Journal of Cleaner Production 45 (2013) 9–19

Contents lists available at SciVerse ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Business models for sustainable innovation: state-of-the-art and steps towards a research agenda

Frank Boons [a,*], Florian Lüdeke-Freund [b]

[a] Department of Public Administration, Erasmus University Rotterdam, Postbox 1738, 3000 DR Rotterdam, Netherlands
[b] Centre for Sustainability Management (CSM), Leuphana University Lüneburg, Scharnhorststr. 1, D-21335 Lüneburg, Germany

ARTICLE INFO

Article history:
Received 4 March 2011
Received in revised form
3 July 2012
Accepted 5 July 2012
Available online 31 July 2012

Keywords:
Sustainable innovation
Sustainable business model
Business model for sustainability
Literature review
Research agenda

ABSTRACT

The aim of this paper is to advance research on sustainable innovation by adopting a business model perspective. Through a confrontation of the literature on both topics we find that research on sustainable innovation has tended to neglect the way in which firms need to combine a value proposition, the organization of the upstream and downstream value chain and a financial model in order to bring sustainable innovations to the market. Therefore, we review the current literature on business models in the contexts of technological, organizational and social innovation. As the current literature does not offer a general conceptual definition of sustainable business models, we propose examples of normative requirements that business models should meet in order to support sustainable innovations. Finally, we sketch the outline of a research agenda by formulating a number of guiding questions.

1. Introduction

In the past decade, research on sustainable innovations has expanded rapidly to increase our understanding of the ways in which new technologies and social practices enable societies to become more sustainable. Earlier special issues of this journal have focused on eco-innovation (Hall and Clark, 2003) and the diffusion of clean technologies (Montalvo, 2008). Also, in the past decade coherent perspectives have been introduced that look more systemically at the ways in which more sustainable technologies are adopted in society, such as transition management and innovation systems research (see Coenen and Diaz-Lopez, 2010 for a comparative overview). This research has contributed to our knowledge of factors that induce sustainable innovations, such as regulation and firm characteristics, and also show the interplay of factors in innovation and societal systems that determine the often complex journey of new ideas into products and services (Geels et al., 2008).

While an innovation is often distinguished from an invention by the additional condition of successful market introduction, the actual way through which firms succeed in bringing an invention to the market is relatively unexplored (e.g., Teece, 2006; Chesbrough, 2007a). While this issue is gaining increasing attention in the "mainstream" literature (Baden-Fuller et al., 2010), it is still underexplored in the field of sustainable innovation (Charter et al., 2008; Schaltegger et al., 2012; Tukker and Tischner, 2006; Wells, 2008).

In this article we focus on this gap. We look not so much at products or services themselves, nor at their physical attributes and sustainability impacts. Instead we focus on how business models and sustainable innovations interrelate and what can be learned from the current scientific literature. We search for links between sustainable innovations and the business model concept. The latter concept, which is drawn from the field of business management, captures key dimensions of successful market introduction: it specifies how a firm is able to earn money from providing products and services. This includes not only the value proposition to customers, but also the value creating constellation in which the firm connects to suppliers and acquires resources in a profitable manner. We propose that these elements are crucial for making sustainable innovations successful.

The questions we seek to answer in this article are:

What does the current scientific literature reveal about the interrelations between business models and sustainable innovations?

How can the business model perspective help to define future topics for research on sustainable innovation?

* Corresponding author.
E-mail address: boons@fsw.eur.nl (F. Boons).

0959-6526/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jclepro.2012.07.007

By answering these questions, we contribute to the literature in three ways. First, we provide insight into the ways in which the sustainable innovation literature currently lacks attention towards aspects that are crucial for successfully marketing innovations. These elements are provided by incorporating the business model literature. Secondly, we propose a set of normative requirements under which business models for sustainable innovation should operate. Thirdly, we present a research agenda for sustainable innovation that incorporates the elements of business models.

While we focus on forging a link between sustainable innovation and business models in research, this link is also relevant for practitioners. As will become clear, the business model perspective reveals a number of components that need to be actively managed in order to "create customer and social value by integrating social, environmental, and business activities" (Schaltegger et al., 2012, p. 112).

We proceed by introducing the business model as a market device that is closely related to innovation (Section 2). Section 3 summarizes the literature on sustainable innovation and identifies three relevant levels of analysis: the organizational, inter-organizational and societal level. In combination with insights from early considerations of sustainable business models these lead us to propose basic normative requirements for business models that facilitate sustainable innovations (4.1). These basic requirements are then further developed, based on literature revealing general barriers to marketing sustainable innovations (4.2) and current literature dealing with business models for technological, organizational and social innovations (4.3). Section 5 reflects the main findings from our review and Section 6 concludes with five key questions for setting up an agenda for research on sustainable innovation that integrates the business model perspective.

2. The business model: an emerging concept

Identifying business models as a means of creating value through sustainable innovations requires a clear understanding of the unit of analysis.[1] In order to build on the diversity which is present in the literature on this topic, we screened 87 journal articles on business models which could be identified in the Thomson Reuters database Web of Science. Our search string was "business model" in article titles, to make sure that business models were explicit objects of research. We searched for articles from 1990 to 2010, whereas the earliest ones were actually published in 2000. Further articles were identified through cross-reference searches which were essential to identify articles on sustainable business models. In sum we worked on a set of 115 articles, a handful of books and some research working papers.

Combining Osterwalder (2004) and Doganova and Eyquem-Renault (2009) we distinguish the following elements of a generic business model concept:

1. *Value proposition*: what value is embedded in the product/service offered by the firm;
2. *Supply chain*: how are upstream relationships with suppliers structured and managed;
3. *Customer interface*: how are downstream relationships with customers structured and managed;
4. *Financial model*: costs and benefits from 1), 2) and 3) and their distribution across business model stakeholders.

For existing firms it is possible to specify these elements. For new ventures this may be unclear. In this context, a business model is used as a plan which specifies how a new venture can become profitable. Doganova and Eyquem-Renault (2009) argue that a business model is a "market device" (Callon et al., 2007), an intermediary between different innovation actors such as companies, financiers, research institutions, etc., i.e., actors who shape innovation networks. In their theory, such networks are created through what they call "narratives" and "calculations" which entrepreneurs circulate to describe their ventures and to construct markets. Here, the business model is seen as a reference point for communication among the different actors with whom entrepreneurs engage. Markets for innovations thus emerge through interaction between these actors who also interfere with different kinds of devices (e.g., support materials such as analysts' reports, presentations, software, or money). The business model, as it connects actors through narratives and calculations (see also Magretta, 2002), can be interpreted as such a market device (Doganova and Eyquem-Renault, 2009). This perspective is relevant because marketing sustainable innovations may require a rethinking of the terms of competition and collaboration among the actors engaged in the corresponding innovation networks.

In his overview of business model literature, Wirtz (2011) identifies three streams. The first stream focuses on technology. Explicating business models became popular during the internet boom, when firms and analysts came to realize that existing ways of earning a profit were not suitable for capitalizing on new technologies: web-based products and services (e.g., Ghaziani and Ventresca, 2005; Timmers, 1998). Hence, there is a substantial body of literature which focuses on the consequences of particular technologies on how firms organize to earn profits. This is relevant for the field of sustainable innovation since technologies that contribute to sustainability may have a similar effect.

The second, organizational, stream emanates from this work and deals with the business model as a strategic management tool to improve a company's value chain (e.g., Linder and Cantrell, 2000; Tikkanen et al., 2005). Here, a business model serves as a development tool for business systems and architectures for representing, planning and structuring business with an emphasis on organizational efficiency.

A third stream is strategy-oriented. It adds the element of market competition to the efficiency focus of the second stream (e.g., Afuah, 2004; Casadesus-Masanell and Ricart, 2010; Chesbrough, 2007a; Hamel, 2000; Magretta, 2002). Common sense amongst strategy-oriented business model scholars is that creating and delivering customer value lies at the heart of any business model (e.g., Afuah, 2004; Chesbrough, 2010; Johnson, 2010; Osterwalder and Pigneur, 2009; Teece, 2010; Zott and Amit, 2010). Moreover, while creating and delivering customer value, the business model itself can become a source of competitive advantage – by means of business model innovation (e.g., Chesbrough, 2010; Johnson, 2010; Markides and Charitou, 2004; Mitchell and Coles, 2003). Companies striving for a competitive edge through unique value propositions can use the configuration of their business models' building blocks to execute their strategies on the market. Therefore, "a business model is the direct result of strategy but is not, itself, a strategy" (Casadesus-Masanell and Ricart, 2010, p. 212). In this sense, strategic interaction between rivals results in competition based on business model modifications (Casadesus-Masanell and Ricart, 2010). An important question for future research, which cannot be dealt with in this article due to page limits, is to what extent strategy as business model modification

[1] A systematic overview of perspectives is Wirtz's book on business model management (Wirtz, 2011). Moreover, Long Range Planning published a special issue on latest business model research (2010, Vol. 43, No. 2/3) and a Harvard Business Review paperback collection on business model innovation was released in 2010; a second HBR paperback on "Rebuilding Your Business Model" was published in 2011. For other definitions, see, for example, Johnson et al., 2008, Chesbrough, 2010, Wirtz, 2011, or Zott et al., 2011.

and competition can support the marketing of sustainable innovations.

Our review shows that innovation is a dominant topic in the literature on business models as an important aspect of creating competitive advantage and renewing organizations (about 50 articles deal with business model innovation and more than 20 with business models *and* innovation). Two roles of business models can be distinguished (Baden-Fuller et al., 2010; Wirtz, 2011). First, business models can support the strategic marketing of innovative processes, products and services (e.g., Pateli and Giaglis, 2005; Teece, 2010; Zott and Amit, 2008, 2007). Secondly, business models themselves can be changed and innovated to provide competitive advantage by changing the terms of competition (e.g., Chesbrough, 2010; Demil and Lecocq, 2010; Johnson, 2010; Zott and Amit, 2010). Situations where process or product innovations impact business model designs and vice versa are also explored, especially by Chesbrough (e.g., Calia et al., 2007; Chesbrough, 2007b; Chesbrough and Rosenbloom, 2002; Chesbrough et al., 2006).

In the management literature there is thus a clear linkage between the business model of a firm and its innovation activities. Following this lead, we propose that to advance research on sustainable innovation the linkage to business models should be further explored. This requires first of all that we make clear what makes innovations sustainable.

3. Sustainable innovation and sustainable business

This section starts with an overview of the literature on sustainable innovation (Section 3.1). We then summarize earlier discourses where business models were acknowledged as a crucial aspect of entrepreneurial and managerial sustainability activities (Section 3.2). We then present current work on sustainable business models with an innovation focus (Section 4).

3.1. Research on sustainable innovation

A systematic review of the literature on sustainable innovations and related concepts is beyond the scope of this article. Getting an overview is further complicated because the literature on sustainable innovation is hampered by a lack of conceptual consensus. A recent overview (Carrillo-Hermosilla et al., 2010) lists many different definitions of the term “eco-innovation”, a label which is often used interchangeably with sustainable innovation. Related terms such as clean(er) technologies are also used in a way that overlaps with innovations that have a superior ecological performance. This situation is a consequence of the fact that researchers from many different disciplines have picked up this topic: evolutionary economics, science and technology studies, innovation economics, economic sociology, and history. All of these focus mainly on innovations related to the ecological impact of a product or service. There is, however, a rapidly growing body of work focusing on the social aspect under the banner of so called “bottom of the pyramid” initiatives (e.g., Prahalad, 2005; Prahalad and Hart, 2002; Seelos and Mair, 2005, 2007; Yunus et al., 2010).

For our purposes, we rely on 5 recent publications that provide an overview of several segments of this literature (Weber and Hemmelskamp, 2005; OECD, 2009; Carrillo-Hermosilla et al., 2009; Arimura et al., 2007; Smith et al., 2010). We have structured research according to the level of analysis on which it focuses: the organizational, inter-organizational, and societal level. In our presentation we focus on ways in which researchers conceptualize the marketing of innovations.

At the *organizational level*, the focus is on the individual firm and its innovative capacities. Here, research focuses on the capacity to develop new technologies, and how to connect this within the firm to other functions (such as marketing and production) in order to come up with a marketable value proposition. While many contributions provide tools (such as for EcoDesign or calculating ecological impact), insight into the actual process of managerial decision making is limited (Visser et al., 2008 is an exception). More often, firms are treated as a black box, and researchers study the impact of various factors on its innovative capacities through statistical methods (Arimura et al., 2007; Horbach, 2008). The Porter hypothesis and the research it has stimulated is an example of such work, where the impact of regulation on the capacity of firms to develop environmental innovations is studied. Some of these studies measure innovative capacity in terms of input (R&D expenditure; Jaffe and Palmer, 1997) or patents (Brunnermeier and Cohen, 2003). If anything, this shows a neglect of the importance of the process of marketing innovations. This is shown by a similar approach to the adoption of cleaner technologies which also looks at individual factors affecting adoption behavior of firms (Montalvo, 2008).

Studies at the organizational level often do not explicitly address the mechanisms through which influencing factors affect innovative capacities or help to produce concrete results in terms of marketed innovations. At the *inter-organizational level* such mechanisms begin to come into focus. Examples are studies on the adoption and diffusion of clean technologies (Kemp and Volpi, 2008). Also, modeling studies give insight into the complex way in which, for instance, regulatory standards and supply chain pressures interact in a supply chain (Saint-Jean, 2008; Seuring and Müller, 2008). A substantial amount of work has been done under the banner of (environmental) innovation systems. These studies draw a system boundary around the network of actors who contribute to the innovation process (Edquist, 1997; Weber and Hemmelskamp, 2005). A specific strand of this literature seeks to identify functions that need to be performed by the system in order to produce successful new technologies (Hekkert et al., 2007). One of these functions is a typical business model function: the formation of markets (e.g., Amit and Zott, 2010; Seelos and Mair, 2007). Inter-organizational studies of sustainable innovation bring into focus the relevance of what we have distinguished above as the second and third elements of a business model: the relationships with other actors (i.e., suppliers and customers). At the same time, they often fail to link these elements to the analysis of value propositions and financial models. However, this systemic view on connecting actors in an innovation network is related to the market device functions proposed by Doganova and Eyquem-Renault (2009).

Studies at the *societal level* draw the system boundary even wider, aiming to understand what is called transitions (an overview is provided by Smith et al., 2010). While there is criticism to this perspective as a management approach to innovations at the societal level (Shove and Walker, 2007), there is a growing body of literature which seeks to understand societal shifts in terms of technological changes where the existing technology is conceptualized as a regime which is challenged by new innovations that occupy niches in the wider landscape (Geels, 2005). Given their scope, these studies also focus on the first element of business models, i.e., that of the definition of value which brings together actors around an existing or new technology. Unfortunately, most of the work done under this banner shows a lack of consideration for agency (Genus and Coles, 2008). As a result, it is difficult to link it to our perspective where the business model is put forward by a firm, and serves as a device which acts as a conduit to facilitate the problematic interactions among actors.

An earlier special issue of this journal (Hall and Clark, 2003) similarly focused on this crucial aspect: without a successful

diffusion in society, eco-innovations are meaningless. In capitalist societies the market is a dominant coordination mechanism where such success is achieved. There it is defined as increased market share and profitable returns for the firms that bring a new product or service to the market. The premise of market success alone challenges any attempt of change. As will be discussed below, an additional challenge for the creation and further development of businesses towards sustainability is the co-creation of societal and economic profits. Looking at sustainable innovation from a business model perspective might shed light on how these challenges can be met.

3.2. Antecedents of a modern discourse on sustainable business models

In the literature on sustainable entrepreneurship and corporate sustainability management the concept of business models is still used in a fuzzy way (Lüdeke-Freund, 2009; Schaltegger et al., 2012). Nevertheless, general connections to corporate sustainability, including sustainable innovation, can be found, for example, in two classic articles.

Lovins et al. (1999) propose a four step agenda to align business practice with environmental needs. This agenda, labeled Natural Capitalism, consists of management principles beyond the often efficiency-centered perspective of environmental management – increase of natural resources' productivity; imitation of biological production models; change of business models; and reinvestment in natural capital. Important for our review is the fact that Lovins and colleagues see a change towards sustainable business models as crucial to realizing Natural Capitalism. But the emergence of such models requires a revision of distorted information and incentive systems: "the instruments companies use to set their targets, measure their performance, and hand out rewards are faulty" (Lovins et al., 1999, p. 12; see Burritt and Schaltegger, 2010 for more information on sustainability accounting and reporting). The necessarily distorted business models increase work force productivity, but at the same time they amplify exploitation of natural resources and sometimes even employees (Schnaiberg, 1980). Lovins and colleagues refer to the much-cited example of US-based carpet manufacturer Interface Inc. as a positive counter-example (Box 1).

> Box 1. Interface Inc. – a role model for ecologically enhanced business.
>
> *Interface Inc.* changed its business from manufacturing and selling carpets for office buildings to a billion-dollar floor-covering service-leasing model (Stubbs and Cocklin, 2008). The change to a service-centered business model lead to the new customer value proposition "floor-covering" and a more than thirty-fold reduced flow of materials (Lovins et al., 1999). The produce-and-use (up) logic changed to a model in which suppliers "get paid to provide the agreed-upon level of comfort, however that's delivered" (Lovins et al., 1999, p. 10). Such approaches can realign metrics, incentives, measurement and accounting practices with the goal of reducing ecological harm.

Lovins and colleagues' plea resonates with the work of Hart and Milstein (1999), who see sustainable development as a force of industrial renewal and progress – if managers learn to see the business opportunities connected to this challenge. They argue that three ideal types of economies can be differentiated: consumer, emerging, and survival economies. Each calls for different business strategies and models as their respective conditions for production and consumption differ considerably in the light of sustainable development. Thus, they conclude that "simply transplanting business models" (Hart and Milstein, 1999, p. 29) from one economy to another will run counter to sustainable development. Openness to social and technological leapfrog innovations is required to avoid replicating the weak points of dominant Western business models in emerging and survival economies (Hart, 1997). Consumer economies, highly industrialized nations with roughly one billion people, are characterized by great purchasing power, extensive infrastructures, and literally unlimited consumption possibilities. Here, business models have to change in a way that reduces corporate footprints and decouples production and consumption from social and ecological impacts. In survival economies, mainly based on rural lifestyles, lacking infrastructures of any kind and whose three to four billion people often suffer from unmet basic needs, companies have to come up with radical business model innovations that must inevitably deviate from common consumer models. Here, the authors refer to groundbreaking businesses like micro-credits (Grameen Bank) or low-priced ready-to-make kits for clothing (Ruf and Tuf jeans). The economies in between, two to three billion people in emerging countries, are characterized by satisfied basic needs and increasing purchasing power. According to Hart and Milstein, trends of rapid industrialization and urbanization urgently ask for new solutions to meeting familiar customer needs.

These two classic articles envision changing business models as a way to reduce negative social and ecological impacts or even as a way to purposefully achieve sustainable development. While Lovins and colleagues discuss business model change as a central step on their path towards Natural Capitalism, Hart and Milstein point to the fact that the world is a patchwork of different, in part even non-compatible, economies that require carefully selected business models – all the more, if economic development is to contribute to sustainable development. Having identified business model change as an important instrument to support sustainability-oriented businesses, we argue that this instrument is not an end in itself. Moreover, the business model concept has to be linked to approaches of sustainable innovation to identify possibilities of creating sustainable value.

4. Linking business models to sustainable innovation

In this section we aim to show how the business model perspective helps to better explore and understand how different types of sustainable innovations are marketed, and thus, how this perspective can become a new field of sustainable innovation research – a crucial topic that has only rarely been addressed (e.g., Charter et al., 2008; Wells, 2008). Building on the insights from Sections 2 and 3, we start with proposing a basic set of normative requirements that have to be met for business models to contribute to marketing sustainable innovation. We then confront these with literature on barriers that have to be overcome by *business models for sustainable innovation.*

4.1. Normative requirements for business models for sustainable innovation

The concept of sustainable innovation is grounded in wider normative concepts such as environmental sustainability or sustainable development (e.g., Boons, 2009; Carrillo-Hermosilla et al., 2009, 2010; Hall and Clark, 2003). Comparable conceptual notions of sustainable business models do not exist today (Lüdeke-

Freund, 2009; Schaltegger et al., 2012). This may be a result of the fact that sustainable development does not denote a specific content, but rather a process where ecological, economic and social values are balanced in continuous action (Lélé, 1991). From the literature on sustainable innovation we learn that this process involves inter-organizational networks and even wider societal systems. Such networks do not only include firms, but also other stakeholders. Based on these insights we use the four elements of a business model – value proposition, supply chain, customer interface, and financial model – identified earlier and propose a set of basic normative requirements that we believe need to be met for successfully marketing sustainable innovations:

1. The *value proposition* provides measurable ecological and/or social value in concert with economic value. The value proposition reflects a business-society dialog concerning the balance of economic, ecological and social needs as such values are temporally and spatially determined. For existing products, a particular balance is embedded in existing practices of actors in the production and consumption system; for new products or services, such a balance is actively being struck among participants in the evolving alternative network of producers, consumers, and other associated actors.
2. The *supply chain* involves suppliers who take responsibility towards their own as well as the focal company's stakeholders. The focal company does not shift its own socio-ecological burdens to its suppliers. This condition requires that a firm actively engages suppliers into sustainable supply chain management, which includes, for example, forms of social issue management and materials cycles that avoid/reuse wastes (Seuring and Müller, 2008).
3. The *customer interface* motivates customers to take responsibility for their consumption as well as for the focal company's stakeholders. The focal company does not shift its own socio-ecological burdens to its customers. Customer relationships are set up with recognition of the respective sustainability challenges of differently developed markets (Hart and Milstein, 1999) as well as company-specific challenges resulting from its individual supply chain configuration.
4. The *financial model* reflects an appropriate distribution of economic costs and benefits among actors involved in the business model and accounts for the company's ecological and social impacts (Maas and Boons, 2010).

These requirements are defined generically on purpose. For future research, more detailed and refined formulations may allow for empirical tests of their actual relevance. So far, they provide a basic set of normative principles for sustainable business models which need to be fulfilled in order to contribute to a successful marketing of sustainable innovations. These conditions do not specify a sustainable business model per se, nor do they explain how specific innovations are commercialized. Such questions can only be answered for specific firms operating in specified contexts.

But making these normative requirements explicit helps to understand that any innovation has to be successfully marketed to unfold its sustainability potential (Schaltegger and Wagner, 2008, 2011), and that the underlying business model has to operate according to certain principles to not contradict this potential. While an innovation *bears* an assumed sustainability potential, the underlying business model is the market device that allows (or hinders) to *unfold* this potential, given that certain barriers can be overcome: namely barriers of the institutionalized organizational memory and the external business environment (e.g., Carrillo-Hermosilla et al., 2009; Hall and Clark, 2003; Johnson, 2010).

4.2. Barriers to marketing sustainable innovations

Implementation and diffusion of innovations are often considered as challenges of introducing new technologies and designs, overcoming economic barriers and gaining acceptance among users, and sometimes even changing whole socio-technical systems (e.g., Charter et al., 2008; Geels, 2005). It is a special characteristic of sustainable innovations that they have to fit from a technical or organizational point of view, be economical *and* contribute to solving sustainability problems (e.g., Carrillo-Hermosilla et al., 2009; Charter et al., 2008; Hansen et al., 2009; Horbach, 2008). Our literature review shows that this challenge is increasingly discussed as a business model challenge (see Section 4.3).

Two generic situations can be imagined: The innovation, be it a process, product or service, fits with the existing business model (e.g., a company producing and selling light bulbs will be able to shift from conventional to energy saving bulbs); or it fits only to a certain degree or not at all (this will be the case when the light bulb producer delivers lighting services where the bulbs are only part of the value proposition). The latter situation calls for explicit awareness of the company's business model and the ability to identify and overcome internal as well as external barriers to bringing a new product or service to the market. Here, an important internal barrier is the *institutionalized organizational memory* consisting of business rules, behavioral norms and success metrics (Johnson, 2010; see also Lovins et al., 1999). These evolve and become firmly established once a business model is fully developed, and, as Johnson argues, "…these guidelines and control mechanisms are powerful inhibitors to the introduction of new business models" (Johnson, 2010, p. 46). Comparable obstacles can be identified in the *external business environment*. In many industries, such as automobile manufacturing or energy, characteristics like high capital intensity in concert with incumbents' resilience to disruptive technologies often lead to the dominance of locked-in "fire and forget" business models (e.g., Wells, 2008; Wüstenhagen and Boehnke, 2008). An example for an industry that is locked in its business environment is mobile telephony (Box 2).

Box 2. Mobile telephony – an unsustainable business model.

Mobile telephony provides an example of a locked-in business model with high ecological impact. A typical situation is that the marketing of mobile phones is a joint effort of the device producer and the network provider. Hardware is offered at substantially reduced prices, or even for free, combined with a long term contract with a network provider. While this is a viable model in terms of revenues for both the network provider and the hardware producer (Camponovo and Pigneur, 2003), it leads to a high level of substitution of technically functioning devices. Hardware firms offer new models at a high pace, fuelling new fashions among users. This business model leads to excessive resource use (especially rare earths) and negative social impacts (e.g., working conditions in coltan mines).

These barriers indicate that introducing a sustainable innovation requires a far-reaching approach to change things at the company level while taking into account external barriers imposed by the wider environment of the respective production and consumption system. This may be a risky and costly venture, for

start-ups as well as for incumbents, which becomes even more complicated when complex social constructs like demands of sustainable development are to be integrated (Birkin et al., 2009a, 2009b; Boons, 2009; Charter et al., 2008). But at the same time, more systemic innovations are expected to have a greater sustainability potential (e.g., Hansen et al., 2009; Tukker and Tischner, 2006).

4.3. Business models for sustainable innovation – what the literature reveals so far

As a holistic and systemic concept (Baden-Fuller and Morgan, 2010), a business model perspective may be expected to contribute to a sustainable innovation agenda by opening up new approaches to overcoming internal and external barriers. In this subsection, we uncover this potential as described in the current literature.

Sixteen out of the identified 115 business model articles as well as five book chapters are directly concerned with business models and sustainability issues. Based on these sources, we defined three streams which appear to be most important with regard to sustainable business models: *technological, organizational, and social innovation*. It is important to recognize that these streams do not stand for separated phenomena. That is, for example, technological innovations might depend on organizational change (e.g., Interface Inc.; Box 1) or support social value propositions (e.g., "Grameen telephone ladies"; Box 4). However, for reasons of clarity we discuss the three streams separately.

4.3.1. Technological innovation

According to Wells (2008), the business model can be used as an analytical unit to explore and understand the economic logic of production and consumption systems revolving around the fulfillment of specific needs (e.g., mobility) through specific technological artifacts (e.g., automobiles) and which connect suppliers and customers through economic exchange relationships. He contrasts, for example, the economic logic of linear mass production businesses with specialized niche suppliers, and concludes that "the business model undoubtedly influences how consumers think about the product, and the normative rules that shape expectations" (Wells, 2008, p. 84). That is, the business model acts as a mediator between technologies of production and consumption – i.e., between how technological artifacts are made, the artifacts themselves, and how they are finally used – which also influences further stakeholders' perceptions of these technologies and the ways in which they are marketed (such as customers, regulators and competitors).

This role as market device can refer to three combinations of business model and technology[2] innovation (Table 1): a new business model can employ given technologies (1); existing business models can take up new technologies (2); and new business models can be triggered by new technologies, and vice versa (3).

These combinations pose different challenges. In case (1) existing products are offered in new ways; e.g., based on new modes of distribution and application (from selling carpets to floor-covering services) (e.g., Halme et al., 2007; Lovins et al., 1999) (Box 1). Here, the primary challenge is to convince customers of a new product or service handling. Case (2) refers to the integration of new production processes, products or services with a company's existing business model. The automobile industry illustrates the challenge of introducing new technological paradigms against an industry's dominant business model (e.g., Johnson and Suskewicz, 2009; Wells, 2008). In contrast, a textbook example of marketing a technological system innovation through new business models, case (3), is the electric mobility concept of Better Place as described by Johnson and Suskewicz (Box 3).[3]

Table 1
Business model/technology innovation combinations.

		Business model	
		Existing	New
Technology	Existing	Not considered here	(1)
	New	(2)	(3)

Box 3. Better Place – radical system innovation.

Better Place is the most prominent example of a system innovation and a radically different business model for a locked-in industry. The most important barrier is the infrastructure that is completely adapted to gasoline fueled cars (Wells, 2008). Users expect convenient, flexible and relatively low cost mobility – features that current battery-driven cars cannot offer. "But instead of focusing on how to make batteries work in the existing system, Agassi [founder of Better Place] asked what new system would be needed to make them as convenient, effective, and affordable as gasoline". (Johnson and Suskewicz, 2009, p. 56) Better Place separates car ownership (user) from battery ownership (Better Place) to make the battery a changeable item. That is, the user does not buy the expensive battery, but pays per kilometer. A close-meshed network of automatic change stations and a tracking system that directs the driver to the next station secure convenience and easy handling. As the costs per kilometer, including battery, network service and electricity, are lower than for gasoline, Better Place can use this margin to subsidize electric vehicles.

As the example in the Textbox shows, new technologies alone are insufficient to change paradigms of production and consumption systems. In combination with new business models this becomes possible.

Thus, sustainable business models with a focus on technological innovation are market devices that overcome internal and external barriers of marketing clean technologies; of significance is the business model's ability to create a fit between technology characteristics and (new) commercialization approaches that both can succeed on given and new markets.

4.3.2. Organizational innovation

In their studies on North European and Chinese companies Birkin and colleagues identify societal and cultural demands of sustainable development that evolve outside the economic sphere as drivers for organizational change in business enterprises (Birkin et al., 2009a, 2009b). Their understanding of a business model refers to a more general interpretation of doing business,

[2] As simplification, technology shall comprise production technologies as well as the resulting product/service offerings and their applications.

[3] We recognize the fact that the Better Place case is also about organizational innovation, but focus on the technology and system aspect for reasons of analytical clarity.

comparable to notions of the "US Model" or the "Asian Model" (e.g., Cappelli, 2009; Singh and Zammit, 2006). Birkin and colleagues argue that, as social and natural needs become institutionalized as concrete societal and cultural demands, these models will change radically. Hence, companies are expected to induce significant organizational adaptations in order to secure legitimacy and legality – and not least, business success. But the approaches observed in their studies are of rather incremental nature and primarily aim to integrate aspects of economic sustainability into existing business models due to constraints such as a lack of time, problems with the market model, cost aspects and vested interests. In sum, their descriptions fall short of highlighting companies which may serve as role models for their industries.

Stubbs and Cocklin (2008) follow a different approach and analyze the US-based carpet manufacturer Interface Inc. and the Australian Bendigo Bank in more detail to develop their "sustainability business model". Their perspective on organizational development is comparable to Birkin and colleagues since their conception starts from the assumption that sustainable business models are developed around sustainability concepts from the non-economic sphere that are transferred to the organizational level. A heuristic is derived from the two cases to describe how their characteristics contribute to corporate sustainability. This heuristic is a white list of preconditions, drivers and measures arranged in two dimensions (Fig. 1): *structural* and *cultural attributes* in the first dimension (x-axis); and *internal organizational capabilities* and the *socioeconomic environment* in the second dimension (y-axis).

The heuristic helps to classify business model attributes as structural or cultural, as well as being related to the external socioeconomic environment or internal organizational capabilities, which allows addressing the above discussed internal and external barriers. The authors find that, for example, in the socioeconomic environment structural aspects such as financial market support for sustainability or revised tax systems which sanction negative externalities are crucial. Approaches referring to waste and emission reduction by means of closed-loop systems are boundary-spanning as they connect external and internal structural attributes. Important socioeconomic-cultural aspects are community spirit, stakeholder and shareholder engagement, whereas a long-term focus on business operations is also an internal as well as external capability.

Whereas authors from the technological innovation stream see business models as market devices to support innovations, Birkin and colleagues as well as Stubbs and Cocklin discuss sustainable business models as an expression of organizational and cultural changes in business practices and attitudes that integrate needs and aspirations of sustainable development as formulated in the Brundtland definition or other concepts such as ecological modernization.

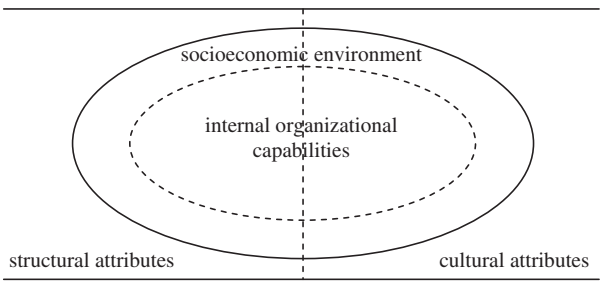

Fig. 1. Dimensions of the "sustainability business model" heuristic (Stubbs and Cocklin, 2008, p. 114).

Business model change on the organizational level is about the implementation of alternative paradigms other than the neoclassical economic worldview that shape the culture, structure and routines of organizations and thus change the way of doing business towards sustainable development; a sustainable business model is the aggregate of these diverse organizational aspects.

4.3.3. Social innovation

A third stream of literature deals with business models related to social value creation. Authors from this stream are inspired by the remarkable achievements of companies like Indian microfinancing pioneer Grameen Bank or Sekem Group, a multi-business organization specialized on the production of cotton and host of diverse social ventures in Egypt (e.g., Seelos and Mair, 2005, 2006). These models are discussed in the context of the recently emerging concept of social entrepreneurship (SE) that embraces different approaches such as "bottom of the pyramid" (BOP) strategies or social businesses (e.g., Dees, 1998a, 1998b; Mair and Martí, 2006; Prahalad, 2005; Prahalad and Hart, 2002; Yunus et al., 2010).

Hockerts and Wüstenhagen (2010) point to the varied meanings of social innovation: One view emphasizes the role of product and process innovations with a social purpose. Another is related to the scope of entrepreneurial and managerial activities, where innovation can refer to founding and further developing social enterprises, company-internal activities ("social intrapreneurship"; Mair and Martí, 2006), or "corporate social innovation" as business/social sector collaboration (Kanter, 1999). Accordingly, the spectrum of actors and organizational forms reaches from single entrepreneurs dedicated to alleviating urgent social problems by means of non-profit but self-sustaining businesses (e.g., Ibrahim Abouleish and Sekem Group, Muhammad Yunus and Grameen Group; Seelos and Mair, 2005, 2007) to multi-national corporations taking the strategic chance of future BOP markets (e.g., Unilever, Danone; Yunus et al., 2010). Social innovation, like environmental innovation, is seen as a key to creating and transforming markets towards sustainable development (see above Hart and Milstein, 1999; Lovins et al., 1999) – and this is where the transformative power of business models comes into play.

Obviously, social innovations can be linked to technological and/or organizational innovations. However, the approaches mentioned here are primarily orientated towards social purposes and missions. While technological innovations are more about "jobs-to-be-done" (Johnson, 2010) and organizational innovations are a form of corporate self-reflection, social innovations are providing solutions to problems of others, i.e., of societal groups that lack the resources or capabilities to help themselves.

The most prominent research topics, besides theorizing and case studies on the concept of social entrepreneurship, are those linked to the provision of market access and market creation in BOP contexts (e.g., Seelos and Mair, 2005, 2007; Thompson and MacMillan, 2010; Wu et al., 2010). Here, the challenge of SE is to change the value creation logic while human, financial and political resources must be acquired and managed under precarious conditions and high uncertainty (cf. Thompson and MacMillan, 2010). Changing the focus of value creation is thus the primary purpose of business model management and innovation. Whereas social benefits such as employment and access to products and services are by-products of conventional economic value creation, earning money becomes a by-product or condition of social value creation through SE (Seelos and Mair, 2005). The premise is to develop self-sustaining instead of profit maximizing businesses, giving space to entrepreneurs and managers to focus their business models on social issues (see Box 4 for an example).

Box 4. Grameen Telecom – a social enterprise model.

The "*Grameen telephone ladies*" are a good example of a business model for social innovation (Yunus et al., 2010). Grameen Bank offers micro-credits to persons who could never borrow from commercial banks due to a lack of collateral (Seelos and Mair, 2005). Telephone ladies use these loans to buy mobile phones and airtime. Then, they sell airtime to anybody who wants to make a call but cannot afford an own telephone. At the time this model started, 80,000 Bangladesh villages did not have telephone service, i.e., the 300,000 telephone ladies brought electronic communication to the rural and poor population. Despite its initial success this model has reached obsolescence: As cell phones and airtime become more and more affordable to the Bangladeshis, the telephone ladies' market has shrunk significantly (Schaffer, 2007). Nevertheless, the telephone ladies provided valuable insights into the dynamics of social business models in developing countries.

This all is not to say that SE business models exclude any profit orientation. Quite the opposite, as Thompson and MacMillan (2010) see both social and economic profits as conditional for large corporations' engagement in SE initiatives. The crucial point here is the expected magnitude of business model change. As long as social entrepreneurs aim for economic profits (e.g., to pay dividends to shareholders) they may be able to apply rather modified conventional models. But the more the social value creation function is focused, the more will SE result in so called social businesses (a not-for-profit sub-category of SE; Yunus et al., 2010). Yunus and colleagues reason that for social businesses a specific business model framework is needed (Fig. 2) that integrates a social profit equation – whereas the environmental dimension is also recognized (the basic framework includes three elements only: value proposition, value constellation, economic profit equation; e.g., Schoettl and Lehmann-Ortega, 2011).

According to their concept, social businesses apply business models that above all recover their full costs and pass profits on to customers who shall benefit from low prices, adequate services and better access to maximize the social profit equation: "It is a no-loss, no-dividend, self-sustaining company that sells goods or services and repays investments to its owners, but whose primary purpose is to serve society and improve the lot of the poor". (Yunus et al., 2010, p. 311) Not least, the magnitude of business model change depends on the kind of partnership, such as firm/NGO collaboration, which is required to create social value and maximize social profit (Chesbrough et al., 2006; Dahan et al., 2010; Kanter, 1999).

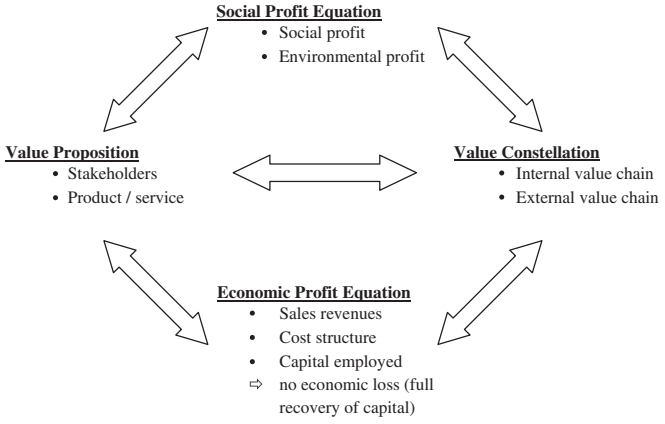

Fig. 2. Components of a social business model template (Yunus et al., 2010, p. 319).

To conclude, sustainable business models enable social entrepreneurs to create social value and maximize social profit; of significance is the business models' ability to act as market device that helps in creating and further developing markets for innovations with a social purpose.

5. Discussion and concluding remarks

Above we have looked at the intersection of two bodies of literature: that on sustainable innovation and the one on business models. We have concluded that the former tends to disregard the precise ways in which firms connect the elements specified by our definition of a business model – the value proposition, organization of supply chain and customer interface, and financial model. In contrast, the firm is often treated as a black box on which external factors impinge, or only specific internal factors are analyzed. At other levels of analysis, elements of the business model are present (especially the organization of the value chain and the value proposition), but without being connected to the firm and mostly leaving out the revenue model. This confirms our idea that the business model concept may help to bring these elements into the research on sustainable innovation.

Hence, one result from our literature review is that the business model of a company, whole industry or business philosophy is seen as a mediator for innovations that not only links production and consumption but also embraces stakeholders and their expectations from non-business areas. These features support the interpretation as a market device (Doganova and Eyquem-Renault, 2009). Moreover, the proposed principles for sustainable business models can be developed further by embedding them into these insights.

For a sustainable *value proposition* business-society dialogs must identify trade-offs between optimal product and service performance (e.g., convenience, low costs) and improved social and environmental effects (e.g., de-materialization, better working conditions). A balanced fulfillment of customer needs will likely require enhanced offerings of which profits are insecure during implementation (e.g., product-service-systems such as Interface's floor-covering service-leasing; see also Charter et al., 2008). Such balancing is highly context-sensitive, as studies in social and organizational innovation reveal.

Barriers to such enhanced offerings are often found in *supply chain* dependencies and locked-in infrastructures (e.g., Wells, 2008; Wüstenhagen and Boehnke, 2008). But Interface shows that transformed product-service models can reduce ecological pressure throughout the supply chain and promote profitable recycling and closed-loop systems (e.g., Lovins et al., 1999; Wells and Seitz, 2005), while the Grameen experience shows that sometimes unforeseen but highly effective supply chains evolve on their own (Yunus et al., 2010).

This shows that the *customer interface* can be addressed very differently, either by means of linear mass-production (Wells, 2008), or in processes of value co-creation or consumer co-production which intensify the producer-consumer relationship. Marketing science recognizes different intensities of cooperation and consumers' motivation to take over responsibility (from community tools such as Wikipedia to product design) (e.g., Etgar, 2008; Payne et al., 2008). These insights should be adapted to enable sustainable value propositions.

Finally, *financial models* must shift from "price-per-unit" to pricing the "job-to-be-done", i.e., focus on the fulfillment of needs instead of selling amounts of products (see Johnson, 2010; Johnson et al., 2008). Job-oriented pricing would be in line with approaches such as de-materialization through product-service-systems (e.g., Halme et al., 2007; Lovins et al., 1999; Tukker and Tischner, 2006).

As mentioned above, the three distinguished innovation categories are interlinked phenomena. While our conclusions from the literature on technological and social innovations emphasize a business model's ability to support technological or social offerings, products and/or services, organizational innovations are more about cross-cutting structural and cultural preconditions within and around companies. Birkin et al. (2009a, 2009b) emphasize the role of management concepts and tools to integrate sustainability-relevant information as well as to maintain legitimacy and legality in the face of increasing stakeholder demands derived from the vision of sustainable development. Stubbs and Cocklin (2008) go even further and ask how a company can be grounded on alternative paradigms other than the neoclassical economic worldview. Here, the search for business models for sustainable innovation turns into the search for another business model for our capitalist society.

6. Towards a research agenda on sustainable business models and innovation – five key issues

Without doubt, the design and management of sustainable business models is an important but yet insufficiently researched area. Therefore, our main contribution is to show how business models and sustainable innovations are interrelated in the current literature; a gap we identified in the first two sections of this article. Second, we contribute to closing this gap as we propose exemplary normative requirements under which business models for sustainable innovation should operate. A first attempt to connect the business model perspective to already established concepts such as corporate sustainability or sustainable innovation. The third contribution is to reflect our findings and ideas in order to offer a starting point for a more focused research agenda.

Therefore we present a number of guiding questions for future research. These are intended to help building a research agenda on business models and sustainable innovations. We suggest thematic avenues for future research, which, in following steps, will require the specification of according research methods and theoretical perspectives. Setting this agenda might start with the fundamental question if and to what degree today's companies are already implementing the normative requirements we formulate in Section 4.1. Empirical research, e.g., following a case study approach, will be needed to shed some light on the state-of-the-art of corporate sustainability management, sustainable organizational development and sustainable innovation in daily business (e.g., Tukker et al., 2008; Stubbs and Cocklin, 2008). Thus, our first guiding question is:

To what extend do firms consider the normative requirements for sustainable business models in their innovation practices – be it process-, product-, or system-oriented?

In part this question is currently taken into account in research on sustainable supply chain management. There is substantial literature on how supply chains are reorganized in the process of making them more sustainable (e.g., Boons and Mendoza, 2010; Seuring and Müller, 2008; Vermeulen and Seuring, 2009). This captures two elements of the business model as defined above, i.e., the organization of links between the firm and its suppliers and customers. It would be interesting to broaden the scope of the supply chain literature in such a way that the other elements of the business model (financial model and value proposition) are also incorporated into the analysis. This leads to our second guiding question:

How do firms connect the four elements of a business model to their innovation attempts?

We find the business model concept helpful in connecting insights at the different levels of analysis that we have identified in the context of sustainable innovation. Business models require a systemic perspective, but always from the viewpoint of how the firm can connect to, or build up, that system while delivering a certain value proposition. System innovation is seen as a crucial strategy to implementing sustainability into wider socio-technical systems (e.g., Charter et al., 2008; Geels, 2005; Johnson and Suskewicz, 2009). Hence, our third question captures this insight:

To what extend do business models allow for sustainable system innovations, and how does this relate to business success?

A related question deals with the extent to which business models allow, or hamper, specific types of innovations (e.g., Johnson, 2010). More specifically:

Is there a relationship between the magnitude of improvement of an innovation and the lock-in provided by the existing business model?

The emphasis of Doganova and Eyquem-Renault (2009) on business models as a market device points out that it does not necessarily make sense to try and pin down the exact business model. When a business model serves to build linkages among actors that are necessary to successfully market a sustainable product or service, various elements being open to multiple interpretations is an asset rather than a problem. In other words, the often lamented "vagueness" of the concept of sustainability may sometimes be a useful quality in bringing about sustainable innovations (e.g., Boons, 2009; Hansen et al., 2009; Tukker and Tischner, 2006; Tukker et al., 2008). This is in sharp contrast with the attempts to define, once and for all and objectively, the sustainability of an innovation. This insight suggests that the way in which sustainability is constructed by actors involved in value creation is an important topic for research (Boons and Mendoza, 2010):

How does the definition of sustainability, as constructed by business model stakeholders, compare to sustainability measures as employed by evaluators of sustainable innovations?

Being aware that our deductive approach is far from delivering a complete, all embracing concept, we aim to direct part of the exponentially increasing work on business models towards a systematic (and systemic) inclusion of sustainability-related business challenges. On the more practitioner-oriented side, business management authors like Porter or Johnson are driving this change (e.g., Eyring et al., 2011; Johnson and Suskewicz, 2009; Porter and Kramer, 2011). To make the topic of sustainable business models become more than rhetoric we suggest drawing some lessons from the topical articles and projects that can be identified today. Therefore, even if it is too early to discuss further aspects such as methodical issues, we would like to start an open process of developing a research agenda that integrates the crucial aspect of creating sustainable value through business models for sustainable innovation.

Acknowledgments

The authors thank five anonymous reviewers as well as the editors for their valuable suggestions and comments.

References

Afuah, A., 2004. Business Models: A Strategic Management Approach. McGraw-Hill/Irwin, Boston.

Amit, R., Zott, C., 2010. Business model innovation: creating value. In: Times of Change. IESE Business School of Navarra, Barcelona. IESE Working Paper, No. WP-870.

Arimura, T., Hibiki, A., Johnstone, N., 2007. An empirical study of environmental R&D: what encourages facilities to be environmentally innovative. In: Johnstone, N. (Ed.), Environmental Policy and Corporate Behavior. Edward Elgar, Cheltenham.
Baden-Fuller, C., Demil, B., Lecoq, X., MacMillan, I., 2010. Special issue "Business Models". Long Range Planning 43, 143–145.
Baden-Fuller, C., Morgan, M.S., 2010. Business models as models. Long Range Planning 43, 156–171.
Birkin, F., Cashman, A., Koh, S.C.L., Liu, Z., 2009a. New sustainable business models in China. Business Strategy and the Environment 18, 64–77.
Birkin, F., Polesie, T., Lewis, L., 2009b. A new business model for sustainable development: an exploratory study using the theory of constraints in Nordic organizations. Business Strategy and the Environment 18, 277–290.
Boons, F.A.A., 2009. Creating Ecological Value. In: An Evolutionary Approach to Business Strategies and the Natural Environment. Elgar, Cheltenham.
Boons, F.A.A., Mendoza, A., 2010. Constructing sustainable palm oil: how actors define sustainability. Journal of Cleaner Production 18, 1686–1695.
Brunnermeier, S., Cohen, M., 2003. Determinants of environmental innovation in US manufacturing industries. Journal of Environmental Economics and Management 45, 278–293.
Burritt, R., Schaltegger, S., 2010. Sustainability accounting and reporting: fad or trend? Accounting, Auditing & Accountability Journal 23, 829–846.
Calia, R.C., Guerrini, F.M., Mourac, G.L., 2007. Innovation networks: from technological development to business model reconfiguration. Technovation 27, 426–432.
Callon, M., Millo, Y., Muniesa, F., 2007. Market Devices. Blackwell, Oxford.
Camponovo, G., Pigneur, Y., 2003. Business model analysis applied to mobile business. In: Proceedings of the 5th International Conference on Enterprise Information Systems (ICEIS) (Angers, France).
Cappelli, P., 2009. The future of the US business model and the rise of competitors. Academy of Management Perspectives 23, 5–10.
Carrillo-Hermosilla, J., del Río, P., Könnölä, T., 2009. Eco-Innovation. In: When Sustainability and Competitiveness Shake Hands. Palgrave iacmillan.
Carrillo-Hermosilla, J., del Río, P., Könnölä, T., 2010. Diversity of eco-innovations: reflections from selected case studies. Journal of Cleaner Production 18, 1073–1083.
Casadesus-Masanell, R., Ricart, J.E., 2010. From strategy to business models and onto tactics. Long Range Planning 43, 195–215.
Charter, M., Gray, C., Clark, T., Woolman, T., 2008. Review: the role of business in realising sustainable consumption and production. In: Tukker, A., Charter, M., Vezzoli, C., Stø, E., Andersen, M.M. (Eds.), Perspectives on Radical Changes to Sustainable Consumption and Production 1. System Innovation for Sustainability. Greenleaf, Sheffield, pp. 46–69.
Chesbrough, H., 2007a. Business model innovation: it's not just about technology anymore. Strategy & Leadership 35, 12–17.
Chesbrough, H., 2007b. Why companies should have open business models. MIT Sloan Management Review 48, 22–28.
Chesbrough, H., 2010. Business model innovation: opportunities and barriers. Long Range Planning 43, 354–363.
Chesbrough, H., Ahern, S., Finn, M., Guerraz, S., 2006. Business models for technology in the developing world: the role of non-governmental organizations. California Management Review 48, 48–61.
Chesbrough, H., Rosenbloom, R.S., 2002. The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. Industrial and Corporate Change 11, 529–555.
Coenen, L., Diaz-Lopez, F., 2010. Comparing systems approaches to innovation and technological change for sustainable and competitive economies: an explorative study into conceptual commonalities, differences and complementarities. Journal of Cleaner Production 18 (2), 1149–1160.
Dahan, N.M., Doh, J.P., Oetzel, J., Yaziji, M., 2010. Corporate-NGO collaboration: co-creating new business models for developing markets. Long Range Planning 43, 326–342.
Dees, J.G., 1998a. Enterprising non profits. Harvard Business Review 76, 54–66.
Dees, J.G., 1998b. The Meaning of Social Entrepreneurship. http://www.caseatduke.org/documents/dees_sedef.pdf (revised as of May 30, 2001).
Demil, B., Lecocq, X., 2010. Business model evolution: in search of dynamic consistency. Long Range Planning 43, 227–246.
Doganova, L., Eyquem-Renault, M., 2009. What do business models do? Innovation devices in technology entrepreneurship. Research Policy 38, 1559–1570.
Edquist, C., 1997. Systems of innovation approaches – their emergence and characteristics. In: Edquist, C. (Ed.), Systems of Innovation: Technologies, Institutions and Organizations. Pinter/Cassell, London.
Etgar, M., 2008. A descriptive model of the consumer co-production process. Journal of the Academy of Marketing Science 36 (1), 97–108.
Eyring, M.J., Johnson, M.W., Nair, H., 2011. New business models in emerging markets. Harvard Business Review 89 (1/2), 88–95.
Geels, F.W., 2005. Technological Transitions and System Innovations; a Co-evolutionary and Socio-Technical Analysis. Edward Elgar, Cheltenham.
Geels, F.W., Hekkert, M., Jacobsson, S., 2008. The micro-dynamics of sustainable innovation journeys: editorial. Technology Analysis & Strategic Management 20 (5), 521–536.
Genus, A., Coles, A., 2008. Rethinking the multi-level perspective of technological transitions. Research Policy 37 (9), 1436–1445.
Ghaziani, A., Ventresca, M., 2005. Keywords and cultural change: frame analysis of business model public talk, 1975–2000. Sociological Forum 20, 523–559.
Hall, J., Clark, W., 2003. Introduction to the special issue on environmental innovation. Journal of Cleaner Production 11, 343–346.
Halme, M., Anttonen, M., Kuisma, M., Kontoniemi, N., Heino, E., 2007. Business models for material efficiency services: conceptualization and application. Ecological Economics 63 (1), 126–137.
Hamel, G., 2000. Leading the Revolution. Harvard Business School Press, Boston, MA.
Hansen, E.G., Große-Dunker, F., Reichwald, R., 2009. Sustainability innovation Cube – a framework to evaluate sustainability-oriented innovations. International Journal of Innovation Management 13, 683–713.
Hart, S.L., 1997. Beyond greening: strategies for a sustainable world. Harvard Business Review 75, 66–76.
Hart, S.L., Milstein, M.B., 1999. Global sustainability and the creative destruction of industries. Sloan Management Review 41, 23–33.
Hekkert, M., Suurs, R., Negro, S., Kuhlmann, S., Smits, R., 2007. Functions of innovation systems: a new approach for analyzing technological change. Technological Forecasting & Social Change 74, 413–432.
Hockerts, K., Wüstenhagen, R., 2010. Greening Goliaths versus emerging Davids – theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. Journal of Business Venturing 25, 481–492.
Horbach, J., 2008. Determinants of environmental innovation –new evidence from German panel data sources. Research Policy 37, 163–173.
Jaffe, A.B., Palmer, K., 1997. Environmental regulation and innovation: a panel data study. The Review of Economics and Statistics 79 (4), 610–619.
Johnson, M.W., 2010. Seizing the White Space. In: Business Model Innovation for Growth and Renewal. Harvard Business School Press, Boston, MA.
Johnson, M.W., Christensen, C.M., Kagermann, H., 2008. Reinventing your business model. Harvard Business Review 86, 50–59.
Johnson, M.W., Suskewicz, J., 2009. How to jump-start the clean tech economy. Harvard Business Review 87, 52–60.
Kanter, R.M., 1999. From spare change to real change: the social sector as a beta site for business innovation. Harvard Business Review 77, 123–132.
Kemp, R., Volpi, M., 2008. The diffusion of clean technologies: a review with suggestions for future diffusion analysis. Journal of Cleaner Production 16 (S1), S14–S21.
Lélé, S., 1991. Sustainable development – a critical review. World Development 19 (6), 607–621.
Linder, J.C., Cantrell, S., 2000. Changing Business Models: Surveying the Landscape. Accenture Institute for Strategic Change.
Lovins, A.B., Lovins, L.H., Hawken, P., 1999. A road map for natural capitalism. Harvard Business Review, 1–14 (HBR paperback reprint 2000).
Lüdeke-Freund, F., 2009. Business Model Concepts in Corporate Sustainability Contexts. In: From Rhetoric to a Generic Template for 'Business Models for Sustainability'. Centre for Sustainability Management, Lüneburg.
Maas, K.E.H., Boons, F.A.A., 2010. CSR as a strategic activity: value creation, redistribution and integration. In: Louche, C., Idowu, S., Leal Filho, W. (Eds.), Innovative CSR: From Risk Management to Value Creation. Greenleaf, London, pp. 154–172.
Magretta, J., 2002. Why business models matter. Harvard Business Review 80, 86–92.
Mair, J., Martí, I., 2006. Social entrepreneurship research: a source of explanation, prediction, and delight. Journal of World Business 41, 36–44.
Markides, C.C., Charitou, C.D., 2004. Competing with dual business models: a contingency approach. Academy of Management Executive 18, 22–36.
Mitchell, D., Coles, C., 2003. The ultimate competitive advantage of continuing business model innovation. Journal of Business Strategy 24, 15–21.
Montalvo, C., 2008. General wisdom concerning the factors affecting the adoption of cleaner technologies: a survey 1990–2007. Journal of Cleaner Production 16, 7–13.
OECD, 2009. Eco-innovation in Industry: Enabling Green Growth. OECD, Paris.
Osterwalder, A., 2004. The Business Model Ontology. In: A Proposition in a Design Science Approach. Université de Lausanne, Lausanne.
Osterwalder, A., Pigneur, Y., 2009. Business Model Generation. In: A Handbook for Visionaries, Game Changers, and Challengers. Modderman Drukwerk, Amsterdam.
Pateli, A.G., Giaglis, G.M., 2005. Technology innovation-induced business model change: a contingency approach. Journal of Organizational Change Management 18, 167–183.
Payne, A., Storbacka, K., Frow, P., 2008. Managing the co-creation of value. Journal of the Academy of Marketing Science 36 (1), 83–96.
Porter, M.E., Kramer, M.R., 2011. Creating shared value. Harvard Business Review 89 (1/2), 62–77.
Prahalad, C.K., 2005. The Fortune at the Bottom of the Pyramid. In: Eradicating Poverty through Profits. Wharton School Publ., Upper Saddle River, NJ.
Prahalad, C.K., Hart, S.L., 2002. The fortune at the bottom of the pyramid. Strategy and Business (Reprint) 26, 1–14.
Saint-Jean, M., 2008. Polluting emissions standards and clean technology trajectories under competitive selection and supply chain pressure. Journal of Cleaner Production 16 (S1), S113–S123.
Schaffer, R., 2007. Unplanned Obsolescence, vol. 118. Fast Company. http://www.fastcompany.com/magazine/118/unplanned-obsolescence.html.
Schaltegger, S., Lüdeke-Freund, F., Hansen, E.G., 2012. Business cases for sustainability – the role of business model innovation for corporate sustainability. International Journal of Innovation and Sustainable Development 6 (2), 95–119.
Schaltegger, S., Wagner, M., 2008. Types of sustainable entrepreneurship and the conditions for sustainability innovation. In: Wüstenhagen, R., Hamschmidt, J., Sharma, S., Starik, M. (Eds.), Sustainable Innovation and Entrepreneurship. New

Perspectives in Research on Corporate Sustainability. Edward Elgar, Cheltenham, pp. 27–48.
Schaltegger, S., Wagner, M., 2011. Sustainable entrepreneurship and sustainability innovation. Categories and interactions. Business Strategy and the Environment 20 (4), 222–237.
Schnaiberg, A., 1980. The Environment. Oxford University Press, New York.
Schoettl, J.M., Lehmann-Ortega, L., 2011. Photovoltaic business models: threat or opportunity for utilities? In: Wüstenhagen, R., Wuebker, R. (Eds.), Handbook of Research on Energy Entrepreneurship. Edward Elgar, Cheltenham, pp. 145–171.
Seelos, C., Mair, J., 2005. Social entrepreneurship: creating new business models to serve the poor. Business Horizons 48, 241–246.
Seelos, C., Mair, J., 2006. Social entrepreneurs – the contribution of individual entrepreneurs to sustainable development. The ICFAI Journal for Entrepreneurship Development. March Issue, 30–46.
Seelos, C., Mair, J., 2007. Profitable business models and market creation in the context of deep poverty: a strategic view. Academy of Management Perspectives 21, 49–63.
Seuring, S., Müller, M., 2008. From a literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production 16 (15), 1699–1710.
Shove, E., Walker, G., 2007. CAUTION! transitions ahead: politics, practice, and sustainable transition management. Environment and Planning A 39, 763–770.
Singh, A., Zammit, A., 2006. Corporate governance, crony capitalism and economic crises: should the US business model replace the Asian way of "doing business"? Corporate Governance – An International Review 14, 220–233.
Smith, A., Voss, J., Grin, J., 2010. Innovation studies and sustainability transitions: the allure of the multi-level perspective and its challenges. Research Policy 39, 435–448.
Stubbs, W., Cocklin, C., 2008. Conceptualizing a 'sustainability business model'. Organization & Environment 21, 103–127.
Teece, D.J., 2006. Reflections on "profiting from innovation". Research Policy 35 (8), 1131–1146.
Teece, D.J., 2010. Business models, business strategy and innovation. Long Range Planning 43, 172–194.
Thompson, J.D., MacMillan, I.C., 2010. Business models: creating new markets and societal wealth. Long Range Planning 43, 291–307.
Tikkanen, H., Lamberg, J.A., Parvinen, P., Kallunki, J.P., 2005. Managerial cognition, action and the business model of the firm. Management Decision 43, 789–809.
Timmers, P., 1998. Business models for electronic markets. EM – Electronic Markets 8, 3–8.
Tukker, A., Charter, M., Vezzoli, C., Stø, E., Andersen, M.M. (Eds.), 2008. Perspectives on Radical Changes to Sustainable Consumption and Production. Greenleaf, Sheffield.
Tukker, A., Tischner, U. (Eds.), 2006. New Business for Old Europe. Product-service Development, Competitiveness and Sustainability. Greenleaf, Sheffield.
Vermeulen, W., Seuring, S., 2009. Sustainability through the market: the impacts of sustainable supply chain management (Special Issue). Sustainable Development 17 (5), 269–273.
Visser, R., Jongen, M., Zwetsloot, G., 2008. Business-driven innovations: towards more sustainable chemical products. Journal of Cleaner Production 16 (S1), S85–S94.
Weber, M., Hemmelskamp, J. (Eds.), 2005. Towards Environmental Innovation Systems. Springer Verlag, Berlin.
Wells, P., 2008. Alternative business models for a sustainable automotive industry. In: Tukker, A., Charter, M., Vezzoli, C., Stø, E., Andersen, M.M. (Eds.), Perspectives on Radical Changes to Sustainable Consumption and Production 1. System Innovation for Sustainability. Greenleaf, Sheffield, pp. 80–98.
Wells, P., Seitz, M., 2005. Business models and closed-loop supply chains: a typology. Supply Chain Management – An International Journal 10 (3–4), 249–251.
Wirtz, B.W., 2011. Business Model Management. In: Design – Instruments – Success Factors. Gabler, Wiesbaden.
Wu, X., Ma, R., Shi, Y., 2010. How do latecomer firms capture value from disruptive technologies? A secondary business-model innovation perspective. IEEE Transactions on Engineering Management 57, 51–62.
Wüstenhagen, R., Boehnke, J., 2008. Business models for sustainable energy. In: Tukker, A., Charter, M., Vezzoli, C., Stø, E., Andersen, M.M. (Eds.), Perspectives on Radical Changes to Sustainable Consumption and Production 1. System Innovation for Sustainability. Greenleaf, Sheffield, pp. 70–79.
Yunus, M., Moingeon, B., Lehmann-Ortega, L., 2010. Building social business models: lessons from the Grameen experience. Long Range Planning 43, 308–325.
Zott, C., Amit, R., 2007. Business model design and the performance of entrepreneurial firms. Organization Science 18, 181–199.
Zott, C., Amit, R., 2008. The fit between product market strategy and business model: implications for firm performance. Strategic Management Journal 29, 1–26.
Zott, C., Amit, R., 2010. Business model design: an activity system perspective. Long Range Planning 43, 216–226.
Zott, C., Amit, R., Massa, L., 2011. The business model: recent developments and future research. Journal of Management 37 (4), 1019–1042.