation*, *business model*, and *business cases for sustainability* (Figure 3). From Section 3 follows that sustainability innovations (e.g., new processes, products, or services) require and thus *motivate* new or modified business models to enter and diffuse in the market (Boons et al., 2013; Boons & Lüdeke-Freund, 2013) and finally to *create* business cases (Schaltegger et al., 2012).

Figure 3 shows that the business model is the focal concept in this initial framework and that its role is that of a *mediator* because sustainability innovations themselves do not bring about business success, but the business models used for their commercialisation do so. This assumption is supported, for example, by Chesbrough's (2010) finding that mediocre technologies can outperform superior technologies if the applied business model creates an additional competitive advantage. The importance of business model design for commercial success with alternative technologies has recently been demonstrated in different studies, for example, on energy service companies (ESCos; Bolton & Hannon, 2016) and electric vehicles (Bohnsack et al., 2014; Bohnsack & Pinkse, 2017).

4.2 | Environmental contingencies

4.2.1 | Public policy, private financing, and stakeholder relationships

Although sustainable entrepreneurs aim at integrating their ecological, social, and financial performance by developing BMfSI, this does not occur in isolation or without interfering with their business environment (Schaltegger, Lüdeke-Freund, et al., 2016). This is critical because "the environment in which new ventures emerge is an important field of research, not only because environmental variables open up opportunities to exploit market inefficiencies ... but also because different environments can be more or less favourable to the success of new ventures" (Simón-Moya et al., 2014, p. 715). It seems reasonable to assume that this does not only hold for new but also for established firms. A range of environmental factors exert influence and some even act as contingencies, that is, factors with which BMfSI must be aligned



FIGURE 3 Initial framework of sustainability innovation, business model, and business cases for sustainability

to achieve optimal performance (cf. Tidd, 2001, on contingencies in innovation management).

Such factors are discussed, for example, in studies that locate business models within sociotechnical systems (Bidmon & Knab, 2018; Bolton & Hannon, 2016; Budde Christensen, Wells, & Cipcigan, 2012; Hannon, Foxon, & Gale, 2013). Applying a multilevel perspective, Bidmon and Knab (2018) and Bolton and Hannon (2016, p. 1739) contend that business models can serve as “translation devices” that help new technologies to leave their niches and enter the regime level, thus contributing to the evolution of sociotechnical systems. Similarly, Budde Christensen et al. (2012, p. 499) refer to innovative business models as “forces for change.” Bolton and Hannon (2016) furthermore argue that the relationship between a business model and its wider environment is determined by the specific position it has in a sociotechnical system. In the case of ESCos, a form of customer-oriented product-service system, they are but one part of a complex system including resource extraction, energy conversion and transmission, and several other value-creating activities. Therefore, although ESCo business models promote energy efficiency, their overall effect on sociotechnical systems and their sustainability performance is limited.

This points to both supporting and limiting influences, that is, barriers, resulting from environmental factors such as technical infrastructures, institutions, and actors who shape a system while they are shaped by that system in a mutual coevolutionary relationship (Hannon et al., 2013; Schaltegger, Lüdeke-Freund, et al., 2016). The ability of new or modified business models to survive these

evolutionary dynamics depends to a large extent on public policy support and the willingness of private investors to provide financial resources. Correspondingly, Bolton and Hannon (2016) find “a synergistic relationship between a business model, investor perceptions of risk and a political framework.” Regarding the fundamental role of *public policy and private financing*, Wüstenhagen and Menichetti (2012) explain their varying influence along a generic innovation cycle (see also Grubb, 2004). They argue that in the early stages of basic and applied research and development (R&D) and demonstration, only little engagement from private investors can be expected. Public support, such as funding R&D and large-scale demonstrations, compensate for the reluctance of private investors in these stages. The more an invention approaches the market stage, that is, the more it turns into an innovation, the more are private investors willing to step in—which is rational from their perspective because most of the risks and development costs have been incurred by public institutions. This means that the influence of policy interventions and private investors varies along the innovation cycle, which concurrently implies that although sustainability innovations mature, they are subject to varying policy support and private investor engagement.

The most critical phase is the passage from R&D and demonstration to commercialisation, the so-called valley of death, which describes a critical financing gap between initial public funding and regular private financing (Wüstenhagen & Menichetti, 2012). This gap, as a range of studies show (Grubb, 2004), results from an uncoordinated phase-out of policy support while private investors are still hesitant to step in. The fundamental role public policy and private

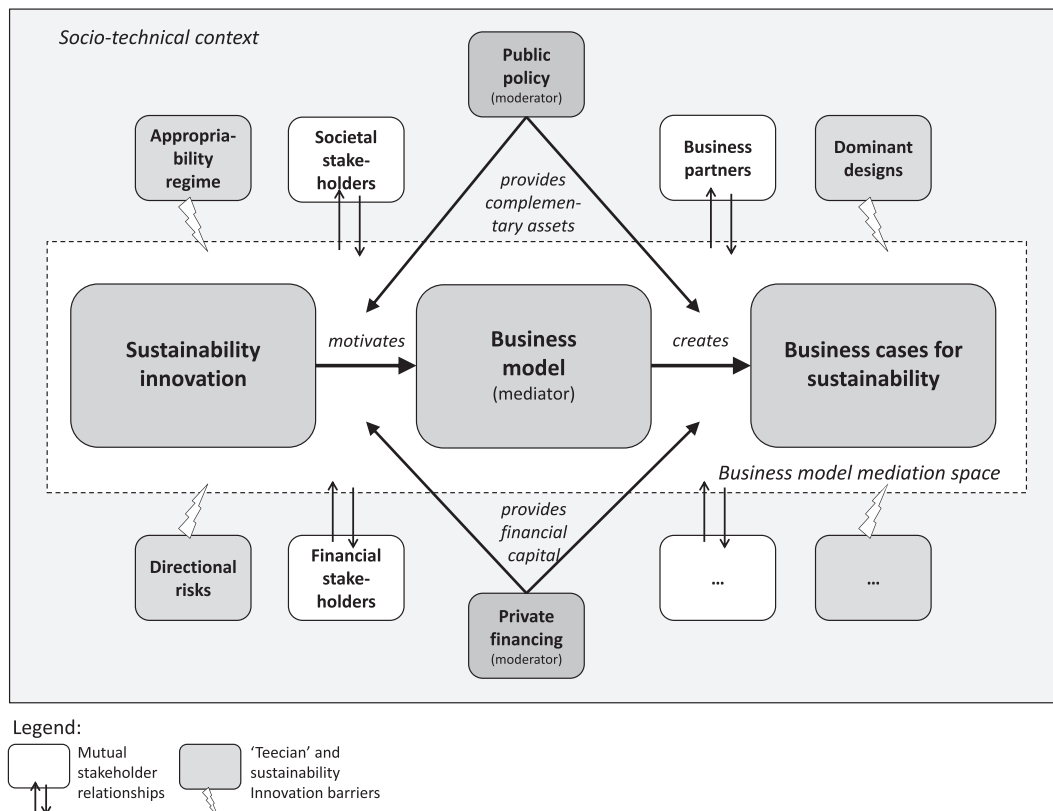


FIGURE 4 The business models for sustainability innovation framework

financing play along the innovation cycle should also hold for the life cycles of business models, including those of sustainable entrepreneurs. The BMfSI framework puts some emphasis on these two environmental factors as they are crucial to deal with the various barriers faced by sustainable entrepreneurs and their innovations. But this is *not* to say that policymakers and private investors are the only relevant stakeholders. Every business model depends on various stakeholders and their willingness to engage in mutual relationships with a firm as a precondition for business cases for sustainability and thus value creation with and for stakeholders. Freudenreich et al. (2019) discuss this issue in detail and propose a framework that considers an initial, nonexclusive list of stakeholders (customers, business partners, employees, societal stakeholders, and financial stakeholders). Some of these are indicated in the BMfSI framework (Figure 4). Although the following discussion focuses on public policy and private financing as key moderators for the emergence and commercialisation of sustainability innovations, an extension or reconfiguration of the BMfSI framework with a focus on further or other stakeholders as moderators is possible as well.

4.2.2 | Barriers to BMfSI

The commercialisation of innovations confronts innovators with diverse challenges from identifying customer segments to production upscaling. Besides such challenges, Teece (1986, 2006) identified a more fundamental dilemma. It is often *not* the innovator who profits most from an innovation but, for example, suppliers, co-operators, and competitors. Teece developed the “profiting from innovation” (PFI) theory to understand the causes of this dilemma and to propose strategies to solve it.

The PFI theory contains three building blocks to analyse and predict commercialisation success (Teece, 1986). The *appropriability regime* describes how the type of an innovation and intellectual property protection determine the likelihood of capturing value from an innovation. Teece distinguishes tight regimes (e.g., hard to imitate, patent-protected chemical processes) from weak regimes (e.g., manufacturing processes that can be copied without defying copyrights). *Dominant designs* are product layouts or production processes that are official or quasi industry standards. In the early phase of an industry, competition is about design sovereignty as the owner of a dominant design can achieve a superior market position. When a dominant design has emerged, competition is about learning, production costs, and the optimal employment of specialised capital. Specialised assets and capabilities are central to the *complementary assets* concept, the third PFI building block. Teece argues that the successful commercialisation of innovations often depends on third-party assets and capabilities as well as complementary products or services (e.g., marketing and after-sales services), particularly in the case of systemic innovations.

Besides these “Teecian barriers,” BMfSI are confronted with specific barriers resulting from the deliberate aspiration to create sustainable value with and for stakeholders. Besides problems such as cost disadvantages from the deliberate internalisation of otherwise externalised ecological and social costs and the multidimensionality of

socioecological problems (Carrillo-Hermosilla, del Río, & Könnölä, 2010), the concept of sustainability innovation itself is problematic. With regard to balancing the various stakeholder interests that converge on this notion, Hansen et al. (2009, p. 687) argue that “[a]ggregating economic, ecological and social effects inevitably leads to trade-offs and is limited due to current methodological constraints ... [and that] objective and specific ‘labelling’ of innovations as being sustainable can only be achieved within a collective and social discourse.” As an example, although customers are able to agree on the most desirable smartphone, achieving agreement on the most sustainable one would be much more difficult. Boons et al. (2013) frame this problem as spatial, temporal, and cultural embeddedness, which leads to *discursive ambiguity*, that is, different context-specific meanings of sustainable development as a process and sustainability as a goal. Moreover, despite the often presumed business opportunities of “sustainable business,” Hansen et al. (2009) point out that only a minority of companies initiate sustainability innovations because they bear additional risks, such as *directional risks*. These imply that the direction of innovation impacts, that is, positive or negative ecological or social effects, cannot be anticipated and thus add complexity to firms’ decision making.

Furthermore, it is commonly assumed that sustainability innovations must be rather *radical and systemic* to change existing patterns of production and consumption (Boons et al., 2013). The literature on sustainability transitions emphasises these characteristics as important to break up dominant technological regimes, though the accumulation of incremental changes is also seen as a transformative force (Geels, 2010). Widely discussed examples are product–service systems (Reim et al., 2015; Tukker, 2015), including approaches such as using instead of buying products (e.g., car sharing), dematerialisation through extended services (e.g., washing centres), leasing (e.g., chemical leasing), or repairing instead of disposal (e.g., refitting household devices; Mont, 2004). However, despite the assumed advantages of such innovations, Andersen (2008) adds for consideration that their problem-solving potential should not be overestimated. Reliable links between innovation and sustainability performance can rarely be determined because of *methodological constraints* of sustainability assessments.

Finally, the most denoting challenge is the so-called double externality problem (Rennings, 2000). Adding to the aforementioned internalisation of negative ecological and social externalities, innovators have to deal with spillovers from their R&D activities, which allow third parties to profit from their efforts “for free” (a positive externality), for example, through (un-)intended knowledge transfers or the dependency on complementary assets of others (Teece, 2006). The double externality problem means that part of the value of an innovation cannot be appropriated due to spillovers, while external costs are deliberately borne by the innovator (Hockerts & Wüstenhagen, 2010). Table 1 summarises the “Teecian barriers” and sustainability innovation challenges.

4.3 | The BMfSI framework

Figure 4 integrates the initial framework and the environmental factors. The resulting framework illustrates that the mediating

TABLE 1 Barriers to business models for sustainability innovation

| Barriers relate to ... | Description of barriers |
|---|--|
| "Teece barriers" to profiting from innovation | |
| Appropriability regime | Type of innovation (e.g., product, knowledge (e.g., tacit), and protection (e.g., patents) determine the ability to capture value from an innovation |
| Dominant design | In early industry phases, innovators compete about standards, i.e., dominating product and process designs |
| Complementary assets | Innovations depend on generic or (co-)specialised assets and capabilities of others (whereas these assets can also depend on the innovation) |
| Further barriers to sustainability innovation | |
| Discursive ambiguity | The meaning of sustainable development and sustainability is spatially, temporally, and culturally embedded |
| Directional risks | The social, ecological, and economic effects of an innovation cannot not (or only insufficiently) be anticipated |
| Radical innovation | Technological regimes and unsustainable dominant designs must be replaced by radical innovations; these are mostly developed in niches |
| System-level change | Besides radical changes, system-level changes are required to transform technological regimes and currently dominating designs |
| Methodological constraints | Lack of (trusted) methods to prove the sustainability of an innovation, e.g., accounting systems, performance measurement, and communication |
| Double externality problem | Innovation spillovers and the internalisation of external costs are a double burden for sustainable entrepreneurs |

relationships between sustainability innovation, business model, and business cases are embedded within a wider sociotechnical context and a mesh of stakeholder relationships, which can exert supporting and limiting moderating effects. A new theoretical concept is also introduced in Figure 4, the *business model mediation space*. This is the space, or totality, of decisions and activities that sustainable entrepreneurs pursue to align their business models with their innovations and business cases, their specific sociotechnical contexts, and stakeholder relationships.¹

The dashed line between sociotechnical context and business model mediation space indicates that a strict separation between these two spheres is hardly possible due to the various cross-boundary relationships in which firms typically engage (with business partners, competitors, regulators, holders of complementary assets, customers, etc.), as well as the fact that the effects of sustainability innovations and business cases are, by definition, not limited to the firm level. On the contrary, their effects are expected to unfold beyond firm boundaries, ideally as positive externalities that help solve ecological and social problems (Cohen & Winn, 2007; Schaltegger & Wagner, 2011).

Diverse claims about the importance and effects of sustainability innovations and transitions are formulated in the literature (e.g., Geels, 2010; Hansen et al., 2009). But one aspect that is often missing is *agency*. Who is bringing forth the required innovations? How are the respective agents stimulating evolutionary dynamics in sociotechnical systems? How are they contributing to systems change and transitions? Among other factors, it is the agency of sustainable entrepreneurs who develop new business models or modify existing ones and thereby create new relationships between their innovations and the markets they serve (cf. Bidmon & Knab, 2018). They also create new relationships to their sociotechnical contexts and align their decisions and activities to public policies and the expectations of private investors and other stakeholders, whereas they can also try to influence these environmental factors, for example, through lobbying (Schaltegger & Wagner, 2011).

The proposed business model mediation space offers a broad range of theoretical and empirical issues that need to be analysed to better understand the potentials and limitations of sustainable entrepreneurs and their business models. Further contingencies and stakeholders can of course come into play, such as complementary technological artefacts or different actor groups. But it can be assumed that Figure 4 includes the essential concepts that are needed to introduce the BMFSI framework in general.

The business model plays a dual role in this framework. In the first horizontal relationship shown in Figure 4 (sustainability innovation → business model), the business model is an outcome, whereas in the second horizontal relationship (business model → business cases for sustainability), it is an antecedent of business success, that is, business cases and, associated to these, sustainable value creation

with and for stakeholders. The following sections discuss these two relationships separately.

4.3.1 | The sustainability innovation and business model relationship

The first major relationship deals with sustainability innovations and their purposes, how sustainability innovations and business models interrelate, and how business models can be aligned with the former. According to Boons and Lüdeke-Freund (2013), the relationships between sustainability innovations and business models depend on the specific purposes of these innovations, which can be the dissemination of clean technologies, the introduction of new organisational forms, or the solution of social problems. Regarding clean technologies, for example, the literature seems to agree on the importance of business models for commercial success (e.g., Bohnsack et al., 2014; Bolton & Hannon, 2016; Huijben, Verbong, & Podoyntsyna, 2016). Three relevant technology and business model combinations can be distinguished: (a) new business models can employ given technologies; (b) given business models can take up new technologies; and (c) new business models can be triggered by new technologies and vice versa.

Transcending the question of how to combine particular innovations and business models, Wells (2008) points to cognitive and normative effects on consumers and other stakeholders and argues that “the business model undoubtedly influences how consumers think about the product, and the normative rules that shape expectations” (p. 84). As an example, if electric power is offered as a low-cost commodity, users will undervalue and waste it. This, however, is only possible because of high externalised costs (e.g., for nuclear waste treatment or subsidies for solar power). It is not only the innovation in question that determines if and how it will unfold positive effects (e.g., green power). The way it is brought to customers can be equally important—rebound effects due to an increasing demand for more efficient products are a common example of unintended side effects of supposedly green innovations (Carrillo-Hermosilla et al., 2010). The questions sustainable entrepreneurs have to answer are as follows: Which societal problem shall be solved (e.g., supplying cost competitive green power); what are the major barriers to commercialising according solutions; and how can business models help in overcoming these barriers?

Public policies, such as governmental support for low-carbon energies through push and pull instruments (Mowery, Nelson, & Martin, 2010), can positively influence the sustainability innovation and business model relationship and help in overcoming barriers. For example, Hannon, Foxon, and Gale (2015) study how demand pull policies help in cultivating ESCos as a particular type of product-service system that applies business models that replace the sale of energy units with energy services (e.g., selling a particular level of space heating instead of kilowatt hours). In this case, a more efficient way of using energy requires an alternative business model that was hindered under the originally dominating policy regime (Bolton & Hannon, 2016) but was made possible through different complementary assets offered by

¹The concept of *business model mediation space* is inspired by the notion of “business model design space” proposed by Huijben et al. (2016) as well as Tidd’s (2001) notion of “strategic degrees of freedom.”

direct (e.g., capital grants and feed-in tariffs) and indirect (e.g., capacity building, certification, and accreditation) policy support (Hannon et al., 2015; Hansen, Lüdeke-Freund, Quan, & West, 2019). In a similar way, a study on former e-mobility provider Better Place in Denmark finds that “regulatory and policy change within a spatial jurisdiction may provide the opportunity for innovative business model design ... Hence in seeking to understand the basis of business model innovation it is pertinent to analyze the policy framework” (Budde Christensen et al., 2012, p. 500). In this case, not only the direct government support for e-mobility exerted moderating effects but also Denmark's historically strong support for wind power, which provided green power as a complementary asset for Better Place's business model. These examples show that we cannot simply assume that sustainable entrepreneurs align their business models with their sustainability innovations without considering external influences. Public policy-based moderating effects, complementary assets held by certain stakeholders, and other influences from the wider sociotechnical context play an important role in business model design.

One major reason for public policy support is the limited availability of financial capital for social and eco-innovations in particular phases of their development and application (Grubb, 2004; Yunus, Moingeon, & Lehmann-Ortega, 2010). In an Organization for Economic Cooperation and Development study on green business models, Beltramello et al. (2013, p. 9) conclude: “Access to financing is a major constraint for many new business models ... financing is an important challenge for many young and innovative firms, and also for larger and riskier business models that engage in more systemic or radical innovations.” The second moderator represents such financing issues and points to the importance of *private financing*, inter alia, to balance public policy changes (e.g., when public funding is phased out). From a Teece perspective, financial capital can be seen as a complementary resource if it has to be acquired from third parties (Teece, 2006, 2010). Capital needs, risks, and investors differ along the innovation cycle from basic research to market diffusion, and once the valley of death has been survived (Wüstenhagen & Menichetti, 2012; section 3.2), sustainable entrepreneurs and their innovations have to make their way from niche to mass market (Schaltegger & Wagner, 2011)—another critical phase in which access to private financing can be crucial for survival.

Following Wüstenhagen and Menichetti (2012), it can be assumed that private investors supporting the sustainability innovation and business model relationship are very limited, because private investments are scarce in the precommercial phase when entrepreneurs search for appropriate business models. Most of the above-identified barriers play against private financing in this phase, and only a very small number of specialised business angels and venture capitalists are willing to support this search.

4.3.2 | The business model and business cases relationship

The second major relationship deals with contributions to business cases for sustainability and thus sustainable value creation with and

for stakeholders as an outcome of business model alignment resulting from the aforementioned first relationship. The focus is on the identification of success drivers such as costs, risks, or reputation and on understanding how aligned business models contribute to their improvement (cf. Schaltegger & Burritt, 2018). Considering that success does not automatically result from combining an innovation with the “right” business model, Schaltegger et al. (2012, p. 102) propose that “mapping the links between business models and business cases for sustainability may be worthwhile to get from single and event-driven business cases for sustainability to business models for sustainability, which serve as templates for reproducing the respective business cases on a regular basis.” This means that, if sustainable entrepreneurs use their business models as mediating devices to commercialise their innovations, they might increase the likelihood of business success. Schaltegger et al. (2012) discuss the links between the business model and major success drivers to elaborate on this assumption. Table 2 shows exemplary interrelations between these drivers and a business model's value proposition.

Furthermore, Schaltegger et al. (2012) argue that designing and maintaining a business model is directly related to a firm's sustainability strategy. If the strategy is defensive, rather weak business model adjustments should result, whereas a proactive strategy should conversely lead to radical business model redesign (for the underlying strategy typology, see Henriques & Sadosky, 1999). For example, a firm with a defensive human resources strategy might attract personnel mainly by high salaries, whereas sustainability-oriented employees might prefer companies with an alternative organisational culture paying attention to employees' diverse needs and values (Ehnert, 2009). In this case, further reaching organisational change might be necessary and even lead to business model innovation (Stubbs & Cocklin, 2008).

But regardless of how well-aligned business models are with the innovations they seek to commercialise, they often struggle with competitive disadvantages such as relatively high costs or incompatibilities

TABLE 2 Exemplary interrelations between a business model's value proposition and business case drivers

| Business case driver | Business model value proposition |
|----------------------------|---|
| Costs and cost reduction | Products and services with lower energy or maintenance costs for customers |
| Risk and risk reduction | Lowering societal risks through products and services can create value to certain customer segments |
| Sales and profit margin | Environmentally and socially superior products and services require modified or new value propositions to turn into sales and profits |
| Reputation and brand value | Sustainability as distinctive element of good corporate reputation and brand value |
| Attractiveness as employer | A companies' offerings and value propositions allowing for personal identification to attract employees |
| Innovative capabilities | Unfolding the full sustainability potential of innovations enables modified or new value propositions |

Source: Schaltegger et al. (2012), p. 107.



with dominating sociotechnical systems (Bidmon & Knab, 2018; Budde Christensen et al., 2012). The insolvency of Better Place is an example of how fragile a new business model can be when it comes to the creation of a self-sustaining business case, even though it is funded with hundreds of millions of dollars (Reed, 2013). Public policies are needed that burden unsustainable practices (e.g., using fossil fuels) while they support socially and ecologically superior alternatives (Hockerts & Wüstenhagen, 2010). Using Teece language, BMfSI need public policies that offer complementary assets such as funding and mandate using more sustainable alternatives. Such policies must be reliable in the long run because it can take a whole generation (or even longer) for innovations to unfold their full transformative potential (Kemp, Loorbach, & Rotmans, 2007; Mowery et al., 2010) and to develop competitive business case drivers, such as reduced costs and risks for customers or the reputation of a whole class of new technologies.

Various financing issues are related to the market introduction and diffusion of sustainability innovations. Different studies analyse how the financing success of clean technologies relates to specific business model features (e.g., Bohnsack et al., 2014; Richter, 2013). For example, experiments with renewable energy financing experts revealed a brand bias, where the employment of premium brand solar technologies was rated as the most important criterion, even more important than quantitative financial indicators (Loock, 2012; Lüdeke-Freund & Loock, 2011). Clean energy business models with premium brand technologies provide better access to financial capital, which is important for the development of roll-out strategies and finally business cases. Sustainable entrepreneurs can use these insights to optimise their business models when they enter the market and scale their businesses. Instead of striving for lowest costs to be competitive, investing in premium brand technologies can pay off in terms of improved access to financial capital. If a business case is based on such a branding strategy, private financing will strengthen appropriate financial models, value propositions, and marketing approaches and thus positively moderate the business model and business case relationship.

As another example, Budde Christensen et al. (2012) found that a "combination of the sunk costs in batteries and those associated with the recharging and battery swap infrastructure means that Better Place is based on a capital intensive business model" (Budde Christensen et al., 2012, p. 503). This capital intensity can be traced back to certain features of their sustainability innovation, such as the need for expensive batteries and high infrastructure costs. On their way to the market and a potential business case, which the firm did not achieve, Better Place relied heavily on private financing to scale their business model simultaneously in different countries. One industry that is successful and shows a positive moderating effect of private financing is the large-scale renewable energy industry (e.g., Lüdeke-Freund, 2014), where "financially strong investors have entered the renewable energy market, because large-scale renewable energy projects offer relatively stable returns which are independent from the financial markets" (Richter, 2013, p. 1226). In this case, the continuous inflow of private financing, in concert with public policy support, creates a basis for continued business cases.

5 | DISCUSSION AND PROPOSITIONS FOR FUTURE RESEARCH

This article presents the BMfSI framework to structure core issues that emerge at the diverse intersections of sustainable entrepreneurship, sustainability innovation, and business model research (Boons et al., 2013; Schaltegger, Hansen, & Lüdeke-Freund, 2016). The framework builds on the theoretically grounded assumption that the most important business model function for the creation of ecological, social, and economic value is its ability to mediate between innovations, for example, new processes, products or services, and valuable outcomes such as solved ecological and social problems. This view is a theoretical extension of the mediation hypotheses put forward by, for example, Al-Debei and Avison (2010), Chesbrough and Rosenbloom (2002), or Doganova and Eyquem-Renault (2009), who define business models as focusing and mediating devices that can unlock the latent economic value of innovations. This theoretical characteristic is taken up by the BMfSI framework. As such, it is meant to support systematic analyses of how business models can be used by sustainable entrepreneurs to unlock their innovations' latent sustainability potentials, that is, to improve their ability to create ecological and social value.

Sustainable value creation, however, faces several barriers. General ("Teecean") and sustainability-specific barriers can be distinguished. Teece (1986, 2006) defines general barriers in his PFI theory, including the appropriability regime in which an innovation is embedded, dominant designs it has to compete with, and complementary assets it depends on. Although Teece refers to technological innovations without considering social or ecological issues, the literature on sustainability innovation identifies more specific barriers. The identification and systematisation of six sustainability-specific barriers is not only a contribution to the framework developed in this article but also a contribution to the wider discourse on responsible and sustainability innovation (e.g., Adams, Jeanrenaud, Bessant, Denyer, & Overy, 2016; Boons et al., 2013; Hansen et al., 2009; Stilgoe, Owen, & Macnaghten, 2013). These barriers might also be seen as a call for further studies on distinctive sustainability-oriented capabilities as recently laid out by Demirel and Kesidou (2019). They identified voluntary self-regulation, deliberate investments in environmental R&D, and green market sensing as key capabilities that firms need to develop to increase the likelihood of environmental innovations. Merging research on resources and capabilities, business model innovation, and sustainable entrepreneurship could be one way of studying in more detail if and how Teecean and sustainability innovation barriers can be overcome, that is, if and how sustainable entrepreneurs can unfold agency within given systems such as industries and markets.

Several empirical studies indicate that it is *how* an innovation is brought to the market, and not only the innovation itself, that decides about market success or failure (e.g., Mitchell & Coles, 2003; Zott & Amit, 2008). Its effects on production and consumption patterns, which are crucial from a sustainable entrepreneurship perspective, can also depend on the underlying business model (Wells, 2008). This leads to rethinking the sources of competitive advantage. Chesbrough

(2010, p. 355) famously stated that, "it is probably true that a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model." That is, sustainable entrepreneurs who excel at developing or innovating business models might be better positioned to exploit even radical innovations, despite their relative competitive disadvantages, which can result from higher (financial) costs or a lack of complementary assets such as established retail partners (Schaltegger et al., 2012). Although there seems to be broad agreement on the importance of business models for competitive success and value creation, there are also more critical observers who quite rightly question whether business models are really all-in-one solutions for sustainability innovations that shall be brought to commercial success (Budde Christensen et al., 2012). Therefore, the aforementioned assumptions about the mediating role of the business model might be contested and thus need empirical testing. A hypothesis that might be tested could be: *Sustainability innovations commercialised through new or adapted business models are more likely to enter markets and diffuse successfully.*

However, "success" cannot be defined in general (cf. Upward & Jones, 2016). Although green innovators might define success as financial profit with environmental technologies, social entrepreneurs might perceive the social benefits of providing medical goods to poor people as success while their own financial rewards are not that important (Schaltegger & Wagner, 2011; Yunus et al., 2010). Therefore, the successful commercialisation of sustainability innovations is not the same as success per se. The latter depends on the entrepreneur's individual definition of the particular outcome that is to be achieved, as well as the potential of a BMfSI to create stakeholder value, that is, to meet stakeholders' expectations. Essentially, it is a question of fulfilling a joint purpose (Freudenreich et al., 2019). This particularity of sustainable entrepreneurship is acknowledged, for example, in the Framework for Strategic Sustainable Development and its generic success concept (Broman & Robèrt, 2017). This somehow elusive property of the concept of success requires accepting varying success or business case definitions, which also depend on the associated sustainability strategies. These can also address different kinds of success drivers; a selection of which has been presented in Section 4.3.2. Improving these drivers might sometimes require radical sustainability strategies, leading to correspondingly radical BMfSI. In this regard, we may hypothesise the following: *Sustainability innovations without aligned business models fall short of improving business case drivers and are thus not successful.* If this is true, larger corporations that use their traditional business models to market sustainable products or service should not wonder if they are not successful in the market. The question whether incremental or radical business model alignment is required to mediate the relationship between sustainability innovation and business case goes beyond the discussion in this paper. But it points to a promising avenue for future research as there is a lack of studies analysing this relationship and its effects on business case drivers in a systematic way.

Another insight refers to a topic that has also gained little attention thus far. Although several market and policy studies conclude

that sustainability-oriented business models need specific policy support (e.g., Beltramello et al., 2013; Bisgaard, Henriksen, & Bjerre, 2012), like most types of green or social innovation, it is not known if and how sustainable entrepreneurs actually use their business models to benefit from public policies. Available examples of single-case or small sample studies often refer to clean energy or mobility (e.g., Bohnsack et al., 2014; Budde Christensen et al., 2012; Hannon et al., 2013), but general information about policy-driven business model innovations and strategies, for example, gained from large and mixed sample studies, are currently missing. Teece (2006), reflecting on his PFI theory, acknowledges the importance of business models for the acquisition of complementary assets but does not make a connection between business models as devices that help in acquiring complementary assets and the public policies providing them. Studies that provide more details about the relationships between business models and public policies are needed, also to better understand if different moderators (e.g., public policies and private funding) are of varying importance along the different phases of a business model life cycle.

This relates to the valley of death, that is, the phase of highest financial insecurity as innovations approach the market, which is another major barrier for innovation-driven entrepreneurship. However, due to the additional challenges associated with sustainability innovations—such as directional risks and the double externality problem—it might be more demanding to convince banks and equity investors. Wüstenhagen and Menichetti (2012) offer a systematic perspective on the different phases that have to be passed on the way to market success and argue that the valley of death challenges entrepreneurs to switch from public funding to private financing, for example, based on venture capital, private equity, and project financing. The ability to adapt and communicate a business model's financing component in a convincing manner can be crucial to survive this passage. A case in point is Welsh mobility designer Riversimple. This start-up is successfully using crowdfunding and raised a significant amount of money. Riversimple's hydrogen-based mobility service and its financing model are prominently described on the firm's website. The narrative used by Riversimple attracts a lot of interest and creates trust in this new firm: "We don't believe that there needs to be any trade-off between a successful, profitable, resilient business and delivering our aim of eliminating environmental impact. We have designed our business, from scratch, to turn sustainability from a cost on the bottom line to a source of competitive advantage. The more environmental damage we eliminate, the more successful we will be as a business" (Riversimple, 2019). A related hypothesis that could be tested could state that a clear and strong business model narrative is required to be more successful than companies that promote a sustainability innovation without such a narrative: *Companies that promote a sustainable product or service and a corresponding business model narrative are more successful in attracting private funding than companies without such a narrative.* One possible avenue may be to take a behavioural finance perspective to study how nonfinancial and even seemingly irrational decision criteria, triggered by a "smart" business model narrative, are applied in financial decision making. These insights could

motivate a rather unexplored field of sustainable business model research that recognises behavioural and nonfinancial aspects, as, for example, proposed by Loock and Hacklin (2015) who discuss heuristics and the cognitive foundations of business modelling.

In sum, this article makes a contribution to the emerging field of research and practice on sustainable business models in that it offers a new framework to structure major topics within this field. Although it is often assumed that business models are crucial for sustainable entrepreneurship and their sustainability innovations to unfold, we lack an understanding of the processes, “mechanisms”, and dynamics that integrate these phenomena. It might be an obvious and logical assumption that business models—here, with a focus on their mediating function—are as important for sustainable entrepreneurs, as they are for traditional entrepreneurs. But, in fact, this assumption is mostly formulated without opening an important black box; a black box that obscures critical and yet unexplored relationships between sustainability innovations, business models, and business cases. Opening this black box is a prerequisite to support the deliberate application and study of business models with a green and social purpose. By delineating major theory streams, concepts, and their relationships, this article develops a foundation for further theorising and empirical research in a domain that has yet to be thoroughly studied, namely, the manifold decisions and activities that take place in the business model mediating space. The conceptual and theoretical work done in this article suggests a reference point for this domain and a first step towards more comprehensive research programmes for its further development. The specific strength of the BMfSI framework is that it builds on and integrates several theoretical streams, that is, entrepreneurship, innovation, and business model studies, embedded in the overarching search for business contributions to a sustainable development of the natural environment and society.

Although Section 2 argues for the importance of conceptual research as a bridge between phenomenon, empirical testing, and theory building, such research faces some limitations. In its current form, the BMfSI framework highlights some ways in which business models can help to commercialise sustainability innovations, whereas others are not discussed and should be addressed in future research. The conditions under which BMfSI emerge could be studied from an evolutionary perspective considering the dependencies between different organisations (Hockerts & Wüstenhagen, 2010; Schaltegger, Lüdeke-Freund, et al., 2016) and institutional contingencies (Hannon et al., 2013). Studies on change in sociotechnical systems and sustainability transitions offer promising directions to embed business model studies within wider systems perspectives (Köhler et al., 2019). Others could take a firm perspective emphasising the role of “intrapreneurship” (cf. Gapp & Fisher, 2007). Moreover, the classification of environmental factors and their influence on the business model mediation space requires some more consideration (e.g., building on Stubbs & Cocklin, 2008; Teece, 2006). This also points to the question whether and how the BMfSI framework could be refined through contingency theories of organisational development. Further refinement is needed regarding not only these factors but also the types of entrepreneurship that are studied. So far, this article builds on the notion of sustainability

innovation, but how must the framework be adapted if more fine-grained forms of ecological or social innovation were distinguished? For example, the eco-innovation types identified by Kiefer et al. (2019), who distinguish systemic, externally driven, continuous improvement, radical and technology-push, and eco-efficient innovations. It can be assumed that these different types of innovations lead to different business model alignments and different outcomes in terms of stakeholder value creation. Empirical studies could therefore analyse the interplay of different types of sustainability innovations and how these translate into different business model patterns (cf. Lüdeke-Freund, Carroux, Joyce, Massa, & Breuer, 2018; Lüdeke-Freund, Gold, & Bocken, 2019) and different business cases. Moreover, only a few barriers to sustainability innovation are explicitly addressed in the discussion of the mediating and moderating relationships. The identified list of barriers is extensive but not yet conclusive. Further barriers might be added, such as cognitive effects influencing entrepreneurs' ability to engage in sustainability innovation (e.g., Laukkanen & Patala, 2014) or limitations imposed by the available resources, competencies, and dynamic capabilities of a firm (Kiefer et al., 2019). Future research could start by refining these and further analytical variables implied by the BMfSI framework. Recent publications (e.g., Spieth & Schneider, 2016) offer concepts to operationalise and quantify the degree of business model innovation, which would be a central variable in empirical research building on the proposed framework.

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How to cite this article: Lüdeke-Freund F. Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research. *Bus Strat Env*. 2020;29:665–681. <https://doi.org/10.1002/bse.2396>