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Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions

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ABSTRACT
The purpose of this paper is to propose a framework to position sustainable entrepreneurship in relation to sustainability innovation. The framework builds on a typology of sustainable entrepreneurship, develops it by including social and institutional entrepreneurship, i.e. the application of the entrepreneurial approach towards meeting societal goals and towards changing market contexts, and relates it to sustainability innovation. The framework provides a reference for managers to introduce sustainability innovation and to pursue sustainable entrepreneurship. Methodologically, the paper develops an approach of qualitative measurement of sustainable entrepreneurship and how to assess the position of a company in a classification matrix. The degree of environmental or social responsibility orientation in the company is assessed on the basis of environmental and social goals and policies, the organization of environmental and social management in the company and the communication of environmental and social issues. The market impact of the company is measured on the basis of market share, sales growth and reactions of competitors. The paper finds conditions under which sustainable entrepreneurship and sustainability innovation emerge spontaneously. The research has implications for theory and practitioners in that it clarifies which firms are most likely under specific conditions to make moves towards sustainability innovation. The paper makes a contribution in showing that extant research needs to be expanded with regard to motivations for innovation and that earlier models of sustainable entrepreneurship need to be refined. Copyright © 2010 John Wiley & Sons, Ltd and ERP Environment.

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Introduction

COMPANIES ARE CONSIDERED BY MANY TO BE THE MAIN PLAYERS CREATING ENVIRONMENTAL AND SOCIAL PROBLEMS and thus to be the source of a lack of sustainability in society. From this perception government and non-government organizations have to create and control a tight regulatory framework for business. As a consequence, management is challenged to comply with regulations and requirements and to keep the

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unwanted, negative impacts under control. However, while this view tends to overestimate the possibilities of political programmes, legal regulations and NGOs, it underestimates and distorts the role of companies in society.

For many years and with increasing visibility the managements of leading companies have been core drivers of sustainable development. With their innovations sustainable entrepreneurs and sustainability managers are shaping markets and society substantially. Probably, cars, computers and the internet have changed the world more fundamentally than most political programs. To be innovative means to provide organizational and technical improvements that can be sold successfully in the marketplace. In a market system, sustainable development requires sustainability innovation and entrepreneurs who can achieve environmental or social goals with superior products or processes that are successful in the marketplace of mainstream customers. Market innovations driving sustainable development do not necessarily occur by accident but can be created by leaders who put them into the core of their business activities. Actors and companies making environmental progress to their core business can be called sustainable entrepreneurs. They generate new products, services, techniques and organizational modes that substantially reduce environmental impacts and increase the quality of life.

Joseph Schumpeter (1934) referred to entrepreneurial activities as creative destruction. Sustainable entrepreneurs destroy existing conventional production methods, products, market structures and consumption patterns, and replace them with superior environmental and social products and services. They create the market dynamics of environmental and societal progress. This paper attempts to analyse which actors are most likely to bring about sustainability innovation under different conditions. This is based on a typology of sustainable entrepreneurship (Schaltegger, 2002) that distinguishes it from other forms of corporate environmental and social responsibility activities and is summarized with a positioning matrix of sustainable entrepreneurship that allows management to assess its state of environmental and economic activities in relation to others. The framework for sustainable entrepreneurship, which so far has covered business approaches with a strong inclusion of sustainability issues, is further developed by including social entrepreneurship, i.e. the application of the entrepreneurial approach towards the primary goal of meeting societal goals. In this context also the notion of institutional entrepreneurship, i.e. the effort to change institutions such as market regulations despite pressures towards stasis, plays a role and is considered.

Sustainable Development and Entrepreneurship

The relationship between entrepreneurship and sustainable development has been addressed by various streams of thought and literature such as ecopreneurship, social entrepreneurship, sustainable entrepreneurship and, in an indirect way also, institutional entrepreneurship. In terms of extant literature, earlier authors addressing sustainability and entrepreneurship have dealt exclusively with environmentally orientated entrepreneurship, often called 'ecopreneurship', in more detail (Blue, 1990; Bennett, 1991; Berle, 1991; Anderson and Leal, 1997; Staber, 1997; Keogh and Polonsky, 1998; Lober, 1998; Pastakia, 1998; Isaak, 1999; Schaltegger, 2002; Lehmann *et al.*, 2005; Cohen, 2006). The core motivation and main goals mentioned with ecopreneurship are to earn money through contributing to solving environmental problems (Table 1). Economic goals are the ends of the business, whereas environmental goals are considered as an integrated part of the economic logic of the business. The organizational challenge of entrepreneurship is to better integrate environmental performance into the economic business logic or to multiply the number of (small) green businesses (Hockerts and Wüstenhagen, 2010).

Some authors have focussed exclusively on social entrepreneurship (Brinckerhoff, 2000; Borzaga and Solari, 2001; Prahalad and Hammond, 2002; Mair *et al.*, 2005; Bright *et al.*, 2006; Desa and Kotha, 2006a, 2006b; Milstein *et al.*, 2006; Nicolls, 2006; Ridley-Duff, 2008; Bull, 2008). The social entrepreneurship literature is concerned with achieving societal goals and securing its funding (Table 1). In most cases, social entrepreneurship is about how to provide club goods to members or how to provide access to innovation for specific deprived market segments (Desa and Kotha, 2006a), especially in the context of base-of-the-pyramid innovation in emerging markets and developing economies (Prahalad, 2005, 2006).

It also is concerned with detailed case analyses of successful non-profit social ventures, such as for example Benetech (Desa and Kotha, 2006b). In this literature, social entrepreneurship has been described as a specific form of ownership structure (for example, Mair and Noboa, 2003) as well as a philanthropic, fund-raising or

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	Ecopreneurship	Social entrepreneurship	Institutional entrepreneurship	Sustainable entrepreneurship
Core motivation	Contribute to solving environmental problem and create economic value	Contribute to solving societal problem and create value for society	Contribute to changing regulatory, societal and market institutions	Contribute to solving societal and environmental problems through the realization of a successful business
Main goal	Earn money by solving environmental problems	Achieve societal goal and secure funding to achieve this	Changing institutions as direct goal	Creating sustainable development through entrepreneurial corporate activities
Role of economic goals	Ends	Means	Means or ends	Means and ends
Role of non-market goals	Environmental issues as integrated core element	Societal goals as ends	Changing institutions as core element	Core element of integrated end to contribute to sustainable development
Organizational development challenge	From focus on environmental issues to integrating economic issues	From focus on societal issues to integrating economic issues	From changing institutions to integrating sustainability	From small contribution to large contribution to sustainable development

Table 1. Characterization of different kinds of sustainability oriented entrepreneurship

social-purpose business venture. Compared with this focus of the social entrepreneurship literature environmental entrepreneurship is more strongly linked to the pursuit of profitable entrepreneurial opportunities. The organizational development challenge is to better integrate economic issues in the core logic of solving societal problems (Mair and Marti, 2006; Zahra *et al.*, 2009).

As some product, service and organizational innovations may have a limited effect and success if market conditions are very unfavourable, entrepreneurial activities aiming at sustainable development have to consider market issues and, in addition, aim at influencing market conditions. Thus, the environmental entrepreneurship literature, and to some extent also the social entrepreneurship, also addresses corporate influence in changing market conditions and regulations as well as initiating societal change. The ambition to change institutional settings creates links to institutional entrepreneurship (Table 1). Actors who initiate changes that contribute to transforming existing institutions or to creating new institutions are termed institutional entrepreneurs (DiMaggio, 1988) and their effort to change institutions despite pressures towards stasis is discussed as institutional entrepreneurship (Ostrom, 1990; Holm, 1995; Dacin *et al.*, 2002; Seo and Creed, 2002; Battilana *et al.*, 2009).

Furthermore, the notion of sustainable entrepreneurship has been raised more recently to address the contribution of entrepreneurial activities to sustainable development in a more comprehensive way. Such an ambitious approach of entrepreneurship that attempts not only to contribute to sustainable development of the organization itself, but also to create an increasingly large contribution of the organization to sustainable development of the market and society as a whole, requires substantial sustainability innovations.

Observing the development of these different streams of literature raises the question of whether these types of entrepreneurship are distinct, given their different histories. However, even though the historic trajectories of these types differ, it seems that the underlying motivations for the activities are very similar and this seems to make likely a convergence of these currently rather independent literatures. Despite this, up to now, significantly less attention has been devoted to sustainable or sustainability entrepreneurship as a concept integrating

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environmental and social aspects (Larson, 2000; Kyrö, 2001; Strothotte and Wüstenhagen, 2005; Cohen *et al.*, 2008; Cohen and Winn, 2007).

We synthesize these streams of literature on entrepreneurship with environmental and social objectives and shall put it in perspective with regard to the conditions under which entrepreneurs pursuing sustainability innovation are likely to emerge spontaneously in a market system and which types of firm are most probably involved in it. The joint treatment of sustainable entrepreneurship and sustainability innovation is crucial because the underlying logics differ considerably. As concerns innovation, the core dimensions are private and social benefits and these can be related to a defined sequence of product and process innovations, the existence of complementary assets and the means to protect the innovation from undesirable knowledge spillovers to third parties (Utterback and Abernathy, 1975; Teece, 1986; Utterback, 1994). Conversely, as concerns entrepreneurship, the dominant logic is that of opportunity recognition and exploitation (Shane, 2000, 2003) and the aspect of innovativeness is mainly confined to the level of the individual (Kuckertz and Wagner, 2010).

The following section defines the term 'sustainable entrepreneurship' (including social entrepreneurship and environmental entrepreneurship or ecopreneurship, and considering institutional entrepreneurship) and its derivation from entrepreneurship. The next section discusses a first typology of sustainable entrepreneurship and the elements of a positioning matrix of sustainable entrepreneurship. The fourth section analyses how sustainable entrepreneurs emerge and what their likely characteristics are. The fifth section concludes.

What is Sustainable Entrepreneurship?

Sustainable entrepreneurship is in essence the realization of sustainability innovations aimed at the mass market and providing benefit to the larger part of society. By realizing such (radical) sustainability innovations sustainable entrepreneurs often address the unmet demand of a larger group of stakeholders. Stakeholders are groups or individuals that materially affect or are affected by a firm's activities (Freeman, 1984). Stakeholder demands go beyond narrow economic interests of shareholders and are the ultimate sources of entrepreneurial opportunities for sustainability innovation (Figge *et al.*, 2002), discovery and exploitation of which is at the core of sustainable entrepreneurship (Dean and McMullen, 2007). This interpretation is also consistent with recent work arguing that specific market failures are the underlying root cause for entrepreneurial activities aimed at realizing social objectives as well as environmental improvements (Cohen and Winn, 2007; Cohen *et al.*, 2008). Stakeholders can demand environmental improvements (e.g. environmental NGOs) or social improvements (e.g. consumer associations or stakeholders concerned with child labour). Such extended stakeholder demands also matter economically, as they can foreshadow demand from a larger group of customers. Stakeholders with currently weak bargaining positions and limited relevance for the continuation of a firm's operation can in this respect be lead users in an economic sense (see von Hippel (1982) and von Hippel *et al.* (1999) on the lead user model in general). To the degree that this is true, such 'fringe' stakeholders provide important input on entrepreneurial opportunities (see Hart and Sharma, 2004) that are ultimately discovered and/or exploited by sustainable entrepreneurs, since lead users foreshadow future demand of a large majority of market participants.

Economics and management theory neglected the phenomenon of entrepreneurship for a long time. However, for the last couple of years more and more authors have started to deal with entrepreneurship following the work of Schumpeter (1934) and Kirzner (1973), and this has partially contributed to the increasing focus on sustainable entrepreneurship as a specific type of entrepreneurship.

The word 'entrepreneur' derives from French and can be taken to mean 'taking the initiative to bridge'. Entrepreneurs are the catalyst that brings together money, people, ideas etc. to establish value creating networks. Whereas all entrepreneurs deal with bridging activities between suppliers and customers to create and change markets, sustainable entrepreneurs differ from conventional entrepreneurs in that they also build bridges between environmental progress and market success. Entrepreneurship can describe various phenomena (Lambing and Kuehl, 1997).

- Many authors concentrate on the process of a start-up company (e.g. Bennett, 1991). In this view entrepreneurs are actors opening a new company and entrepreneurship is the process of creating and establishing a new company.

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- Another aspect of entrepreneurship is the striving for growth (Kyrö, 2001; Gartner, 1990). Entrepreneurs are viewed as actors enlarging companies and expanding businesses.
- Entrepreneurship has also been interpreted as a social movement or another kind of environmental grassroots or social concern movement (Pastakia, 1998; Mair and Marti, 2006). In this perspective entrepreneurs are actors changing existing consumption and production patterns on the basis of individual initiatives.
- Entrepreneurs are sometimes distinguished from traditional companies by their capability to innovate and to create competitive advantage (Schumpeter, 1934; Staber, 1997; Wiklund, 1999). Entrepreneurship links inventions with market success.
- Finally, entrepreneurship is characterized by the personal characteristics of a leader such as ambition, leadership, team building, personal involvement and commitment (Keogh and Polonsky, 1998; Prahalad, 2005, 2006).

The term 'sustainable entrepreneurship' essentially brings many of the above phenomena together and combines two words, sustainability and entrepreneurship (see also Table 1, last column). Sustainable entrepreneurship is characterized by some fundamental aspects of entrepreneurial activities which are less oriented towards management systems or technical procedures, and focus more on the personal initiative and skills of the entrepreneurial person or team to realize large-scale market success and societal change with environmental or societal innovations.

Entrepreneurial thinking first starts with individuals. Environmental and social preferences are also in many ways personal concerns. This is why sustainable entrepreneurs such as Hipp, one of Europe's larges producer of baby food, Duttweiler, the founder of Migros, the largest food supplier in Switzerland, Pfenninger, the head of Trisa, a leading European producer of brushes and brooms, or Anita Roddick, the founder and former head of Body Shop, have been analysed to embody the combination of strong environmental and social values with an energetic entrepreneurial attitude (Schaltegger, 2002). Sustainable entrepreneurs show personal mastery (Senge, 1990) and consider their professional life as a creative act. Differences between personal goals and the perceived reality are taken as a challenge and not as a problem (Senge, 1990). Sustainable entrepreneurs furthermore mostly influence the company very much with their personal goals and preferences in such a way that these are reflected in the company's goals. This is more often and to a larger extent the case with start-up companies and small companies than with larger enterprises. Whereas environmental or CSR managers can leave a company without the company losing substantial character, sustainable entrepreneurs constitute and shape the 'face' of their company. Because of the strong influence of the personality of the company leader (or leaders) on company goals, sustainable entrepreneurship and the status of such an entrepreneur can also be related to the company directly.

As a consequence, sustainable entrepreneurship – defined in a narrow sense – deals with a very innovative company start-up supplying environmentally and/or socially beneficial products and services with the potential to conquer a large part of the market. However, the spirit and the process of creating substantial market success with environmentally or socially beneficial products and services is not limited to start-ups; sustainable entrepreneurship can also be seen in established companies, or in the process of building up corporate ventures, spin-offs etc.

As a distinction to many views of conventional entrepreneurship, sustainable entrepreneurship furthermore extends the goal of corporate influence beyond market success to initiating societal change and changing market conditions and regulations. The ambition to achieve societal goals by means of entrepreneurship and business approaches has been dealt with under the term of social entrepreneurship (Brinckerhoff, 2000; Borzaga and Solari, 2001; Prahalad and Hammond, 2002; Mair *et al.*, 2005; Bright *et al.*, 2006; Milstein *et al.*, 2006; Desa and Kotha, 2006a, 2006b; Bull, 2008). Social enterprises constitute a heterogeneous business movement, which is oriented towards the equitable distribution and not accumulation of social and economic capital (Ridley-Duff, 2008).

The idea of a 'beyond market' application of the entrepreneurial approach, however, with the goal of changing institutions and market regulations, has also been taken up by the notion of institutional entrepreneurship, which addresses the attempt to change institutional settings (Ostrom, 1990; DiMaggio, 1988; Holm, 1995; Dacin *et al.*, 2002; Seo and Creed, 2002; Battilana *et al.*, 2009).

Defined more widely, sustainable entrepreneurship can thus be described as an innovative, market-oriented and personality driven form of creating economic and societal value by means of break-through environmentally or socially beneficial market or institutional innovations. This wide definition of sustainable entrepreneurship takes into account intrapreneurs (Pinchot, 1988; Gapp and Fisher, 2007) as an important subgroup of sustainable

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entrepreneurs; they represent actors inside an organization who substantially change and shape the environmental and business growth development of the company (Jorna, 2006; Zhao, 2005). The conceptual idea behind this subgroup is related to that of promoters, which is a well established concept in the innovation management literature (see e.g. Hauschildt and Chakrabati, 1988).

A Positioning Matrix of Sustainable Entrepreneurship

This section shows in more detail what can be understood by sustainable entrepreneurship and how it is distinguished from other kinds of environmental and socially responsible activity of companies. After an introduction to the positioning matrix of sustainable entrepreneurship, the two main dimensions, priority of environmental and societal goals and market effect, are discussed in more detail.

On a pragmatic scale sustainable development requires the integrative achievement of environmental, social and economic goals now and for future generations. Corporate sustainability management thus attempts to shape the environmental, social and economic effects of a company in a way that results in first a sustainable development of the company and second that the company contributes to the sustainable development of society as a whole. Among the core challenges are the management of social and environmental issues with economic approaches and to integrate environmental and social issues in core business processes and tools (see e.g. Figge *et al.* (2002) for details and examples).

Companies contribute most to the sustainable development of an economy and society if their core business deals with solutions to environmental and social problems, if they supply environmentally and socially superior products and if their innovations influence the mass market and society substantially. A positive sustainability influence by companies calls for a real and substantial contribution to sustainability progress. This, in turn, requires sustainability innovations. Real improvement can only be created if the production processes, products and services are superior. A substantial contribution requires that the company can exert both a large market influence and a large social or political influence. A large market influence can be based on a large market share or on influencing competitors and other market actors (such as suppliers) to adopt superior sustainability solutions. A large social and political influence includes the development of trends, fashion, values and political opinions, institutions, regulations and frameworks.

Both dimensions of sustainability management can be further subdivided. The priority of sustainability goals (vertical axis in Figure 1) can range from low priority (social and environmental requirements as a trustee duty) to medium priority (sustainability issues as a supplement to conventional business issues) and high priority (sustainability issues as an integral part of core business activities). On the other, horizontal axis, depicting the real effects of the organization, socially desired effects can be created outside the market or in a manner that is not yet marketable (left of horizontal axis). Once the market is entered the market effect of the company and its businesses can be small in a niche and large through a strong influence on the mass market or even spill over to society and politics at large. The necessary innovations to move from left to right on the horizontal axis are characterized by improving marketability and increasing market effects until both market and society are influenced substantially.

The positions in Figure 1 allow us to distinguish different forms of sustainability management and entrepreneurship. Organizations in which sustainability issues are of low priority – and thus are administered rather than managed – consider these as a trustee duty and concentrate on the implementation of given regulations and standards. Environmental and social issues are left to the legal department and to bureaucracy, which administer the issues according to formally defined rules and regulations. Since, by definition, these firms do not pursue a proactive sustainability strategy, capabilities for sustainability innovation and sustainable entrepreneurship such as that of being able to integrate stakeholders are lacking in such firms (see, e.g., Sharma and Vredenburg, 1998; Aragon-Correa and Sharma, 2003).

Company leaders who consider sustainability issues as a supplementary aspect of business establish environmental, quality and social management systems and departments that attempt to pilot and control impacts in the most efficient manner. Cost reduction, the improvement of competitiveness and eco-efficiency, image campaigns and the differentiation of products and services are major goals of such a sustainable management directed towards doing things right. Firms in this group are likely to carry out some innovation activities, but with a stronger focus

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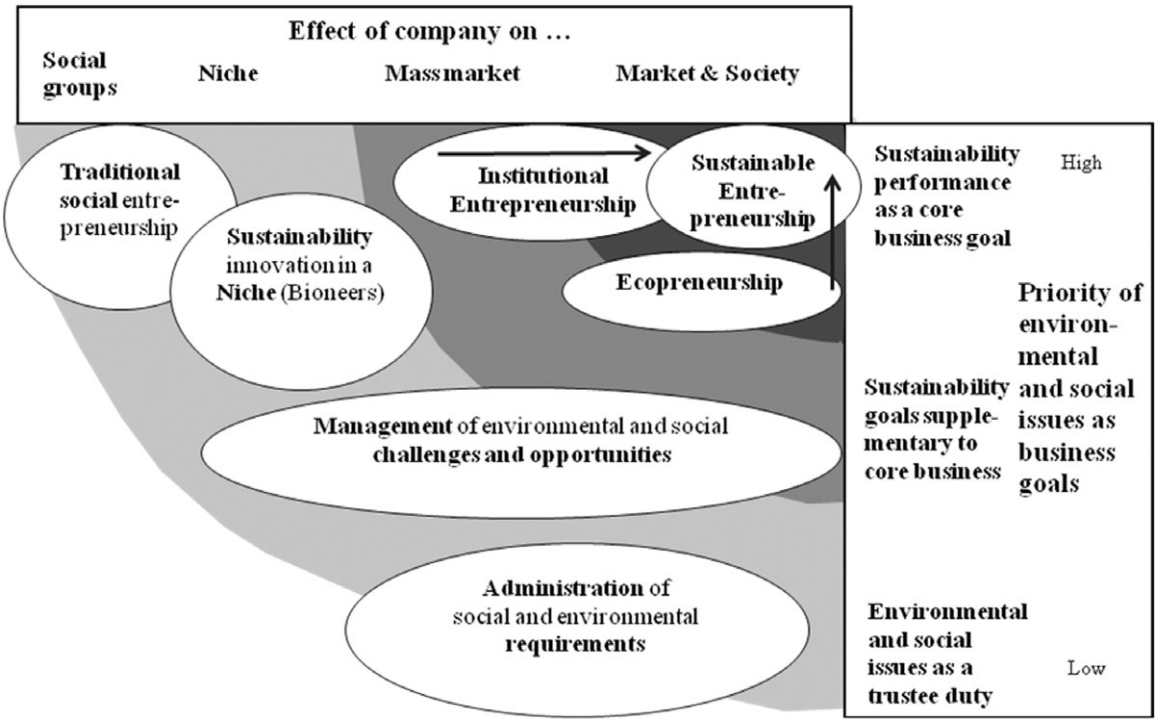

Figure 1. Perspectives and development of sustainable entrepreneurship and sustainability innovation (extended framework based on Schaltegger, 2002)

on mostly incremental innovation. The issue with a purely economic motivation leading to social and environmental improvements is that it is oriented towards the short term and limited by inherent characteristics of incremental innovation.

Sustainability management in its most advanced form becomes sustainable entrepreneurship and fulfils both requirements (see Figure 1). Ideally, sustainable entrepreneurship pulls the whole market towards sustainability and influences the society as a whole. Sustainable entrepreneurs strive for business success through sustainability solutions for the mass market. With their innovations they are able to exert a constructive influence on society and politicians. Companies in the upper right corner of Figure 1 can be called sustainable entrepreneurs. In this view sustainability management is concerned with doing the right thing to promote and push sustainable development in the mass market and society. Sustainable entrepreneurs treat sustainability issues as central to their core business because their economic success is strongly linked to their sustainability performance.

Focussing on environmental aspects, 'ecopreneurs' can be found close to sustainable entrepreneurship, but with a less strong focus of full sustainability performance as a core business goal. Ecopreneurs aim with their companies at considerably large market shares and high or increasing turnover in (more or less ecologically sensitive) mass markets. Whilst ecopreneurs historically often had a focus on a larger market (rather a strong non-profit orientation like traditional social entrepreneurship), their value focus was on environmental performance and not much on social performance. Hence they only to some degree had sustainability performance (combining social and environmental performance) as a core business goal. In recent years, however, social aspects have become more crucial for business as is witnessed e.g. by the UN Global Compact or the millennium goal of eliminating world poverty by 2025. This implies that ecopreneurs have to also address the social aspects of their breakthrough environmental innovations more systematically, and to the degree that this actually happens they move forward towards sustainable entrepreneurship.

For ecopreneurs, their knowledge about substantial environmental problems enables them to foresee a demand for fundamental innovations also in traditional markets. The entrepreneurial challenge is thus to be economically

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successful with the supply of products and services that change – on a purely voluntary basis – consumption patterns and market structures, leading to an absolute reduction of environmental impacts. As a difference from bioneers, ecopreneurs are mostly not inventors. Instead of spending time in laboratories ecopreneurs search for inventions that they can place on markets to create turnover and influence market structures. Only in exceptional cases like the entrepreneur Geoffrey Ballard, who developed fuel cell technology, are successful inventors ecopreneurs at the same time. The core activity of ecopreneurs is thus to search for business ideas created by environmental problems and solutions, to identify the market potential of inventions and to realize market success with them.

To the degree that firms in the upper right corner need to have a minimum economic scale or size to address the mass market, they are likely to have the capability of intrapreneurship (Pinchot, 1988; Gapp and Fisher, 2007). Research on the promoter concept links into this, as power, technical or relationship promoters have been identified as important individuals within larger firms who enable and accelerate innovation projects (Hauschildt and Gemünden, 1998). Similar to their relevance for innovation activities in larger firms in general, they also significantly matter for enabling sustainability innovation.

Compared with the earlier proposal for a positioning matrix of ecopreneurship (Schaltegger, 2002), the framework for sustainable entrepreneurship discussed here and described in Figure 1 considers social entrepreneurship, institutional entrepreneurship and social topics as company goals. The framework thus provides a substantially extended view of more developments of and approaches to sustainability management and entrepreneurship by including various core issues of sustainable entrepreneurship.

- Societal change as a non-market goal and the use of entrepreneurship for societal goals only is addressed by the concept of social entrepreneurship, which is positioned to the upper left in the proposed framework in Figure 1.
- Social issues as an inclusive part of corporate sustainability goals in addition to environmental topics constitute a distinct difference from ecopreneurship. The integration of social issues as integrated business goals extends the framework beyond ecopreneurship in the vertical axis in the framework (vertical arrow in Figure 1).
- Institutional change as a 'beyond market' structural goal of sustainable entrepreneurship includes the basic idea and aim of institutional entrepreneurship and links the market view depicted in the horizontal axis of the framework with the larger societal perspective by extending the framework (horizontal arrow in Figure 1) with a combined market and society perspective.

As described in the introduction, traditional social entrepreneurship is much rooted in a non-profit perception and hence a niche position, since it implies a core focus on social value creation (Zietlow, 2001; Gillian *et al.*, 2003; Nicolls, 2006; Ridley-Duff, 2008). We argue that, to the degree that this essentially moves towards simultaneously involving a private benefit aspect, it will be enabled to address a larger market and larger parts of society. To achieve this successfully may be supported in various cases with institutional entrepreneurship.

If organizations treat sustainability issues as central to core business activities and are pushing not into the mass market, but rather into niche markets, then the result is still with a high probability a societal innovation but in a niche. This is the group of social entrepreneurs in the upper left corner of Figure 1. This group seems to be probably one of smaller firms that focuses on the achievement of societal benefits, using business approaches to enable the creation of these societal values. They often start out supplying customers in the alternative scene (the term 'alternative scene' describes new social movements and movements rooted in the ecological or feminist movements of the 1970s; see, e.g., Lewis, 1992). Focusing on environmental aspects, 'bioneers' can frequently be found in this area of the matrix.

Eco niches mirror medium size market segments and are occupied by bioneers. The expression 'bioneer' is a combination of 'bio' and 'pioneer' and attempts to express the central role of research and development and the attempt to find customers with high preferences for their inventions and innovations. Bioneers focus on attractive market niches with their customer focused eco products.

Niche market suppliers are in general companies that focus on one well defined part of the market by specializing in specific customer preferences (Kotler, 1998; Porter, 1999). The large competitors neglect these niches either because they do not recognize them, because they do not consider them to be attractive enough or because they are not able to fulfil these specific customer preferences well enough. The competition strategy is to focus on

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one precisely defined area of the market that is big enough to be economically successful and small enough to be neglected by the mass market suppliers. They serve exclusive target groups with a consequent differentiation strategy. This requires innovation of the supplied products and services as well as of the production technologies and organizational concepts.

Suppliers driven by environmental invention can be called bioneers as they serve the pioneer function to open new paths of environmental development in markets. The target customers of bioneers are in the intersection of customers with high environmental consumption preferences and customers with a high ability and willingness to pay. This is why the usual marketing and communication approaches of the mass market are not considered by bioneers. Apart from higher income and environmental preferences the customers usually need substantial market and product knowledge and more time. They furthermore tend to accept longer distances to find the products they are looking for. Many examples of bioneers can be found in the environmental high tech sector (solar and wind energy, such as the UK-based start-up Ecotricity Ltd.), in energy contracting and in the textile industry. Another group of bioneers are traditional SMEs, which develop their products and services according to environmental criteria (for example the Canadian paper maker Cascades Inc.). They are often led and strongly shaped by a company owner or family authority striving for a postulated harmony between environmental, social and financial goals.

To achieve change for sustainable development beyond market impacts requires a different kind of innovation – one that changes the business environment, market regulations and societal institutions. Such processes creating societal trends or regulatory innovations that ensure that sustainable consumption flourishes, or that sustainable products become more competitive and that sustainable developments prevail, are addressed by institutional entrepreneurship as a further element of sustainable entrepreneurship.

Having discussed different forms of sustainability innovation and sustainable entrepreneurship from a focus on large markets to the alternative scene, it should have become clear that the size of a firm is not *per se* a defining criterion for sustainable entrepreneurship. Larger firms (e.g. the carpet company Interface Inc. in the US) can show this type of entrepreneurship as well as small start-ups that aim at introducing a product or process with high environmental or social benefits that is attractive for not only niche buyers, but also the mass market, and has the potential for societal transformation. For example, SkySails has developed a traction system for ships that is based on a large kite filled with pressurized air, an auto-pilot system and a routing system that makes optimal use of the wind conditions. Being founded in Hamburg at the end of 2001, this start-up is still in a niche market, but increasingly also attracts the attention of large commercial ship building investors (Clausen, 2005).

When Do Sustainable Entrepreneurs Emerge and Who Are They?

Environmentally and socially superior products and production processes exceeding by far the strictest regulations have been created by numerous companies, for example in the textile, food, furniture and energy industries. These firms can in principle be small start-ups, but also large incumbent firms that have significant market share in their industry. The decision of a company to get involved in sustainability innovation can be triggered by a number of factors, which can relate for example to changes in regulation (see, e.g., Porter and van der Linde, 1995, for various examples), initiatives of important stakeholders, such as NGOs (e.g. Volkswagen in the case of the three-litre engine, where research activities were triggered by pressure from Greenpeace) or changes in the management team of a firm. In order to analyse and better understand when sustainable entrepreneurship emerges and who will be most likely to carry out sustainability innovation, the term sustainability innovation will initially be defined more precisely.

Conceptualizing sustainability innovation in a more general way, one can distinguish the private benefit of an innovation (i.e. the cost reduction the innovation brings about for, e.g., producing a good whilst keeping the benefit of that good constant) and the social benefit, which is defined for sustainability innovation. The higher the private benefit, the higher is the potential of an innovation to compensate for negative social effects of that innovation (e.g. because it implies a high level of resource consumption). If the social benefit and private benefit of an innovation can be fully monetarized then any innovations where the private benefit cannot compensate negative social effects or where positive social effects are lower than the total private disbenefit are not sustainable, in that either

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they have both negative social effects and low private benefit, or their compensation potential due to the (lacking) private or social benefit is so low that it cannot compensate fully for the increased resource use. This can be termed the 'Playstation world' of innovations, based on the notion that such innovations neither provide positive social effects, nor do they meet consumer demand at a cost so much lower that the consumer could at least in principle compensate society with his consumer surplus for the negative social effect.

If innovations provide (1) sufficient private benefits to compensate negative social effects or (2) have a positive social effect that justifies accepting a lower level of private benefit (because the net benefit to society would still be positive) they can be termed compensatory sustainability innovations. Finally, those innovations where (3) positive private and social benefits coincide are the most desirable form of sustainability innovations. The important connection to Figure 1 and Table 1 here is that to initiate innovations moving from situation (1) or (2) to (3) may require institutional entrepreneurship focusing on changing regulations and market institutions.

This becomes particularly obvious from the fact that, when involving themselves in sustainable innovation, company representatives play an important role in society and politics by shaping the market framework towards sustainability. Similarly, many important sustainability innovations are the result of a constructive interaction of corporate, political and social leaders in multi-partite stakeholder cooperation efforts. The strong growth of the wind generator industry in Northern Europe or the photovoltaic industry in Germany are examples where political support in terms of subsidies helped sustainable industries to become competitive.

Based on these considerations, the question arises as to what the conditions are for spontaneous emergence of sustainable entrepreneurs that pursue sustainability innovation in a market system (be it in larger or smaller firms or for the mass market or a sustainability niche). A key insight from the framework developed above and summarized in Figure 1 as concerns spontaneous emergence is that several paths to sustainability innovation can be perceived that depend to differing degrees on sustainable entrepreneurship.

One possible path is based on the existence of a business case, i.e. a demand side that enables profitable sustainability innovation. A business case for a sustainability innovation implies the existence of a sufficiently high willingness to pay (WTP) in the relevant market that enables the product or process innovation in question. For example, Method Inc. develops and markets environmentally more benign cleaning products that also imply fewer health and safety concerns. In the US, this met with customer needs and enabled the start-up to grow significantly in the first years of operation. The key to this success was the disruptive innovation (Christensen, 2003) of providing attractive products with unique benefits in what was a mature industry characterized by a focus on scale of production and low cost.

Whilst in this case a bioneer was able to profit from an innovation, success ultimately depends on the interplay of appropriability regimes (Teece, 1986) and industry life-cycles (Utterback, 1994; Klepper, 1996). Both have their inherent logic of temporal unfolding, which is independent of when sustainability-related stakeholder demands are put to an industry. An illustrative example of this is the automotive industry, which has a mature product design. Incremental improvements such as cars with lower petrol consumption have mainly emerged as innovations from large incumbents, whereas radical innovations such as electric engines are mainly developed by novel entrants in the industry, such as Tesla Motors. Interestingly, however, the established Japanese incumbent Honda with its Prius hybrid car was the first to capture a large share of the market with a significantly altered design based on radical innovation. What this suggests is that the timing between unfolding industry dynamics and emerging sustainability challenges needs to be considered to make predictions about the exact paths to the realization of a sustainability innovation.

As has been pointed out earlier, sustainability innovation is in many cases a radical innovation. Markides and Geroski (2005) define radical innovation as innovation that is characterized by creating new-to-the-world markets that are disruptive for both customers and manufacturers (Markides and Geroski, 2005, p. 17). They argue that, because such innovation is commonly the result of an effort of a larger number of distributed R&D organizations and scientists, they are unlikely to have strong lead users or firm-internal champions to promote them. Because of this, they often target initially only small niche markets that are unattractive for larger firms.

Sustainability innovation often meets many of these criteria. For example, as concerns climate change, it is difficult to identify lead users that have both a high benefit from the innovation and a need that foreshadows that of the large majority of customers at a later point in time. Small island states may be lead users for climate-friendly processes and products. However, they are faced with an externality problem in that they are not the ones using

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the innovation, but it would have to be all the large industrial countries that would need to make use of climate-friendly processes and products to slow down global warming. Currently, the indication is that customers in the latter countries are rather unwilling to bear the learning and switching costs associated with such innovations.

Given the insight that sustainability innovation in many cases has characteristics of a radical innovation, the innovation management literature can be drawn upon as a source for explanation in that one should find a similar situation and similar patterns for radical sustainability innovation as can be found for radical innovation in general. Overall, the innovation management literature argues that large firms are at a disadvantage in carrying out radical innovation. For example, Henderson and Clark (1990) have shown that larger incumbents do not perform well when innovation is architectural, and Christensen (2003) in his seminal work on the hard disk drive industry has shown that disruptive innovation often affects incumbents who are not open enough for more fundamental technology changes.

Reasons for the challenges that radical innovation poses for firms are partly rigid routines and higher levels of administration. For example, Germany's federal railway company Deutsche Bahn AG for a long time did not enter the car sharing business, even though this was a growing market. The reason for this behaviour was that Deutsche Bahn considered itself not in the business of providing mobility, but thought that its strategic focus was on providing rail transportation. However, when it became clear to the company that growth in the latter segment was crucially dependent on providing solutions for the 'last mile' to customers without cars, Deutsche Bahn eventually acquired a private car sharing firm. Whilst some authors argue that revolutionary routines can help larger firms circumventing challenges such as the one described for Deutsche Bahn and help them to capture profitable innovation opportunity, they also acknowledge that incremental innovation routines remain nevertheless attractive to larger firms by reducing costs and risks, enabling firms to maintain their license to operate, and by increasing their reputation (Milstein *et al.*, 2006). Also, larger firms try to circumvent issues such as the ones exemplified by means of corporate venturing, but with varying success (Birkinshaw *et al.*, 2002). Overall, it seems that the persistent challenge of large firms carrying out radical innovation applies similarly to innovations that aim at mutual benefits for business, society and environment, which is precisely what characterizes sustainability innovations according the definition introduced earlier (Bright *et al.*, 2006).

Conversely, the literature argues that smaller firms have many of the characteristics that put them in a position to be pursue better radical innovation (Utterback and Abernathy, 1975; Jovanovic, 1982; Klepper, 1996). However, start-ups face the liabilities of newness and smallness (Gruber, 2004; Gruber and Henkel, 2006). This means that they may not always be as successful at radical innovation as e.g. innovation networks, which enable bundling the resources of different organizations (Gemünden *et al.*, 1996; Lehmann *et al.*, 2005). The role of networks is stressed not only in mainstream entrepreneurship research (De Carolis and Saparito, 2006; Ozgen and Baron, 2007; White, 2002), but especially as relates to sustainability innovation (Boons and Roome, 2005). For example, Larson (2000) suggests that in the case of Method Inc. an iterative process of interactions with prospective stakeholders resulted in a stakeholder network from which the new products emerged and which was also pivotal in developing a lean outsourcing network of 50 suppliers and significant brand loyalty crucial for Method's longer-term success.

In conclusion, the difficulties larger firms have with radical innovation should guide them to a strategy of being fast second (Markides and Geroski, 2005), because they are more likely to have complementary assets that enable diffusing the innovation into a larger market. This would mean that large firms are not the ones who are capturing a market, but are best off consolidating radical markets into mass markets. If they do so, this corresponds exactly to the definition of sustainable entrepreneurship. Whilst the initial prevalence of small firms in these innovation activities relates partly to the fact that a clear dominant design has not yet emerged (Utterback and Abernathy, 1975; Utterback, 1994), to the degree that sustainability innovations are radical innovations, it seems unlikely that they are carried out by larger firms because they lack specific capabilities to do so (Markides and Geroski, 2005). Differences that according to Markides and Geroski (2005) make large firms more suitable to be fast second are their skills in customer segmentation and marketing versus a start-up's engineering or technology competencies. What distinguishes a fast second from the classical second mover is that the former does not wait until the dominant design (Utterback and Abernathy, 1975; Utterback, 1994) is defined.

Larger firms are better at understanding the needs of standard customers and at producing a good that fulfils the majority of needs for a large number of consumers, rather than focussing on lead users (von Hippel, 1982; von Hippel *et al.*, 1999) and on novel features. This means that larger firms are more driven by a viable business

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case, i.e. they will only consider getting involved in an innovation if this seems to be a profitable endeavour. This is also related to competences of larger firms in production and procurement (rather than product design) and in a stronger drive towards cost control (Markides and Geroski, 2005). These insights and arguments also put somewhat in question proposals for increasing the capability of larger firms for radical innovation, as for example brought forward by Milstein *et al.* (2006), in that the competences of larger firms are systematically conflicting with those needed for radical innovation and in that they are critical success factors for larger firms. This insight poses a significant challenge to the hope that radical innovation competences can be acquired easily by larger firms.

Examples of the concept of large firms being fast second in the area of sustainability innovation exist, such as the earlier case of Deutsche Bahn AG, which exhibits many of the features discussed. Car sharing systems initially originated amongst users and small start-ups, which are those most likely to innovate according to the innovation management literature. Later, Deutsche Bahn as a 'manufacturer innovator' and large incumbent firm started to offer car sharing and integrated it into its offerings based on a business case and hence in a way that ensured it would not jeopardize its profitability. This pattern again relates to the work of Teece (1986) on the appropriation of profits from an innovation and especially the role of complementary assets. Part of the explanation of why an established large firm, focussed on the administration and possibly the management of sustainability, can capitalize on the radical innovation of a bioneer or social entrepreneur is that the latter lack complementary assets that enable a diffusion of the innovation to larger market segments. A similar pattern as for the user-based social ventures of car sharing can be identified for other ventures. For example, the sustainability-oriented ice-maker Ben & Jerry's Inc. was ultimately acquired by the large incumbent Unilever because it did not manage to keep its market share alone in the longer term. Whilst up to the point of acquisition Ben & Jerry's was a good example for sustainable entrepreneurship, it seems that the role of complementary assets was so crucial for some mass market segments that ultimately the acquisition was needed to access these successfully.

Another area where the interaction of classical innovation dynamics and sustainability trends is strong is renewable energies, such as photovoltaics or wind turbines. Here again small start-ups initially engaged in the development and manufacturing of renewable energy technologies. Subsequently, large multinational energy suppliers entered this business, partly by acquiring smaller firms, and partly by developing capabilities on their own, even to the extent that oil companies reposition themselves as energy providers that also manufacture photovoltaic cells (as is the case with BP). It is still an open question who the sustainable entrepreneurs are in renewable energy, those multinationals such as BP who move beyond fossil fuels, or former bioneers such as Danish wind turbine maker Vestas who move towards mass production and hence sustainable entrepreneurship.

What becomes clear again from these examples is that there are a variety of paths towards realizing sustainability innovation and that the status of sustainable entrepreneur can be ultimately assumed by established incumbents as well as growing entrants. Similar variation in temporal paths can be observed as concerns innovative products based on renewable resources in the automotive industry and the case of system innovation for sustainable services (see, e.g., Tukker and Tischer, 2006; Tukker, 2004) in the areas of 'green' biotechnology and biofood. The case of 7th Generation Inc., a US biofood provider, suggests for example that bioneers also consciously strategize about becoming a sustainable entrepreneur or not. When faced with the opportunity to supply Walmart and hence to move from a sustainability niche to the mass market, 7th Generation decided to remain focussed on its initial niche, because it feared the expansion would compromise its quality reputation.

Overall, the case examples analysed are consistent with the frequent empirical finding that more radical sustainability innovation tends to be carried out by smaller firms, i.e. there is some negative association between the size of a firm and the radicality of any sustainability innovation it attempts. This insight also reveals a basic complementarity between sustainable entrepreneurship in smaller firms (which is often associated with earlier stages and smaller markets) and that of large firms that carry sustainable innovation into mass markets. The case examples discussed in this paper also reveal a more complex reality that is affected by the temporal interaction of industry life cycles, appropriability regimes and the emergence and development of sustainability demands. In terms of integrating sustainability performance into business objectives smaller and younger firms are better positioned, whereas in terms of addressing mass markets and shaping societal trends large and established companies have more capabilities.

These insights suggest that some form of convergence and interaction of small and large firms is necessary to enable sustainable entrepreneurship. The model summarized in Figure 1 implies that different paths are possible

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to enable this, one example being acquisition of a small firm, another one institutional entrepreneurship aimed at changing market contexts. Ultimately, a dynamic balance between the different modes or types identified in Figure 1 is needed in order to ensure a sufficiently high level of sustainability of innovation as well as sufficiently quick diffusion of such innovations into mass markets.

Conclusions

In this paper, we have introduced a framework of sustainable entrepreneurship and explored its links to sustainability innovation. The business implications of our analysis especially relate to important conditions that bioneers, social and institutional entrepreneurs and other start-ups and incumbents need to consider when deciding on the type of sustainability innovation. First of all, these concern the industry life cycle, since the innovation requirements change over time when a dominant design emerges (Utterback, 1994). Because of this, product and process innovation need to be understood as jointly determined. To enable them to react to this, firms should carefully monitor the market for changes, for example as concerns technologies or context. Specifically, institutional entrepreneurs may want to actively attempt to change market contexts, as has been observed in the case of entrants to the German renewable energy market.

Incumbents can address market changes by developing 'dynamic capabilities' (Teece *et al.*, 1997) that enable them to react more quickly to unanticipated or short-term changes in the market. Furthermore, as concerns the appropriability of innovation rents, bioneers and ecopreneurs in our framework are well advised to focus on innovation that can be easily and effectively protected and where complementary assets are less relevant or easily accessible or available. Conversely, sustainability administrators and managers can benefit most from pursuing innovation (as fast second) where appropriation is difficult for the first movers and where the need for complementary assets is strong.

Finally, the model outlined for sustainability innovations suggests the existence of innovations with high social benefit, but very low private benefits appropriable. For such innovation entrepreneurial activities aimed at profit generation, which are frequently linked to a mass market orientation, may be less appropriate. Also, multi-partite partnerships of stakeholders seem to be necessary to create stable institutional structures that enable pursuing such innovation (Ostrom, 1990). For example, in situations where no business case exists, public policy may become involved in order to regulate market failure if the sustainability innovation in question represents a high social benefit. The energy feed-in tariff in Germany is one example of such an intervention.

Next to the managerial and policy implications discussed, the analysis suggests at least two future streams of research on sustainability innovations and sustainable entrepreneurship: (a) linking with institutional and evolutionary economics and the analysis of conditions and innovation types that are realized best with traditional social entrepreneurship; (b) an investigation of what variables support what kind of sustainable entrepreneurship under what conditions, and the analysis of transformation processes between different kinds of social, institutional and sustainable entrepreneurship.

First, the framework classifications and movements in the classification scheme could be linked with evolutionary and institutional economics. There are a number of ways in which innovation theory and innovation economics bear on sustainable entrepreneurship and sustainability innovation. These can e.g. be linked to the systems-of-innovations concept, which is rooted in evolutionary and institutional economics and has particular relevance to the subject of sustainability innovations, or it can refer to different modes of coordination such as markets, regulation (induced innovation) or networks of actors that may bring about sustainability innovations in firms or between firms. Such alleys could be explored in more detail, in particular with regard to the longitudinal unfolding and development over time of entrepreneurial activities aimed at sustainability innovation. Further research should furthermore clarify for what kinds of innovation traditional social entrepreneurship or sustainability innovation in a niche are more appropriate and under what conditions, and what the role of public policy is in this.

Second, the framework provokes questions like: What criteria or situation variables foster different kinds of sustainable entrepreneurship? One future stream of research may be concerned with the question of shaping different entrepreneurial modes or approaches depending on the situation variables, external factors of influence or

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characteristics of entrepreneurial goals. Future research should also inform us more about the transformation process from traditional social entrepreneurship, ecopreneurship and possibly also sustainable innovation in a niche towards sustainable entrepreneurship. When is such a transformation possible, when is it desirable and when does it happen empirically? Do e.g. bioneers get acquired by large established firms as part of this process, or do they under some circumstances create transition by themselves to become sustainable entrepreneurs? Is institutional entrepreneurship a relevant phenomenon in corporate practice and necessary to ensure societal processes of sustainable development? Are innovation networks an important component of such a transformation process towards sustainable entrepreneurship?

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