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Eco-innovation in business models ? theoretical considerations

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Abstract

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In order to achieve targets of environmental conservation and at the same time increase economic growth, it is essential to aim at further efforts towards absolute reductions in the use of energy and materials used in production to a sustainable level (absolute decoupling). Although the primary focus of corporate practices towards more sustainable solutions has been on technological innovations, some organizations have broadened the scope to organizational level, such as new business models and alternative customer value propositions. It has become obvious that technological eco-innovations alone are not capable to create incremental change in a sufficient pace to achieve decoupling; therefore systemic approach to eco-innovation is necessary. Combining the existing understanding of concepts 'business model' and 'eco-innovation?', this paper focuses on the multidisciplinary area of eco-innovation in business models. Although they both are still searching for a commonly agreed definition, the prevailing approaches are used to explain the overlapping area both verbally and conceptually. The article aims to make a contribution to the theory of eco-innovation by providing a broader perspective to the concept and influencing factors. The proposed framework suggests structure to future empirical research on advancing the understanding of business model innovation as a factor in achieving targets of environmental conservation.

Eco-innovation in business models— theoretical considerations

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In order to achieve targets of environmental conservation and at the same time increase economic growth, it is essential to aim at further efforts towards absolute reductions in the use of energy and materials used in production to a sustainable level (absolute decoupling). Although the primary focus of corporate practices towards more sustainable solutions has been on technological innovations, some organizations have broadened the scope to organizational level, such as new business models and alternative customer value propositions. It has become obvious that technological eco-innovations alone are not capable to create incremental change in a sufficient pace to achieve decoupling; therefore systemic approach to eco-innovation is necessary. Combining the existing understanding of concepts "business model" and "eco-innovation", this paper focuses on the multidisciplinary area of eco-innovation in business models. Although they both are still searching for a commonly agreed definition, the prevailing approaches are used to explain the overlapping area both verbally and conceptually. The article aims to make a contribution to the theory of eco-innovation by providing a broader perspective to the concept and influencing factors. The proposed framework suggests structure to future empirical research on advancing the understanding of business model innovation as a factor in achieving targets of environmental conservation.

Keywords: *eco-innovation, business model*

1. Introduction

The green topics have been on the CEOs' agenda for more than a decade already. So far, usually the question has been put forward in a way that "whether it pays to become green, or not?" Sometimes the social and economic inertia can be so strong that even a change that could produce a large benefit will not change behavior, and it is economically too risky to implement radical eco-innovations.

The prevailing driver for greening the business practices has been tightening environmental regulations. Recently the trend has gained ground by increasing competition during the economic slowdown and rising demand for green products (with rising consumer awareness). Whether it is regulations, pushing competition or eco-aware consumer, a company usually needs to eco-innovate in order to maintain its position on the market, or even enter the market in case of start-ups.

Although the primary focus of corporate practices towards more sustainable solutions has been on product innovations, some companies have broadened the scope by redesigning their production processes and value chains. The eco-innovation pioneers have taken it even further, to organizational level, such as implementing new business models and alternative value propositions.

For politicians, the growing concern over climate change and depleting natural resources have been the main arguments when justifying new and

increasingly tight environmental regulations. From the macro-economic perspective, it has also become obvious that technological eco-innovations alone are not capable to create incremental change in an expected pace to reach the EU 2020 climate change and energy targets¹, therefore more radical eco-innovation approach is needed to achieve the systemic change. The solution may lay in the eco-innovation in business models.

The concepts "eco-innovation" and "business model" have separately been studied in depth also in academic literature (see Appendix 1-2 for selection of various definitions). Among many others, the works on eco-innovation by Ekins (2010), Hellström (2007), Carrillo-Hermosilla & Könnölä (2009; 2010), Andersen (2008), have been most cited; and the research on business model innovation by Amit & Zott (2001; 2002), Afuah (2004), Chesbrough (2003; 2007; 2010), Johnson, Christensen & Kagermann (2008), Osterwalder (2004; 2010), *et al.* But the question about how they are inter-related has still not gained much attention. In this paper the author intends to fulfill this gap by combining the existing understanding of these concepts and proposing a multidisciplinary theoretical framework for future empirical research on eco-innovation in business models. More precisely, on how the business model

¹ http://ec.europa.eu/europe2020/targets/eu-targets/index_en.htm

literature could enrich existing understanding of eco-innovation opportunities.

Two ground laying publications exploring the wider area of possibilities for green growth have been recently released by international organizations- the OECD “Green Growth” (2011)² and UNIDO “Policies for supporting green industry” (2011)³. European Commission has launched its ETAP-initiative⁴ and additionally, the increasing number of academic works published about eco-innovation shows the growing interest in respective knowledge by both politicians and academia. But the role of innovation for realizing green growth can hardly be over-evaluated in any country. Therefore, also in United States the innovations in environmental technologies are supported by various public measures as they are considered to have promise for improving environmental conditions without impeding economic growth. In Japan, according to Machiba (2010), the scope of the concept has been broadened to include also aspects of social innovation. Eco-innovation is thus seen as an overarching concept which provides direction and vision for pursuing the overall societal changes needed to achieve sustainable development.

Innovation, as a mean for achieving long-term competitive advantage, and basic economic approach to continuously strive to resource efficiency (a core target of eco-innovation), are nothing new for business decision makers. However, taking them further from product and service development, integrating innovativeness into whole business model, has not appeared to be an easy task. Policy makers have been also standing before the dilemmas, when creating regulative environment which would best support the green growth and help to achieve absolute decoupling.

We could say that in eco-innovation society counts on entrepreneurs, but at the same time that entrepreneurs count on society. The influencing factors- drivers and barriers to successfully commercialize eco-innovations, especially radical and organizational level eco-innovations, are extremely complicated. Looking from a company’s perspective, these factors have some effect on all components of the business model.

This paper uses a framework for studying eco-innovation in business models by first analyzing verbally the development of both concepts’ descriptions and definitions, and then draws the new multidisciplinary concept of eco-innovation in business models. In general, the article aims to contribute to the theory of eco-innovation by providing a broader perspective to the concept by identifying which factors should be studied, how and why they are related, which are the conditions and boundaries of these relationships. The proposed

framework provides structure to future empirical research on advancing the understanding of business model innovation as a factor in achieving targets of environmental conservation.

2. Descriptions and definitions

Eco-innovation

In the European Union, eco-innovation is considered to support the wider objectives of its Lisbon Strategy for competitiveness and economic growth. The concept is promoted primarily through the Environmental Technology Action Plan (ETAP), which defines eco-innovation as “*the production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use (including energy)*” (ETAP). The Final report of “MEI” project about measuring eco-innovation (2007) explains the concept as “*Eco-innovation is the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organization (developing or adopting it) and which results, throughout its life-cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives*”. The most important difference between the two definitions lies in distinguishing the aim and result of innovation- *i.e.* if the environmental benefit may occur through innovation even if it was not the aim, and *vice versa*. The MEI definition is somewhat more flexible also for the innovativeness, stating that it is enough if it is novel to the particular organization. Also to the environmental impact, which has to be at least a bit lower than alternatives, compared to ETAP definition which states the need for substantial improvement.

The OECD understanding supports the MEI approach of evaluating the eco-innovation by its outcome (result), and adds to the concept wider dimensions by including also external parties- “*implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*” (OECD and Eurostat 2005, p.46).

OECD definition is aligned also with what is suggested in the Methodological report of eco-innovation observatory (2010) “*Eco-innovation is the introduction of any new or significantly improved product (good or service), process, organisational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle*”, with its shortened version “*Eco-innovation is any innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle*” (Methodological report 2010).

² <http://www.oecd.org/dataoecd/37/34/48224539.pdf>

³ http://www.unido.org/fileadmin/user_media/Services/Green_Industry/web_policies_green_industry.pdf

⁴ <http://ec.europa.eu/environment/etap/>

The strength of the ETAP definition is that it emphasizes the life-cycle approach, but at the same time, as a weakness, it does not state clearly that the organizational and social systematic shifts would be the ultimate goal. Therefore the author also prefers the definition suggested by the Methodological report and OECD, as it opens the meanings of rather general terms “environmental risk” and “negative impact”, focuses on the result created by innovation, as well as has the scope of whole life-cycle.

Business model and business model innovation

Compared to eco-innovation, business model is a rather old concept, which emerged to academic literature together with criticism, or to complement the concept of business strategy of Porter & van der Linde (1995). In recent years, the business model has been the focus of substantial attention by both academics and practitioners. The modern view on business model concept became prevalent with the advent of the personal computer and Internet in the mid 1990s (Magretta 2002; Zott *et al.* 2011, Ghaziani & Ventresca 2005; Yip 2004), and it has been gathering momentum since then. According to review made by Zott *et al.* (2011), since 1995 there have been 1,177 papers published in peer-reviewed academic journals in which the notion of a business model is addressed. The business model has also been the subject of a growing number of practitioner-oriented studies, conferences and workshops.

Despite that it has been long talked about, the business model is often studied without explicitly defining the concept. Moreover, existing definitions only partially overlap, giving rise to a multitude of possible interpretations (Zott *et al.* 2011), (see Appendix 2 for selected definitions of business model). To generalize, different approaches to the term “business model” can be grouped to four main categories:

- Business model as an explanation of value creation- about how the company creates value for itself and also to other stakeholders
- Business model as a conceptual framework, model, abstraction of current or future planned firm’s elements
- Business model as a theoretical intermediate layer between business strategy and actual processes
- Business model as a “tool” for managing company, or an intangible asset for supporting strategic decision-making

Generally speaking, business models are about converting company’s potentials and capacities into economic value (Chesbrough and Rosenboom 2002, Chesbrough 2006). At the centre of any business model is the company’s ‘*value proposition*’ – the *products and services that yield tangible results for the company’s target customers*. A company’s value proposition is what makes it different from its competitors (Osterwalder 2010), and can create the competitive advantage. Therefore companies should always be in search for more innovative business

models. To support that, it has been found by Johnson *et al.* (2008), that business model related innovation is becoming more important for success of company than product or service innovation.

According to Johnson *et al.* (2008), a business model consists of *four interlocking elements* that, taken together, create and deliver value. These elements are *customer value proposition (CVP), profit formula, key resources and key processes*. Other scholars have attempted to provide different parts of business model ontologies. A business model ontology by Osterwalder (2004) is a *conceptualization and formalization of the essential components of a business model into elements, relationships, vocabulary, and semantics*. According to Osterwalder *et al.* (2005) a business model is a *conceptual tool*, that contains *a set of elements and their relationships* and allows expressing the *business logic* of a specific firm... / It is a *description of the value a company offers* to one or several segments of customers and of the *architecture* of the firm and its *network of partners for creating, marketing, and delivering this value relationship capital, to create profitable and sustainable⁵ revenue streams*.

Value creation mechanisms often go beyond the value that can be created through Schumpeterian innovation, the (re)configuration of the value chain (Porter 1985), the formation of strategic networks among firms, or the exploitation of firms’ specific core competencies. As Amit & Zott (2001) observe, the focus on value creation, and thus the appropriate unit of analysis for scholars interested in value creation, spans firms’ and industries’ boundaries. Prior frameworks used in isolation cannot sufficiently address questions about total value creation. Chesbrough (2003), who has created the concept of open innovation, has also suggested it gives various opportunities for business model innovation.

Zott *et al.* (2011) have concluded with noting, that, despite the overall surge in the literature on business models, scholars do not agree on what a business model is. Researchers frequently adopt idiosyncratic definitions that fit the purposes of their studies, but that are difficult to reconcile with each other. As a result, cumulative progress is hampered.

In the context of studying the relationships between eco-innovation and business model, the author suggests to use the business model definition and description (“canvas”) suggested by Osterwalder *et al.* (2010), see Figure 1. Also Osterwalder (2004) discusses the difference between business models and strategy and argues that the strategy and the business model handle similar issues but on different business layers. He sees the business model as “*the strategy’s implementation into a conceptual blueprint of the company’s money earning logic.*”

⁵ „Sustainable” is being often used in different contexts with slightly different meanings (e.g. sustainable in time vs. environmentally sustainable)

Key partners	Key activities	Value propositions (CVP)	Customer relationships	Customer segments
	Key resources		Channels	
Cost structure			Revenue streams	

Figure 1. The business model canvas (Osterwalder & Pigneur 2010, p. 49)

Among the many definitions and conceptualizations, the strength of Osterwalder's and Pigneur's business model "canvas" lies in that it is sufficiently detailed for academics, yet easily understandable to entrepreneurs. The later being probably one of the reasons for wide implementation and use in practice.

Innovation in a business model (or business model innovation), is more than mere product, service, or technological innovation. It goes beyond single-function strategies, such as enhancing the sourcing approach or the sales model. *Innovation becomes business model innovation when two or more elements of a business model are reinvented to deliver value in a new way* (Lindgardt et al. 2009). Because it involves a multidimensional and orchestrated set of activities, business model innovation is both challenging to execute and difficult to imitate. /.../ It can help address disruptions- such as regulatory or technological shifts- that demand fundamentally new competitive approaches. (Lindgardt et al. 2009)

Eco-innovation in business model

Based on the previous discussion, and with emphasis on Osterwalder's (2005; 2010) explanations of business model, and OECD/Methodological report (2010) definition of eco-innovation, the author suggests following definitions for the eco-innovation in business model:

- a) *Eco-innovation in business model is change in the logic/way/rationale how an organization offers its customers value (and creates sustainable revenue streams), while reducing the use of natural resources and decreasing the release of harmful substances across the whole life-cycle.*
- b) *Eco-innovation in business model is the new logic/way/rationale how an organization offers its customers value (and creates sustainable revenue streams), while reducing the use of natural resources and decreasing the release of harmful substances across the whole life-cycle.*

Similar at the first sight, they still comprise important difference. Whether to prefer the first or second, depends on the general understanding of innovation- is it a *process of change* or is it the new *status quo*? To the later question the innovation theory has *pros* and *cons* for the both sides, and also in the case of eco-innovation in business models the theoretical-philosophical arguments on this issue can be discussed further. However, we need to have an agreement, before jumping to empirical analysis. Therefore, for practical reasons, the author suggests at first to use the second, the version b, for basic empirical studies. Its static character facilitates easier analysis of the new, improved business model. After that it is possible to continue to using the definition expressing its dynamic character, and study for example the *eco-innovation process* in business model context, together with its drivers and barriers.

3. Components of business model

Referring back to the business model innovation definition by Lindgardt et al. (2009), the business model innovation (or business model eco-innovation in particular case) requires two or more of the business model elements to be changed. When applying it to the Osterwalder & Pigneur's canvas (Figure 1), we could come up with a number of theoretical innovation possibilities. However, the practice is not that easy. When we take into account that the eco-innovation should be also economically feasible, otherwise it would be just an environmental innovation, then the solutions will seem more limited.

Ekins (2010) has summarized that for any product or process which delivers improved environmental performance, there are three possibilities. His suggestions can be illustrated with these possible three trajectories (see Figure 2), and adding them also the contrary option fills the general picture. It is well applicable also in case of eco-innovation in business models. The first and most desired option is that it immediately delivers improved economic and environmental performance

alike (e.g. some home insulation from product category or resource efficiency in general), in which case it is unequivocally an eco-innovation. If it does not deliver immediately improved economic performance, in which case it is only a potential eco-innovation which may or may not become an eco-innovation. It becomes an actual eco-innovation when its economic performance improves, and it is widely taken up (a process which may take decades or even

centuries). But it may happen also, that it never becomes an eco-innovation because its economic performance never improves adequately. Theoretically there is also an option that an innovation is first economically very profitable, and the environmental benefits exfoliate later. However, it does not occur often in practice. It is most likely that in this case the environmental benefits were also always there, we just were not conscious about them.

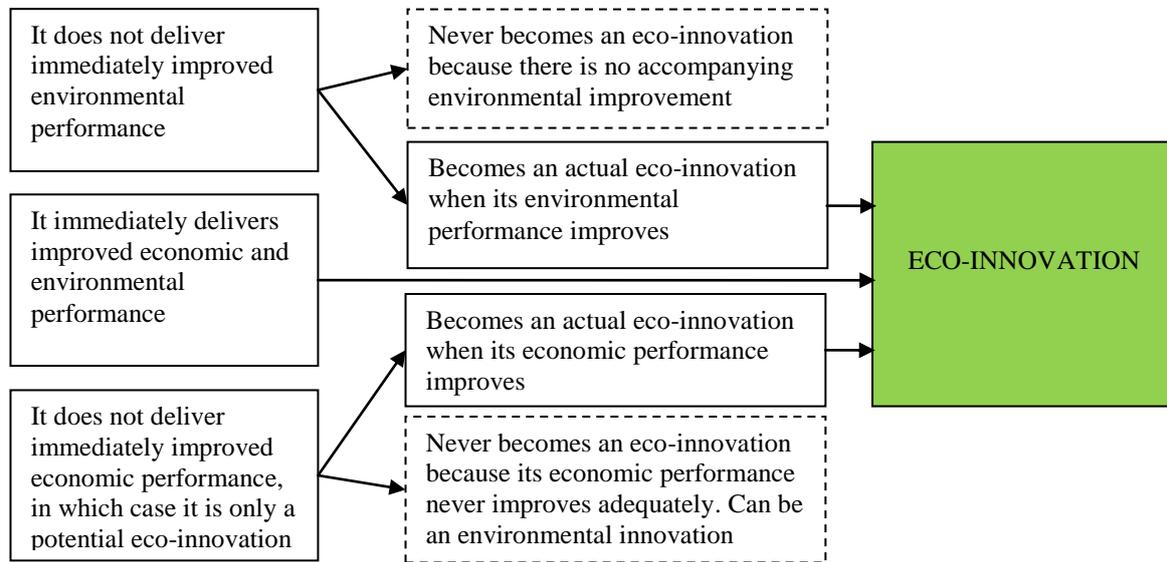


Figure 2. Possible eco-innovation trajectories (composed by the author)

For example when we take the concept of open innovation, introduced by Chesbrough (2003), where customers might do majority of the R&D work, and apply it to business model concept, then it could be simply business model innovation. When we collaborate with other companies in our region in sharing the information about material resources, and also actual material flows, it might create an industrial symbiosis, where our partners may equal our customers, and material resources as well as transportation costs are decreased. Also, the value proposition itself can change, for example from offering a product to offering a comfortable lending system (product-service systems). These are just some examples, but all these changes affect both sides of the canvas- cost structure and revenue structure.

Amit & Zott (2001) propose four potential sources of value creation through business models: (1) novelty, (2) lock-in, (3) complementarities, and (4) efficiency. These value drivers can be mutually reinforcing; that is, the presence of each value driver can enhance the effectiveness of any other value driver. Thompson and MacMillan (2010) have proposed a framework for developing new business models that can lead to societal wealth improvements (e.g., environmental conservation). Thus, value creation can refer to different forms of value (such as social or economic).

Value can also be created through revolutionary business models. According to Hamel (2000), to

thrive in the “age of revolution,” companies must develop new business models— in which both value creation and value capture occur in a value network—which can include suppliers, partners, distribution channels, and coalitions that extend the company’s resources.

3. Characteristics of eco-innovation in business models and factors influencing it

Eco-innovation can include both environmentally motivated innovations and unintended environmental innovations, as the environmental benefits of an innovation may be a side effect of other goals such as reducing costs for production or waste management (MERIT et al 2008, cited via Machiba 2010, p. 359). Eco-innovation reflects the concept’s explicit emphasis on a reduction of environmental impact, whether such an effect is intended or not (Machiba 2010). It can be technological or non-technological (organizational), its impact can vary, and according to Machiba (2010) its scope depends on the target and mechanism (see Figure 3).

Machiba (2010) has also divided the methods by which the change in the eco-innovation target takes place or is introduced to four distinctive categories:

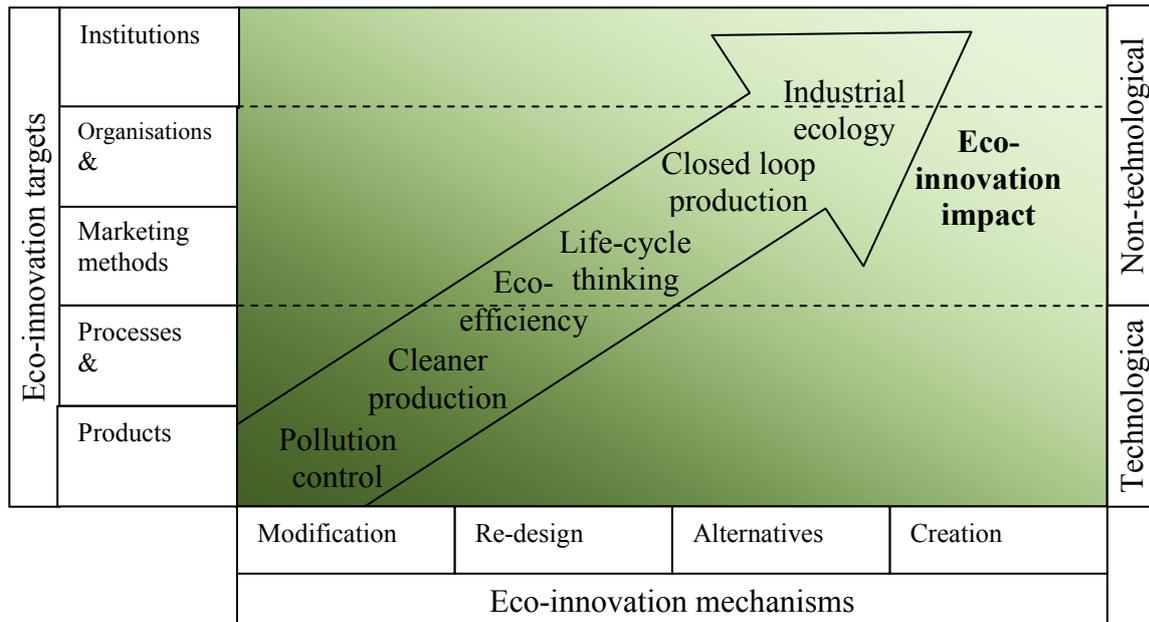


Figure 3. Conceptual relationships between sustainable manufacturing and eco-innovation (Machiba 2010)

- a. Modification, such as small, progressive product and process adjustments.
- b. Re-design, referring to significant changes in existing products, processes, organizational structures, etc.
- c. Alternatives, such as the introduction of goods and services that can fulfill the same functional need and operate as substitutes for other products.
- d. Creation, the design and introduction of entirely new products, processes, procedures, organizations and institutions.

Given a specific target, the potential magnitude of the environmental benefit tends to depend on the eco-innovations mechanism, as more systemic changes, such as alternatives and creation, generally embody higher potential benefits than modification and re-design (Machiba 2010).

These complex, advanced eco-innovation processes can provide possible “system innovation”—i.e. innovation characterized by fundamental shifts in how society functions and how its needs are met (Geels 2005). Although system innovation may have its source in technological advances, technology alone cannot make a great difference. It has to be associated with organizational and social structures and with human nature and cultural values. While this may indicate the difficulty of achieving large-scale environmental improvements, it also hints at the need for manufacturing industries to adopt an approach that aims to integrate the various elements of the eco-innovation process so as to leverage the maximum environmental benefits. The feasibility of their eco-innovative approach would depend on the

organization’s ability to engage in such complex processes.

To sum up, the primary focus of current eco-innovation in manufacturing industries tends to rely on technological advances, typically with products or processes as eco-innovation targets and with modification or re-design as principal mechanisms. Nevertheless, as Machiba (2010) notes, even with a strong focus on technology, a number of complementary changes have functioned as key drivers for these developments. In many of the examples, the changes have been either organizational or institutional in nature, such as the establishment of separate environmental divisions for improving environmental performance and directing R&D, or the setting-up of inter-sectoral or multi-stakeholder collaborative research networks. Some industry players have also started exploring more systemic eco-innovation through new business models and alternative modes of provision.

The heart of an eco-innovation cannot necessarily be represented adequately by a single set of target and mechanism characteristics. Instead, eco-innovation seems best examined and developed using an array of characteristics ranging from modifications to creations across products, processes, organizations and institutions. The characteristics of a particular eco-innovation furthermore depend on the observer’s perspective. The suggested framework of possible sources of eco-innovation (Figure 4) implies diverse approaches to help realize resource efficiency and green growth through accelerating innovation, including both technological and non-technological changes, e.g. eco-innovation in business models.

Influencing factor	Sector specific factors	Company specific factors
Idea	General pace of development	Origin of the idea
Subject/ Target (it's complexity)	Technological level (low-tech vs. high-tech)	Technological vs. Business model innovation
Competition	Free market vs. monopoly	Competitive position
Collaboration	Clusters, value chain cooperation	Position in value chain
Policy	Strength of policy instruments (subsidies, taxes, etc.)	Responsiveness, risk avoidance
Development phase	Old vs. emerging business sector	Old vs. start-up/ spin-off
Size of company	Company size as a entry barrier in business sector /economy of scale as an important success factor in sector?	Big company vs. SME

Figure 4. Framework for analyzing eco-innovation in business models (composed by the author)

As these factors are about business model innovation in general, it is assumed that the innovations considered according to this are already rated to have some positive environmental impact.

The first empirical overviews show, that start-ups are more eager to try out new eco-innovative business models than long existing companies, and hence also more successful in applying them, but this remains yet to be proved by empirical data, which availability is quite limited to date. Many companies pursue business model innovation as a defensive move to protect a dying core business or defend against aggressive competitors. But according to the Boston Consulting Group's long time practice (Lindgardt *et al* 2009), business model innovation can be most powerful when it is approached proactively to explore new avenues of growth/... Moreover, during times of crisis, companies often find it easier to gain consensus around the bold moves required to reconfigure an existing business. (Lindgardt *et al* 2009)

5. Conclusions

Eco-innovation has become an important topic for entrepreneurs, and politicians alike. The concept of business model has also received increasing attention from scholars and business strategists interested in explaining firms' value creation, performance, and competitive advantage. As observed, the business and strategic management theories suggest many ways of understanding and interpretation of "business model" phenomenon and existing definitions often only partially overlap, giving space to numerous interpretations. The business model has been usually divided into different number of elements, components or building blocks, but how and why they are related, which are the conditions and boundaries of these relationships have not been studied thoroughly so far. Yet, it would be an important background for analyzing eco-innovation possibilities in business models.

As it has occurred that the incremental progress is not sufficient to achieve the desired targets of environmental conservation, the paper suggests areas

and factors which need further attention in empirical studies, and also in practice, in order to achieve more systemic change. The approaches can be roughly categorized into incremental and radical innovation, the later being the possible source of expected systemic change. Incremental innovation primarily contributes to the relative decoupling of environmental impacts from economic growth, while the latter tends to have larger potential for helping to make absolute decoupling possible. Also the OECD Green Growth Strategy (2010) emphasizes firstly the need to delink environmental degradation from economic growth by reducing resource use per unit of value added (relative decoupling), and secondly, it would be essential to aim at further efforts towards achieving absolute reductions in the use of energy and materials to a sustainable level (absolute decoupling). The empirical cases need to be analyzed including diverse aspects, e.g. the source of the original idea, the business model, the role of partnerships and collaboration, the impact of policies in facilitating the innovation, the sources of funding and the potential economic and environmental benefits.

References

- AMIT, R., ZOTT, C. 2001. Value creation in e-business. *Strategic Management Journal* 22, 493-520.
- BRYSON, J., LOMBARDI, R. 2009. Balancing product and process sustainability against business profitability: sustainability as a competitive strategy in the property development process. *Business Strategy & the Environment (John Wiley & Sons, Inc)* [serial online]. February 2009;18(2):97-107. Available from: Business Source Complete, Ipswich, MA. Accessed August 17, 2011.
- EKINS, P. (2010). Eco-innovation for environmental sustainability: concepts, progress and policies. *International Economics & Economic Policy*, 7(2/3), 267-290.
- JOHNSON, M.W., CHRISTENSEN, C.M., KAGERMANN, H. 2008. Reinventing Your Business Model. Harvard Business Review.
- LINDGARDT, Z., REEVES, M., STALK, G., DEIMLER, M. 2009. Business Model Innovation. When

the game gets tough, change the game. Boston Consulting Group.

MACHIBA, T. 2010. Eco-innovation for enabling resource efficiency and green growth: development of an analytical framework and preliminary analysis of industry and policy practices. *International Economics & Economic Policy*, Vol. 7, Issue 2/3, p. 357-370.

Methodological report 2010. European Commission (2010), *Eco-Innovation Observatory: Methodological Report*, European Commission, Brussels, (www.eco-innovation.eu).

NIDUMOLU, R., PRAHALAD, C.K., RANGASWAMI, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review*, pp. 56-64.

OSTERWALDER A, PIGNEUR, Y., TUCCI C.L. (2005) Clarifying business models: origins, present, and future of the concept. *Communications of the AIS* 15(May), 2-40.

PORTER, M.E. 1985. *Competitive Advantage*. Free Press, New York.

SMITH, K. Innovation as a Systemic Phenomenon: Rethinking the Role of Policy. *Enterprise and Innovation management Studies*, 2000, Vol. 1, No. 1, pp. 73-102.

ZOTT, C., AMIT, R., MASSA, L. 2011. The Business Model: Recent Developments and Future Research. *Journal of Management*, Volume: 37, Issue: 4 pp. 1019-1042.

THOMPSON, J.D., MacMILLAN, I.C. 2010. Making Social Ventures Work. *Harvard Business Review*, September 2010. pp.

CHESBROUGH, H. W. (2003). Open Platform Innovation: Creating Value from Internal and External Innovation. *Intel Technology Journal*, 7(3) , 5-9.

CHESBROUGH, H. W., ROSENBLOOM, R. S. (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spinoff companies. *Industrial and Corporate Change*, 11(3): 533-534.

MAGRETTA, J. (2002) Why business models matter. *Harvard Business Review*, 80(5), 86-92.

Appendix 1. Selected additional eco-innovation definitions from last decade.

Author(s), Year	Definition or description
European Commission (2007)	Eco-innovation is any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment or achieving a more efficient and responsible use of natural resources, including energy.
European Commission (2008)	Eco-innovation is —the production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use (including energy).
OECD (2005). <i>Oslo Manual: Guidelines for collecting and interpreting innovation data</i> . EU: Eurostat.	Innovation is —the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.
OECD (2009). <i>Eco-Innovation in Industry: Enabling Green Growth</i> . OECD: Organisation for Economic Co-operation and Development	Eco-innovation is generally the same as other types of innovation but with two important distinctions: 1) Eco-innovation represents innovation that results in a reduction of environmental impact, whether such an effect is intended or not; 2) The scope of eco-innovation may go beyond the conventional organizational boundaries of the innovating organization and involve broader social arrangements that trigger changes in existing socio-cultural norms and institutional structures.
VINNOVA (2001). Drivers of environmental innovation.	Environmental innovation is innovation that serves to prevent or reduce anthropogenic burdens on the environment, clean up damage already caused or diagnose and monitor environmental problems.
Europa INNOVA (2006)	Eco-innovation is the creation of novel and competitively priced goods, processes, systems, services, and procedures designed to satisfy human needs and provide a better quality of life for all, with a life-cycle minimal use of natural resources (materials including energy, and surface area) per unit output, and a minimal release of toxic substances.
Fussler, C., James, P. (1996). <i>Driving Eco-Innovation: A Breakthrough Discipline for Innovation and Sustainability</i> . London: Pitman Publishing.	Eco-innovation is the process of developing new products, processes or services which provide customer and business value but significantly decrease environmental impact.
Andersen, M. M. (2008). Eco-innovation-towards a taxonomy and theory. <i>25th Celebration Conference 2008 on entrepreneurship and Innovation-organizations, institutions, systems and regions</i> . Copenhagen.	[Eco-innovation is] innovation which is able to attract green rents on the market.
Charter, M., & Clark, T. (2007). Sustainable Innovation: Key conclusions from sustainable innovation conferences 2003-2006. <i>Center for sustainable design</i> . Farnham: The Center for sustainable design.	Sustainable innovation as a process where sustainability considerations (environmental, social, and financial) are integrated into company systems from idea generation through to research and development (R&D) and commercialization. This applies to products, services and technologies, as well as new business and organization models.
Rennings, K., Zwick, T. (2002). Employment Impact of cleaner production on the firm level: Empirical evidence from a survey in five European countries. <i>Int. Journal of Innovation Management</i> , 6 (3), 319-342.	Environmental innovations consist of new or modified processes, techniques, practices, systems and products to avoid or to reduce environmental harms.
Carrillo, J. H., Río, d. P., & Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. <i>Journal of Cleaner Production</i> , 18, 1073-1083.	Eco-innovation is an innovation that improves environmental performance.

Appendix 2. Selected additional business model definitions.

Author(s), Year	Definition	Papers Citing the Definition
Timmers, 1998	The business model is “an architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues” (p. 2).	Hedman & Kalling, 2003
Amit & Zott, 2001; Zott & Amit, 2010	The business model depicts “the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities” (2001: 511). Based on the fact that transactions connect activities, the authors further evolved this definition to conceptualize a firm’s business model as “a system of interdependent activities that transcends the focal firm and spans its boundaries” (2010: 216).	Hedman & Kalling, 2003; Morris, Schindehutte, & Allen, 2005; Zott & Amit, 2007, 2008; Santos, Spector, & Van Der Heyden, 2009; Bock, Opsahl, & George, 2010
Chesbrough & Rosenbloom, 2002	The business model is “the heuristic logic that connects technical potential with the realization of economic value” (p. 529).	Chesbrough, Ahern, Finn, & Guerraz, 2006; Chesbrough, 2007; Teece, 2007, 2010
Magretta, 2002	Business models are “stories that explain how enterprises work. A good business model answers Peter Drucker’s age old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?” (p. 4).	Seddon, Lewis, Freeman, & Shanks, 2004; Ojala & Tyrväinen, 2006; Demil & Lecocq, 2010
Morris et al., 2005	A business model is a “concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets” (p. 727). It has six fundamental components: Value proposition, customer, internal processes/competencies, external positioning, economic model, and personal/investor factors.	Calia, Guerrini, & Moura, 2007
Johnson, Christensen, & Kagermann, 2008	Business models “consist of four interlocking elements, that, taken together, create and deliver value” (p. 52). These are customer value proposition, profit formula, key resources, and key processes.	Johnson & Suskewicz, 2009
Casadesus-Masanell & Ricart, 2010	A business model is /.../ a <i>reflection</i> of the firm’s <i>realized</i> strategy (p. 195).	Hurt, 2008; Baden-Fuller & Morgan, 2010
Teece, 2010	A business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value (p. 179).	Gambardella & McGahan, 2010
Osterwalder & Pigneur 2010	A business model describes the rationale of how an organization creates, delivers, and captures value.	

Source: Zott et al. 2011, amended and modified by author